Online Appendix

to accompany

When is foreign exchange intervention effective?

Evidence from 33 countries

I. Robustness

We apply a host of robustness tests to our results: (I.1) the sample composition, (I.2) the sample periods, (I.3) the definition of tiny interventions, (I.4) the definition of intervention period, (I.5) the use of stopping rules, (I.6) redefinitions of the fundamental in terms of the horizon, (I.7) by using PPP exchange rates and (I.8) by using centered moving averages, (I.9) variations of volatility measures, (I.10) the regression method, (I.11) considering quantitative effectiveness, (I.12) discussing the meaning of success, then varying.

I.1 Sample composition. The results do not depend on particular countries. Systematically dropping individual countries does not change the results qualitatively (see also Table A1). Moreover, Table A15 shows that on average interventions by countries that make their intervention data freely available on the internet are more effective than interventions by countries which provided data on a confidential basis.

I.2 Sample periods. The results are robust to the inclusion of year fixed effects, which might pick up different levels of effectiveness for example due to global market environments. These results suggest that central banks were significantly less successful in stabilizing their exchange rates in the crisis year 2008. Splitting the sample in the median year of interventions (2004) and re-estimating Table A7 on the split samples suggests that the effectiveness of oral interventions in turbulent periods was higher in the instances coded "turbulent" before 2004 (in 1997, 1998, 2001, and 2002) rather than during the Great Recession in 2008 through 2011. The finding that, according to the event criterion, oral interventions particularly effective in turbulent times holds in both samples. For the smoothing criterion, the point estimate is positive and insignificant in both groups with a large standard error.

I.3 Tiny interventions. Shifting the cutoff for "tiny interventions" from 0.00001 percent of GDP by a factor of 100 up to 0.001 percent, or using an alternative threshold of 1% of a country's maximum intervention volume, does not affect estimates qualitatively. Increasing the threshold further leads to ever lower sample sizes and accordingly at some point starts to decrease the statistical significance of estimates. Furthermore, decreasing the cutoff to 0 increases the noise included in the estimation. Exemplary alternative thresholds are included in Table A16.

I.4 Intervention periods. We test shorter definitions of the gap between intervention episodes. Using gaps between episodes of 1, 3, and 5 days instead of 10 days gives almost identical results. The only noteworthy difference is that the importance of the average intervention volume is lower (but still highly significant) for the event criterion the shorter the gap between episodes is. This makes intuitive sense because longer gaps without intervention within an episode are likely to decrease the effectiveness of intervention and are reflected by a smaller average intervention volume throughout the intervention episode.

I.5 Stopping rule. There is the possibility that a central bank always intervenes until the exchange rate has moved in the intended way, i.e. following a stopping rule, even though the exchange rate may follow a random walk and the intervention may be completely useless. In such a case the success rate (of the event criterion) would be close to 100% by definition. However, the success rate in our sample is 61%. It is also unlikely that we observe a mix of countries that follow the stopping rule and some that do not follow it, because no single central bank in our sample has a success rate of (close to) 100% according to our criteria. Nevertheless, one might argue that patient central banks following the stopping rule would create a success rate which is increasing with the length of the intervention episode. Thus, Figure A1 plots the average success rate according to the event criterion for all regimes over different intervention lengths. The slope of the average line is very close to zero if using a linear fit. Next,

further tentative evidence against the use of a stopping rule is provided by looking at realized changes in exchange rates within episodes. In fact in 45% of episodes that last more than one day, interventions continue after the exchange rate has moved in the (presumably) intended direction. Under a stopping rule, we would expect this share to be small. Finally, some of our success criteria measure the intended change in exchange rates not just until the last day of an intervention episode but include days beyond that last intervention day. Still FX intervention does seem to have a systematic impact. Overall, although the end of an intervention episode is (endogenously) determined by the change in exchange rate over the intervention episode, the empirical evidence provided is not consistent with central banks following a stopping rule in a world of randomly changing exchange rates.

I.6 Lengthening the moving average exchange rate. In the main text of the paper we use a 3-year moving average of the exchange rate in order to proxy for a fundamental exchange rate. While three years seem to be rather short if one has longer-term swings in mind, we note that many countries in our sample have quite rapidly changing nominal exchange rate so that a trade-off arises between a long-term average and a realistic average. Accordingly, we find that result in Tables A17 and A18 tend to weaken with longer moving average. Whereas the change from three years to five years does not matter much, an extension to eight years means more noise, in the sense of the above made argument of a realistic moving average.

I.7 Using a PPP-based moving average exchange rate. We rely in the main text of the paper on simple moving averages of nominal exchange rates as a proxy for the fundamental exchange rate. From an economic point of view PPP-rates are more convincing than simple moving averages in order to capture a fundamental exchange rate. Thus we use PPP-rates of the IMF instead of nominal MAs and show the results in Table A19 and A20. Interestingly, the qualitative picture remains unchanged.

I.8 Using centered moving average exchange rate. While we use moving averages up to this point in the paper which are based on information that was available at each point in time, we also show results with moving averages that are centered around the time of intervention in Tables A20 and A21.

I.9 Variations of volatility measures. Instead of using the VIX (for defining turbulent times), the Cleveland Fed Financial Distress Index or the St. Louis Fed Index (only available weekly) can be used. The Cleveland Fed Financial Distress Index yields near identical results while the St. Louis Fed Index has less explanatory power due to its lower frequency. The estimates for other variables are neither qualitatively nor quantitatively affected by this change.

I.10 Regression method. The binary coding of intervention success according to the various effectiveness measures actually suggests to apply a logit / probit regression approach. These estimates yield qualitatively almost identical results, as Table A14 reports. The simplifying assumption of a linear probability model that we make to allow easier interpretation of effects with OLS is thus not crucial for the results.

I.11 Quantitative effectiveness. In line with the event study literature we look at qualitative effects of interventions. However, it would be also interesting to learn how large an intervention has to be in order to move the market. Therefore, we repeat the benchmark specification in column 1 of Table A22 and then show two kinds of extensions. First, we redefine the success criterion by changing the event definition (0-1) to a threshold that has to be reached before success is claimed. Column 2 applies a threshold of 0.1% by which the exchange has to be moved, in column 3 the critical value is 0.2%. One can see that coefficient signs remain stable but coefficient sizes decrease as the degree of exchange rate volatility becomes important.

Second, in Table A5 we estimate a day-on-day (reduced form) elasticity of intervention for free floaters defined as

$$\Delta fx_{i,t} = \alpha + \beta_1 \cdot \text{fx sale (0/1)} \cdot ln|\text{Intervention volume in percent of GDP}_{i,t}| + \beta_2 \cdot \text{fx purchase (0/1)} \cdot ln|\text{Intervention volume in percent of GDP}_{i,t}| + \gamma X_{i,t} + \epsilon_{i,t}. \quad (1)$$

The number of observations is all observed days that are not following an intervention, the vast majority of which are without interventions. The covariates have to be adjusted from the event-setting for the simpler day-by-day-analysis, thus allowing using the FX trend instead of a dummy variable for intervention leaning with or against the trend. The number of observations is all observed days, the vast majority of which are without intervention. The signs of the intervention coefficients are as expected. A sale of foreign currency (and purchase of domestic currency) leads to an appreciation of the domestic currency, whereas the purchase of foreign currency (and sale of domestic currency) is associated with the opposite effect. Both estimated coefficients are heavily affected by the selection into intervention on that specific day. Not only may the market environment considerably vary between situations in which central banks decide to intervene in a particular direction, but also the central banks involved may differ because some of them intervene in one direction only. Thus, we hesitate to interpret the different coefficient size between purchases and sales.

Furthermore, the smoothing criterion can be adjusted. Any measure of the degree of smoothing that is not also a binary criterion is difficult to interpret because turning around the direction of the exchange rate has to be top-coded to yield a meaningful criterion. We therefore create two alternative smoothing criteria of a binary nature that indicate if an intervention lowered the slope of the exchange rate by 50 percent and 75 percent, respectively. Finally, we calculate a continuous smoothing criterion, which measures the percentage decrease in the slope and is limited to a range between 0 and 100 percentage point reductions. The results can be found in Table A23. The table shows that smoothing becomes more effective if interventions are larger, smoothing to a particular degree becomes more likely in volatile times and the regime-specific intercepts in column 5 suggest that in their typical intervention episode free floaters smooth significantly better than broad band or narrow band regimes.

I.12 Interpretation of success rates. In line with the literature we interpret success rates against the implicit benchmark of having no success. Thus, an 80% success rate looks good within the range from 0% to 100%. Alternatively, however, one could also take the "success rate" of placebo exchange rate changes as the benchmark as they are documented in Table 4. Then, the interpretation is different: in case of the event criterion for floating regimes the placebo rate is 48%, thus realizing a conditional success rate of 80% means that the improvement is 32 percentage points, whereas there are 20 percentage points of unrealized potential success. Still, interventions do work but success from this perspective would be much lower. Nevertheless, we stick to the conventional interpretation because interventions do not occur in a "neutral" situation but they occur exactly when the exchange rate does not behave as desired by policy makers in unfavorable circumstances.

II. Further discussion about the endogeneity of FX interventions

While we have provided some material already in the main text (in Section 6.1), here we put this material into context and discuss further issues. Isolating a causal effect of FX interventions against the potential influence from specific circumstances in the markets has been addressed in the literature using a variety of methods, which we discuss below and relate to our context. We start from a simple qualitative discussion on the role of endogeneity in empirical work. Next, we discuss quantitative methods to deal with this issue by isolating the effect from interventions using controls for other state variables: here we distinguish approaches based on reaction functions and counterfactuals. Finally, we discuss two further empirical approaches that try to reduce the potential influence of confounding factors, an example being high-frequency studies.

Qualitative reasoning. In the main text we had presented our qualitative reasoning regarding the potential endogeneity of FX interventions. In short, while there are good reasons to believe that standard empirical approaches may underestimate the true effect of interventions, various aspects make the estimation of the effectiveness of FX intervention a difficult task, and there are various methods that can be used to investigate the importance of this issue, to which we now turn.

Central bank reaction functions. Working with central bank reaction functions is the most popular approach to deal with endogeneity. The motivation to apply central bank reaction functions is to control for the market environment as central banks react to past exchange rate developments with their interventions (Almekinders and Ejffinger, 1996; Adler and Tovar, 2011). The most basic step involves a model for explaining the intervention operation, i.e. the fact that a central bank intervenes in response to some driving factors. Using a dummy variable $IA_{i,t}$ taking the value 1 on intervention days, a reaction function has to be estimated to explain whether an intervention takes place. The model typically takes the form:

$$\text{IA}_{i,t} = \alpha_0 + \alpha_1 Z_{i,t} + \nu_{i,t} \quad \forall t \tag{2}$$

The interventions implied by this relatively simple model could then be called expected interventions. Thus, one could examine only unexpected interventions for identification, which will have a similar role as truly exogenous shocks in other contexts. Table A8 in the Internet Appendix shows that a typical reaction function model performs poorly, even if lagged interventions on a previous day are added to the model, which is problematic for the calculation of unexpected intervention. This is not very surprising because we know from previous literature that intervention is often secret and revealing an intervention is often an active decision by the central bank. The remarkably low R^2 in Table A8 indicates that such a model of "expected intervention" performs poorly across time and countries. Most interventions in our sample are thus unexpected according to the reaction function approach used here.

With these caveats in mind, the estimates in Table A8 suggest that intervention in free floating regimes and broad band regimes are more likely on days after strong movements in the currency. Furthermore, free floaters and narrow band regimes are more likely to intervene on days with a strong misalignment of the exchange rate from its 5 and 1 year moving average, respectively. The overall insignificance of monthly variables throughout the table nicely fits the results in Neely (2008), who finds that central bankers target longer term misalignments between the exchange rate and its fundamental value, but are less likely to react to shorter term misalignments.

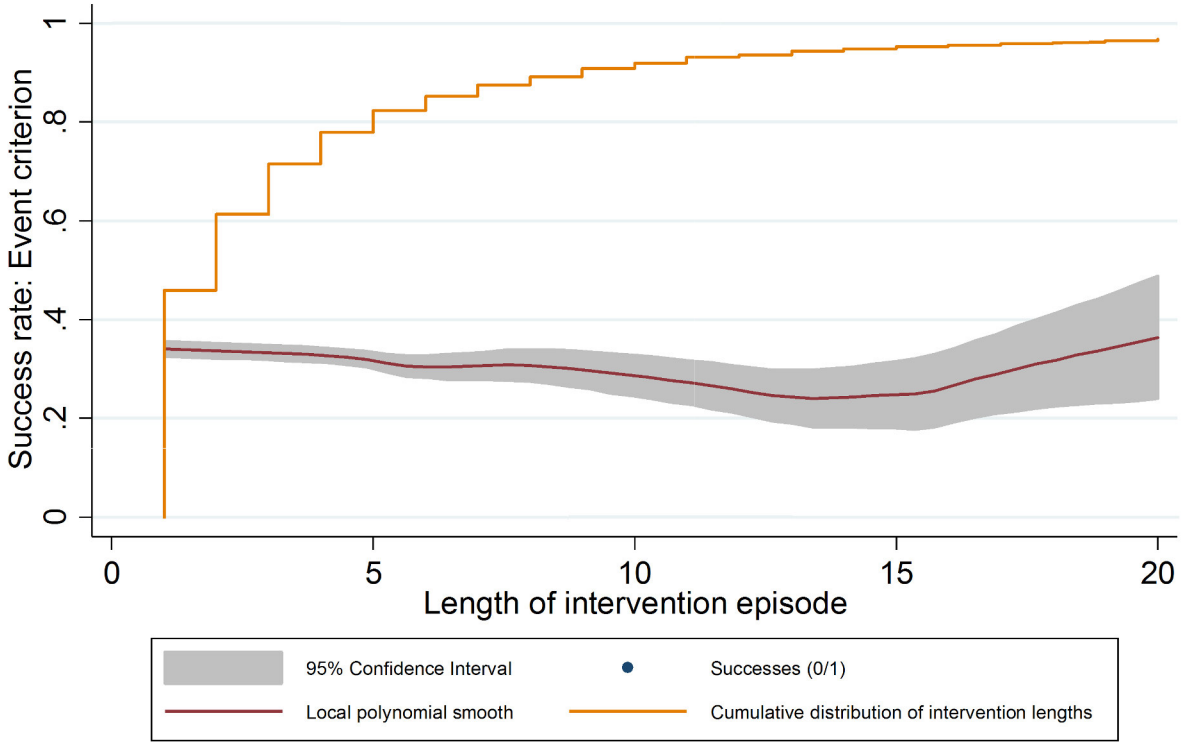
Studying counterfactuals. Within this line of literature there are three approaches, i.e. us-

ing forecasted exchange rates as counterfactuals, using non-intervention transactions as counterfactuals, and creating counterfactuals by a matching approach. Direct prediction of a counterfactual by forecasting from the last non-intervention day before the start of an intervention episode onwards may be, at first glance, the most straightforward approach. However, the likelihood of obtaining a good out-of-sample exchange rate model at the daily frequency is typically small, as indicated by the many studies that highlight the limitations of exchange rate models in out-of-sample forecasting (see Rossi, 2013). Another approach to get counterfactuals involves relying on other transactions of central banks which are not interventions. The first study in this respect is Fischer and Zurlinden (1999) who demonstrate for the Swiss case that only transactions which are classified and communicated to the market as interventions do impact exchange rates. What seems to be a clever way of identification unfortunately requires extremely scarce data so that there are just a few papers along this line (see Menkhoff, 2010, for a survey). Reassuringly, this approach indicates effectiveness of FX interventions. A third approach involves selecting suitable counterfactuals by a matching mechanism to account for market circumstances (see Fatum and Hutchison, 2010). We combine this idea with the reaction function approach and match actual intervention events and placebo events to yield a treatment and a control group. Details are described in the main text above and support the conclusion that our former results may underestimate the true intervention effectiveness.

Applying instrumental variables (IV). The application of an IV-approach is a standard procedure to eliminate or reduce the problem of endogeneity. However, it fully depends on having an appropriate instrumental variable. It seems difficult to imagine a variable which is highly related to interventions but otherwise unrelated to exchange rate changes. Dominguez and Frankel (1993) suggest using oral interventions as instrument but this does not work in today's world where oral interventions are used as policy measure themselves. Another IV-approach uses a combination with structural modeling. This approach assumes deep knowledge about the relations between exchange rates and interventions, and some clearly exogenous piece of information for identification. A prominent case is the study of Kearns and Rigobon (2005) about Japanese FX interventions, where a policy change in the size and frequency of interventions is used for identification. Obviously such an approach can hardly be applied to a broad cross-country study, such as ours, because it is difficult to find an IV that is valid for all countries. Thus, it may not be surprising that the IV-approach is not common in the FX intervention literature.

High-frequency approaches. The least demanding way in reducing unwanted effects from endogeneity is relying on high-frequency data. The idea is to eliminate as many disturbing influences as possible by narrowing the window of observation. Indeed, studies using intra-day data reveal clearly the impact of exchange rate interventions (see Menkhoff, 2010). The disadvantage is obviously the very short period of analysis and thus the question remains whether interventions may impact more permanently on exchange rates. A kind of compromise in this respect are event studies in FX, such as Fatum and Hutchison (2003) and Payne and Vitale (2003). They often use daily data, as in our case. Accordingly, we can interpret our results being based on about 4,500 single event studies, which should reduce the disturbing influence of confounding factors.

III. Figures



Notes: The figure plots the local polynomial smooth of the average success rate of episodes for all regimes over intervention length. Epanechnikov kernel and bandwidth of 2 days used.

Figure A1: Success rate of intervention episodes by intervention length in days

IV. Tables

Table A1: *Unconditional success rates of intervention episodes using weights and sub-samples*

Panel A: Unweighted, equal weight to each intervention episode

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Actual intervention (buy FX)	36.0%†	82.3 %†	71.6%
Actual intervention (sell FX)	29.2%	77.1 %	72.8%
Observations	4,549	1,787	4,549

Panel B: Placebo success rates, no interventions*

Criterion	(4) Event	(5) Smoothing	(6) Stabilization
Placebo intervention (any)	44.4%	37.1%	57.2%
Observations	93,228	88,735	93,228

Panel C: Equal weight to each country

Criterion	(7) Event	(8) Smoothing	(9) Stabilization
Actual intervention (buy FX)	50.5%†	89.2%†	64.6%†
Actual intervention (sell FX)	36.2%	76.0%	53.5%
Observations	4,549	1,787	4,549

Panel D: Interventions in turbulent times, unweighted

Criterion	(10) Event	(11) Smoothing	(12) Stabilization
Actual intervention (buy FX)	45.0%†	91.7%†	52.3%†
Actual intervention (sell FX)	31.7%	75.7%	45.2%
Observations	235	118	235

Notes: †: Difference to mean effectiveness of FX sale statistically significant at the 10% level at least. *: Panel B reports success rates according to criteria on days without interventions. We assume that placebo intervention episodes last as long as an average intervention episode and the sign of the presumed intervention is random. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The stabilization criterion counts success as the exchange rate staying within a 2 percent band during the event and during the next 2 weeks.

Table A2: *Alternative stabilization criteria*

Stabilization in	(1) 2% band	(2) 3% band	(3) 4% band	(4) 5% band
Broad Band	0.611	0.811	0.881	0.956
	(0.025)	(0.023)	(0.018)	(0.015)
Narrow Band	0.955	1.004	1.002	1.016
	(0.010)	(0.009)	(0.008)	(0.006)
Intervention characteristics				
Average intervention size in % of GDP	-0.013	0.023	-0.055	0.011
	(0.086)	(0.072)	(0.067)	(0.051)
Intervention with prior 2 weeks' trend	0.014	0.014	0.025	0.004
	(0.013)	(0.012)	(0.009)	(0.008)
Intervention towards fundamental	-0.004	-0.003	-0.002	-0.002
(based on distance to 3Y-MA)	(0.001)	(0.001)	(0.001)	(0.001)
Share of max. local volatility	-0.601	-0.512	-0.264	-0.232
	(0.042)	(0.040)	(0.033)	(0.030)
Observations	3,955	3,955	3,955	3,955
R-squared	0.792	0.859	0.914	0.943

Notes: This table provides estimates for different bandwidths in which stabilization is required to be counted as a success. Broad and narrow band regimes only. Heteroskedasticity-robust standard errors in parentheses. The table provides results for different exchange rate band widths. 2% is the standard used in the rest of the paper, 5% refers closely to the broad band definition of currency regimes. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A3: *Extended determinants of effectiveness*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Intercepts			
FX purchase episode intervention period	0.539	0.836	0.565
	(0.055)	(0.046)	(0.045)
FX sale episode	0.509	0.794	0.523
	(0.055)	(0.048)	(0.045)
Regime fixed effects			
Free Floater	Baseline	Baseline	Baseline
Broad Band	-0.115	-0.081	0.158
	(0.053)	(0.041)	(0.043)
Narrow Band	-0.316	-0.039	0.524
	(0.051)	(0.041)	(0.042)
Other Regime	-0.394	0.045	0.563
	(0.055)	(0.048)	(0.043)
Intervention characteristics			
Average daily intervention size in % of GDP	0.318	0.096	0.087
	(0.103)	(0.078)	(0.062)
Length of intervention episode in days	-0.000	-0.001	-0.004
	(0.001)	(0.001)	(0.001)
Intervention with prior 2 weeks' trend (0/1)	0.098	-0.068	0.008
	(0.015)	(0.028)	(0.012)
Intervention towards fundamental	0.003	0.000	-0.005
(based on distance to 3Y-MA)	(0.001)	(0.001)	(0.001)
VIX	0.000	-0.001	-0.005
	(0.001)	(0.001)	(0.001)
Share of max. local volatility	-0.001	0.233	-0.515
	(0.043)	(0.052)	(0.041)
Observations	4,549	1,787	4,549
Adj. R-squared	0.373	0.801	0.815

Notes: This table uses an extended list of explanatory variables compared to Table 5. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2 percent band during the event and during the next 2 weeks. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A4: *Longer version of Table 4: Unconditional success rates of intervention episodes by regime*

Panel A: Freely floating

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Intervention episodes	61.1%†	88.3%†	21.1%
Placebo rates	48.1%	40.1%	29.1%†
Actual events	95	77	95

Panel B: Broad band

Criterion	(4) Event	(5) Smoothing	(6) Stabilization
Intervention episodes	48.3%	79.1%†	34.8%
Placebo rates	49.1%	39.6%	49.5%†
Actual events	1,062	561	1,062

Panel C: Narrow band

Criterion	(7) Event	(8) Smoothing	(9) Stabilization
Intervention episodes	28.2%	78.1%†	84.0%†
Placebo rates	38.9%†	34.2%	76.8%
Actual events	2,893	1,010	2,893

Notes: This table provides all possible combinations of exchange rate regimes and success criteria used in Table 4. †: Statistically significantly higher mean effectiveness than the relevant comparison in the cell directly above or below (at least at the 5% level). The placebo effectiveness is calculated based on all days that do not belong to an intervention episode. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The stabilization criterion counts success as the exchange rate staying within a 2% band during the event and during the next 2 weeks. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The panels are separated according to the "coarse grid" by Reinhart and Rogoff (2004). Broad bands comprise pre announced crawling bands of at least $\pm 2\%$, de facto crawling bands of up to $\pm 5\%$, moving bands of up to $\pm 2\%$ and managed floats. Narrow bands comprise more rigid arrangements.

Table A5: *Day-on-day movements of the exchange rate for free floaters*

	(1)	(2)
	Δ Exchange Rate	
FX purchase (0/1) x Average daily	-0.011	-0.012
intervention size in % of GDP	(0.004)	(0.004)
FX sale (0/1) x Average daily	0.238	0.228
intervention size in % of GDP	(0.091)	(0.089)
FX misalignment (from MA-1y) in % of MA		0.000
		(0.000)
FX misalignment (from MA-3y) in % of MA	0.000	-0.000
	(0.000)	(0.000)
FX trend (weekly MA)		-0.051
		(0.035)
FX trend (monthly MA)		-0.209
		(0.067)
Constant	0.000	0.000
	(0.000)	(0.000)
Observations	17,925	17,925
R-squared	0.008	0.020

Notes: The table provides estimates of the extent of exchange rate movement on intervention days for free floaters. Non-intervention days included to estimate coefficients on misalignment and trend terms. Heteroskedasticity-robust standard errors in parentheses. The outcome variable are day-on-day changes in the log exchange rate.

Table A6: *Effectiveness and oral interventions by central banks (short version of Table 6)*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Regime-specific intercepts			
Free Floater	0.451	0.860	0.489
	(0.056)	(0.048)	(0.046)
Broad Band	0.331	0.778	0.664
	(0.029)	(0.035)	(0.027)
Narrow Band	0.187	0.779	0.967
	(0.013)	(0.021)	(0.010)
Other Regime	0.075	0.874	1.042
	(0.025)	(0.032)	(0.015)
Intervention characteristics			
Average daily intervention size in % of GDP	0.278	0.155	0.138
	(0.103)	(0.077)	(0.064)
Intervention with prior 2 weeks' trend (0/1)	0.094	-0.066	0.014
	(0.015)	(0.028)	(0.012)
Intervention towards fundamental	0.004	0.001	-0.005
(based on distance to 3Y-MA)	(0.001)	(0.001)	(0.001)
Share of max. local volatility	-0.020	0.222	-0.581
	(0.041)	(0.050)	(0.039)
Communication			
Any oral intervention (0/1)	0.093	-0.067	-0.062
	(0.018)	(0.024)	(0.013)
Adj. R^2	0.376	0.801	0.811
Observations	4,549	1,787	4,549

Notes: This table provides a shorter version of Table 6 without the interaction term for turbulent times. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2 percent band during the event and during the next 2 weeks. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A7: *Oral intervention and the pre-announcement of regimes*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Intervention characteristics			
Average daily intervention size in % of GDP	0.201	0.112	0.064
	(0.093)	(0.080)	(0.068)
Intervention with prior 2 weeks' trend (0/1)	0.039	-0.066	0.010
	(0.015)	(0.028)	(0.012)
Intervention towards fundamental	0.000	0.000	-0.004
(based on distance to 3Y-MA)	(0.001)	(0.001)	(0.001)
Share of max. local volatility	0.111	0.138	-0.499
	(0.044)	(0.055)	(0.045)
Communication			
Any oral intervention (0/1)	0.123	-0.059	0.002
	(0.021)	(0.030)	(0.017)
Turbulent time (0/1)	-0.065	-0.113	-0.060
	(0.041)	(0.075)	(0.043)
Any oral intervention (0/1) x Turbulent times (0/1)	0.119	0.160	-0.050
	(0.060)	(0.084)	(0.055)
Any oral intervention (0/1) x Preannounced regime (0/1)	-0.345	-0.049	-0.079
	(0.043)	(0.074)	(0.031)
"Fine grid" currency regime fixed effects	yes	yes	yes
Observations	4,549	1,787	4,549
Adj. R-squared	0.413	0.802	0.820

Notes: This table provides estimates for oral interventions depending on whether the country's exchange rate regime is known to the public. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2% band during the event and during the next 2 weeks. "Fine grid" currency regime fixed effects are dummy variables for each relevant value (1 to 14) of the Reinhart and Rogoff (2004) classification. They are not reported due to confidentiality requirements.

Table A8: *Determinants of intervention days*

Panel A: Modelling intervention, including lagged intervention

	(1)	(2)	(3)	(4)	(5)
Estimator	OLS	Logit			
Regimes	All	All	Free Floater	Broad Band	Narrow Band
Lagged absolute change in exchange rate (1 day)	-0.001	-0.021	0.383	0.078	-0.079
	(0.003)	(0.103)	(0.156)	(0.039)	(0.133)
Absolute misalignment from monthly MA	-0.001	-0.033	0.018	0.023	-0.014
	(0.001)	(0.045)	(0.062)	(0.047)	(0.052)
Absolute misalignment from 1y-MA	0.000	0.012	0.042	0.031	0.033
	(0.001)	(0.017)	(0.028)	(0.040)	(0.012)
Absolute misalignment from 3y-MA	-0.001	-0.016	0.001	-0.060	0.012
	(0.001)	(0.017)	(0.021)	(0.020)	(0.019)
Absolute misalignment from 5y-MA	0.002	0.036	0.029	0.033	0.021
	(0.001)	(0.015)	(0.011)	(0.028)	(0.017)
Intervention on previous day (0/1)	0.270	2.526	perfect	3.513	1.841
	(0.036)	(0.332)	prediction= 0	(0.363)	(0.277)
Monthly FX volatility	-0.952	-24.250	-12.884	54.256	-39.242
	(0.700)	(27.726)	(47.221)	(23.615)	(33.202)
Constant	0.019	-3.732	-6.275	-4.552	-3.217
	(0.009)	(0.315)	(0.515)	(0.516)	(0.389)
Observations	112,059	112,059	19,226	40,994	41,871
R-squared	0.086	0.124	0.037	0.202	0.103

Panel B: Modelling intervention, without lagged intervention

	(6)	(7)	(8)	(9)	(10)
Estimator	OLS	Logit			
Regimes	All	All	Free Floater	Broad Band	Narrow Band
Lagged absolute change in exchange rate (1 day)	-0.001	-0.024	0.378	0.159	-0.105
	(0.004)	(0.146)	(0.151)	(0.062)	(0.176)
Absolute misalignment from monthly MA	-0.002	-0.044	0.018	0.028	-0.014
	(0.002)	(0.066)	(0.061)	(0.052)	(0.064)
Absolute misalignment from 1y-MA	0.000	0.012	0.042	0.055	0.043
	(0.001)	(0.020)	(0.028)	(0.071)	(0.013)
Absolute misalignment from 3y-MA	-0.001	-0.017	0.002	-0.087	0.014
	(0.001)	(0.021)	(0.021)	(0.037)	(0.023)
Absolute misalignment from 5y-MA	0.002	0.045	0.029	0.043	0.025
	(0.002)	(0.020)	(0.011)	(0.032)	(0.020)
Monthly FX volatility	-1.336	-38.820	-12.477	63.139	-52.168
	(0.935)	(44.303)	(46.743)	(46.617)	(46.695)
Constant	0.026	-3.454	-6.278	-4.197	-3.016
	(0.013)	(0.400)	(0.513)	(0.560)	(0.462)
Observations	112,059	112,059	19,320	40,994	41,871
R-squared	0.014	0.033	0.036	0.028	0.043

Notes: This table reports day-level estimates of simple reaction functions that test whether interventions can be expected based on spot rate movements on previous days, misalignment of the exchange rate from its short or long term moving average or volatility. Heteroskedasticity-robust standard errors in parentheses.

Table A9: *Matching events and placebo events by country on different misalignment horizons and previous FX change*

Criterion Regime Estimator	(1) Event Free Floater nn-match	(2) Smoothing Free Floater nn-match	(3) Smoothing Broad Band nn-match	(4) Stabilize Broad Band nn-match	(5) Smoothing Narrow Band nn-match	(6) Stabilize Narrow Band nn-match
Matching on 1 year misalignment						
Average Treatment Effect	0.170	0.449	0.239	-0.006	0.347	0.104
on the Treated	(0.083)	(0.072)	(0.096)	(0.075)	(0.060)	(0.015)
Matching on 3 year misalignment						
Average Treatment Effect	0.359	0.857	0.267	-0.001	0.495	0.055
on the Treated	(0.106)	(0.190)	(0.094)	(0.079)	(0.040)	(0.015)
Matching on 5 year misalignment						
Average Treatment Effect	0.250	0.329	0.307	0.000	0.350	0.129
on the Treated	(0.067)	(0.112)	(0.103)	(0.080)	(0.043)	(0.022)
Sample size	18,542	9,563	25,953	28,394	17,716	26,632

Notes: Nearest neighbor matching with bias correction using the lagged absolute misalignment from the 1/3/5 year moving average (uncentered, previous year) of the exchange rate, the absolute change in the exchange rate leading to the previous day for free floaters and broad bands and an exact match by country (cf. Table A8). Exact matching within country results in some observations that cannot be matched and which are excluded. The placebo intervention episodes are designed to have the country-specific median length of the intervention episodes and the length is accounted for in the matching procedure. Note that the alternative matching variables are used here to provide evidence of robustness, not necessarily because they are supported by our analyses. For the summary of matching estimates supported by Table A8, see Table 7 in the main text.

Table A10: *Interest changes on first days of interventions*

	(1) Δi	(2) Δi	(3) Δi	(4) Δi
Purchase FX	0.013	0.013	0.013	0.015
	(0.013)	(0.013)	(0.012)	(0.012)
Sell FX	0.015	0.015	0.014	0.016
	(0.016)	(0.016)	(0.016)	(0.017)
Constant	-0.002	-0.002	-0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.002)
Weekday FE	No	Yes	Yes	Yes
Year FE	No	No	Yes	Yes
Country FE	No	No	No	Yes
Observations	57,443	57,443	57,443	57,443
R-squared	0.000	0.000	0.001	0.001

Notes: This table tests whether interest rates move on first intervention days. Δi is the change in the daily 3-month money market rate on first days of intervention episodes and days without intervention. Purchase FX and Sell FX are dummy variables indicating intervention direction. A basis point is denoted as 0.01. Heteroskedasticity-robust standard errors that cluster at the country level in parentheses.

Table A11: *Determinants of effectiveness and the role of interest rate changes*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Regime-specific intercepts			
Free Floater	0.523	0.801	0.503
	(0.055)	(0.045)	(0.046)
Broad Band	0.405	0.722	0.702
	(0.030)	(0.030)	(0.027)
Narrow Band	0.352	0.740	0.996
	(0.017)	(0.020)	(0.010)
Other Regime	0.138	0.893	1.050
	(0.025)	(0.027)	(0.014)
Intervention characteristics			
Average daily intervention size in % of GDP	0.222	0.165	0.085
	(0.103)	(0.073)	(0.067)
Intervention with prior 2 weeks' trend (0/1)	0.047	-0.079	0.010
	(0.019)	(0.031)	(0.014)
Intervention towards fundamental	0.004	0.001	-0.004
(based on distance to 3Y-MA)	(0.001)	(0.001)	(0.001)
Share of max. local volatility	0.077	0.190	-0.785
	(0.055)	(0.052)	(0.049)
FX purchase (0/1) x Day on day change	0.007	-0.021	-0.008
in money market rate (in percentage points)	(0.007)	(0.012)	(0.005)
FX sale (0/1) x Day on day change	0.003	-0.000	-0.002
in money market rate (in percentage points)	(0.008)	(0.011)	(0.009)
Observations	3,035	1,480	3,035
R-squared	0.443	0.801	0.827

Notes: This table provides estimates on changes in effectiveness depending on whether interest rates change at the same time. Daily data on three month money market rates used where available. Data availability is far better for bigger currencies and in the 2000s. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2% band during the event and during the next 2 weeks. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A12: *Robustness check: Specification of Table 5 with sample used in Table A11*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Regime-specific intercepts			
Free Floater	0.522	0.802	0.504
	(0.055)	(0.045)	(0.046)
Broad Band	0.404	0.722	0.703
	(0.030)	(0.030)	(0.027)
Narrow Band	0.352	0.739	0.996
	(0.017)	(0.020)	(0.010)
Other Regime	0.138	0.893	1.050
	(0.025)	(0.027)	(0.014)
Intervention characteristics			
Average daily intervention size in % of GDP	0.223	0.156	0.084
	(0.103)	(0.073)	(0.068)
Intervention with prior 2 weeks' trend (0/1)	0.047	-0.079	0.010
	(0.019)	(0.031)	(0.014)
Intervention towards fundamental	0.004	0.001	-0.004
(based on distance to 3Y-MA)	(0.001)	(0.001)	(0.001)
Share of max. local volatility	0.079	0.191	-0.787
	(0.055)	(0.053)	(0.049)
Observations	3,035	1,480	3,035
R-squared	0.442	0.801	0.827

Notes: This table re-estimates Table 5 for the sample used in Table A11. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2% band during the event and during the next 2 weeks. Daily data one month deposit rates used where available. Data availability is far better for bigger currencies and in the 2000s. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A13: *Do interventions correlate with changes in the monetary base?*

	(1) ΔMB	(2) ΔMB	(3) ΔMB
Net intervention purchases	-0.243	-0.227	-0.288
in percent of GDP	(0.204)	(0.223)	(0.257)
Constant	0.202	-0.068	1.529
	(0.203)	(0.113)	(0.410)
Year FE	no	yes	yes
Country FE	no	yes	yes
Observations	1,231	1,231	1,231
R-squared	0.001	0.015	0.024

Notes: ΔMB is the change in the monetary base during the quarter in percentage points relative to the monetary base of the previous day/quarter. Daily intervention data are summed up for the whole quarter to yield the net intervention amount. Estimated using OLS. Heteroskedasticity-robust standard errors that cluster at the country level in parentheses, $p<0.01$, $p<0.05$, $p<0.1$.

Table A14: *Effectiveness and oral interventions by central banks (logit estimates)*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Regime-specific intercepts			
Free Floater	-0.239	1.933	0.225
	(0.247)	(0.422)	(0.303)
Broad Band	-0.752	1.290	1.235
	(0.137)	(0.243)	(0.169)
Narrow Band	-1.390	1.340	2.594
	(0.069)	(0.144)	(0.097)
Other Regime	-1.978	2.033	3.503
	(0.144)	(0.283)	(0.205)
Intervention characteristics			
Average daily intervention size in % of GDP	1.320	1.132	1.290
	(0.469)	(0.690)	(0.546)
Intervention with prior 2 weeks' trend (0/1)	0.440	-0.399	0.111
	(0.069)	(0.155)	(0.084)
Intervention towards fundamental	0.020	0.002	-0.031
(based on distance to 3Y-MA)	(0.003)	(0.008)	(0.004)
Share of max. local volatility	-0.217	1.512	-3.366
	(0.213)	(0.418)	(0.257)
Communication			
Any oral intervention (0/1)	0.435	-0.511	-0.424
	(0.089)	(0.157)	(0.112)
Turbulent time (0/1)	-0.362	-0.771	-0.435
	(0.283)	(0.384)	(0.317)
Any oral intervention (0/1) x Turbulent time (0/1)	0.693	1.113	-0.439
	(0.337)	(0.526)	(0.397)
Observations	4,549	1,787	4,549

Notes: This table provides logit estimates for the same setup as in Table A6. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2 percent band during the event and during the next 2 weeks. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A15: *Effectiveness and the public availability of intervention data*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Regime-specific intercepts			
Free Floater	0.441	0.880	0.480
	(0.054)	(0.049)	(0.046)
Broad Band	0.383	0.788	0.649
	(0.030)	(0.036)	(0.027)
Narrow Band	0.171	0.796	0.967
	(0.013)	(0.022)	(0.011)
Other Regime	0.001	0.893	1.050
	(0.028)	(0.034)	(0.017)
Intervention characteristics			
Average daily intervention size in % of GDP	0.263	0.150	0.148
	(0.101)	(0.077)	(0.064)
Intervention with prior 2 weeks' trend (0/1)	0.086	-0.067	0.016
	(0.015)	(0.028)	(0.012)
Intervention towards fundamental	0.002	0.001	-0.004
(based on distance to 3Y-MA)	(0.001)	(0.001)	(0.001)
Share of max. local volatility	0.021	0.207	-0.557
	(0.042)	(0.052)	(0.043)
Communication			
Any oral intervention (0/1)	0.026	-0.074	-0.050
	(0.019)	(0.025)	(0.015)
Turbulent time (0/1)	-0.061	-0.127	-0.053
	(0.042)	(0.074)	(0.044)
Any oral intervention (0/1) x Turbulent time (0/1)	0.130	0.171	-0.063
	(0.060)	(0.085)	(0.055)
Data availability			
Central bank publishes intervention data (0/1)	0.160	-0.018	-0.023
	(0.020)	(0.023)	(0.015)
Observations	4,549	1,787	4,549
Adj. R-squared	0.387	0.802	0.811

Notes: This table provides estimates of effectiveness, differentiating between central banks which make their data public and those who do not. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2 percent band during the event and during the next 2 weeks. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A16: *Effectiveness with different noise canceling thresholds*

	(1)	(2)	(3)	(4)	(5)	(6)
	Threshold: 1% of largest intervention			Threshold: none		
Criterion	Event	Smoothing	Stabilization	Event	Smoothing	Stabilization
Regime-specific intercepts						
Free Floater	0.284	0.823	0.454	0.470	0.837	0.479
	(0.061)	(0.053)	(0.053)	(0.055)	(0.049)	(0.045)
Broad Band	0.177	0.753	0.692	0.353	0.773	0.644
	(0.036)	(0.043)	(0.035)	(0.028)	(0.034)	(0.025)
Narrow Band	0.091	0.794	0.917	0.203	0.769	0.970
	(0.015)	(0.028)	(0.016)	(0.012)	(0.019)	(0.009)
Other Regime	-0.040	0.856	1.014	0.094	0.864	1.042
	(0.031)	(0.037)	(0.021)	(0.024)	(0.032)	(0.015)
Intervention characteristics						
Average daily intervention size in % of GDP	0.313	0.148	0.148	0.254	0.193	0.106
	(0.103)	(0.077)	(0.063)	(0.100)	(0.076)	(0.064)
Intervention with prior 2 weeks' trend (0/1)	0.075	-0.083	0.022	0.085	-0.067	0.018
	(0.019)	(0.034)	(0.016)	(0.014)	(0.027)	(0.011)
Intervention towards fundamental	0.003	0.002	-0.003	0.004	0.001	-0.005
(based on distance to 3Y-MA)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Share of max. local volatility	0.112	0.284	-0.516	-0.009	0.231	-0.525
	(0.049)	(0.053)	(0.049)	(0.039)	(0.046)	(0.038)
Communication						
Any oral intervention (0/1)	0.184	-0.071	-0.030	0.073	-0.069	-0.068
	(0.020)	(0.028)	(0.017)	(0.017)	(0.023)	(0.013)
Observations	2,926	1,201	2,926	4,877	1,905	4,877
Adj. R-squared	0.368	0.816	0.793	0.373	0.796	0.822

Notes: This table provides estimates of effectiveness using different noise-canceling thresholds. Columns 1-3 are based on a sample trimmed by setting intervention days that are smaller than 1 percent of the respective country's largest daily intervention in absolute value. This means fewer intervention episodes because some countries' largest intervention is far larger than their usual intervention. Columns 4-6 are based on all intervention volumes provided by the central banks without setting a noise-canceling cut-off. Everything else as in Table A6 where we use 0.00001% of the country's GDP as the cut-off.

Table A17: *Determinants of effectiveness with alternative 5 year fundamental*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Regime-specific intercepts			
Free Floater	0.520	0.793	0.435
	(0.053)	(0.044)	(0.044)
Broad Band	0.406	0.710	0.611
	(0.024)	(0.028)	(0.024)
Narrow Band	0.205	0.743	0.947
	(0.012)	(0.018)	(0.010)
Other Regime	0.122	0.832	1.000
	(0.022)	(0.031)	(0.013)
Intervention characteristics			
Average daily intervention size in % of GDP	0.305	0.109	0.110
	(0.103)	(0.077)	(0.064)
Intervention with prior 2 weeks' trend (0/1)	0.096	-0.066	0.007
	(0.015)	(0.028)	(0.012)
Intervention towards fundamental	0.003	0.001	-0.002
(based on distance to 5Y-MA)	(0.000)	(0.001)	(0.000)
Share of max. local volatility	0.019	0.216	-0.613
	(0.041)	(0.050)	(0.039)
Observations	4,549	1,787	4,549
Adj. R-squared	0.375	0.800	0.809

Notes: This table provides estimates with an alternative proxy for the fundamental exchange rate. Setup otherwise as in Table 5. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2% band during the event and during the next 2 weeks. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A18: *Determinants of effectiveness with alternative 8 year fundamental*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Regime-specific intercepts			
Free Floater	0.495	0.781	0.440
	(0.053)	(0.044)	(0.044)
Broad Band	0.395	0.705	0.613
	(0.024)	(0.029)	(0.024)
Narrow Band	0.194	0.739	0.947
	(0.012)	(0.018)	(0.010)
Other Regime	0.115	0.831	0.996
	(0.021)	(0.031)	(0.013)
Intervention characteristics			
Average daily intervention size in % of GDP	0.265	0.092	0.118
	(0.101)	(0.078)	(0.065)
Intervention with prior 2 weeks' trend (0/1)	0.090	-0.068	0.007
	(0.015)	(0.028)	(0.012)
Intervention towards fundamental	0.003	0.001	-0.001
(based on distance to 8Y-MA)	(0.000)	(0.001)	(0.000)
Share of max. local volatility	0.040	0.220	-0.622
	(0.041)	(0.050)	(0.040)
Observations	4,549	1,787	4,549
Adj. R-squared	0.379	0.801	0.809

Notes: This table provides estimates with an alternative proxy for the fundamental exchange rate. Setup otherwise as in Table 5.Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2% band during the event and during the next 2 weeks. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A19: *Determinants of effectiveness with PPP-exchange-rate-based uncentered 3Y-MA*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Regime-specific intercepts			
Free Floater	0.523	0.788	0.413
	(0.053)	(0.046)	(0.044)
Broad Band	0.403	0.703	0.600
	(0.024)	(0.029)	(0.024)
Narrow Band	0.198	0.732	0.927
	(0.013)	(0.020)	(0.011)
Other regime	0.128	0.827	0.973
	(0.021)	(0.032)	(0.014)
Intervention characteristics			
Average daily intervention size in % of GDP	0.316	0.097	0.076
	(0.104)	(0.077)	(0.065)
Intervention with prior 2 weeks' trend (0/1)	0.100	-0.067	-0.003
	(0.015)	(0.028)	(0.012)
Intervention towards fundamental	0.001	0.001	0.000
(based on distance to uncentered PPP 3Y-MA)	(0.000)	(0.000)	(0.000)
Share of max. local volatility	0.023	0.221	-0.610
	(0.041)	(0.050)	(0.040)
Observations	4,548	1,787	4,548
Adj. R-squared	0.372	0.800	0.808

Notes: This table provides estimates with an alternative proxy for the fundamental exchange rate. Setup otherwise as in Table 5. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2% band during the event and during the next 2 weeks. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A20: *Determinants of effectiveness with PPP-exchange-rate-based centered 3Y-MA*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Regime-specific intercepts			
Free Floater	0.523	0.787	0.411
	(0.053)	(0.046)	(0.044)
Broad Band	0.403	0.702	0.599
	(0.024)	(0.029)	(0.024)
Narrow Band	0.200	0.731	0.925
	(0.013)	(0.020)	(0.011)
Other regime	0.131	0.826	0.973
	(0.021)	(0.032)	(0.013)
Intervention characteristics			
Average daily intervention size in % of GDP	0.320	0.098	0.075
	(0.104)	(0.077)	(0.065)
Intervention with prior 2 weeks' trend (0/1)	0.104	-0.066	-0.003
	(0.015)	(0.028)	(0.012)
Intervention towards fundamental	0.001	0.001	0.000
(based on distance to centered PPP 3Y-MA)	(0.000)	(0.000)	(0.000)
Share of max. local volatility	0.021	0.221	-0.611
	(0.041)	(0.050)	(0.040)
Observations	4,549	1,787	4,549
Adj. R-squared	0.372	0.801	0.808

Notes: This table provides estimates with an alternative proxy for the fundamental exchange rate. Setup otherwise as in Table 5. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2% band during the event and during the next 2 weeks. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A21: *Determinants of effectiveness with centered 3Y-MA*

Criterion	(1) Event	(2) Smoothing	(3) Stabilization
Regime-specific intercepts			
Free Floater	0.546	0.822	0.439
	(0.053)	(0.044)	(0.044)
Broad Band	0.418	0.735	0.625
	(0.024)	(0.029)	(0.024)
Narrow Band	0.226	0.764	0.947
	(0.012)	(0.018)	(0.010)
Other regime	0.153	0.862	1.009
	(0.021)	(0.030)	(0.013)
Intervention characteristics			
Average daily intervention size in % of GDP	0.349	0.092	0.064
	(0.106)	(0.077)	(0.064)
Intervention with prior 2 weeks' trend (0/1)	0.109	-0.062	0.006
	(0.015)	(0.028)	(0.011)
Intervention towards fundamental	0.001	-0.008	-0.010
(based on distance to centered PPP 3Y-MA)	(0.002)	(0.002)	(0.001)
Share of max. local volatility	0.016	0.218	-0.596
	(0.041)	(0.050)	(0.040)
Observations	0.369	0.802	0.810
Adj. R-squared	0.373	0.798	0.806

Notes: This table provides estimates with an alternative proxy for the fundamental exchange rate. Setup otherwise as in Table 5. Heteroskedasticity-robust standard errors in parentheses. The event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. The smoothing criterion counts a reduction in the absolute slope during the event and for the next week compared to the week before the event as success. The sample size for the smoothing criterion is lower because it is only defined for interventions against the one week trend. The stabilization criterion counts success as the exchange rate staying within a 2% band during the event and during the next 2 weeks. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A22: *Determinants of moving the exchange rate*

	(1)	(2)	(3)
		Movement	
Criterion	Event	$> 0.1\%$	$> 0.2\%$
Subsample	All	All	All
Free Floater	0.518	0.474	0.417
	(0.053)	(0.052)	(0.053)
Broad Band	0.406	0.311	0.267
	(0.024)	(0.023)	(0.022)
Narrow Band	0.205	0.096	0.054
	(0.012)	(0.010)	(0.009)
Other Regime	0.124	0.000	-0.046
	(0.022)	(0.016)	(0.012)
Intervention characteristics			
Average daily intervention size in % of GDP	0.311	0.188	0.152
	(0.103)	(0.088)	(0.081)
Intervention with prior 2 weeks' trend (0/1)	0.095	0.058	0.043
	(0.015)	(0.013)	(0.012)
Intervention towards fundamental	0.003	0.003	0.003
(based on distance to 3Y-MA)	(0.000)	(0.000)	(0.000)
Share of max. local volatility	0.024	0.195	0.247
	(0.041)	(0.040)	(0.038)
Observations	4,549	4,549	4,549
Adj. R-squared	0.376	0.333	0.311

Notes: This table provides estimates of success in moving the exchange rate. As in the rest of the paper, the event criterion defines success as movement of the exchange rate during the intervention that is consistent with the intervention's effect on the exchange rate. "Movement $> 0.2\%$" and accordingly "$> 0.1\%$" indicate that only interventions that move the exchange rate by at least 0.2 and 0.1 percent in the expected direction are coded as success. Heteroskedasticity-robust standard errors in parentheses. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

Table A23: *Determinants of smoothing the exchange rate for free floaters*

Criterion	(1) Event criterion	(2) Smoothing criterion	(3) Decrease absolute slope by 50%	(4) Decrease absolute slope by 75%	(5) Percentage point decrease in slope
Free Floater	0.532	0.798	0.672	0.607	63.038
	(0.053)	(0.043)	(0.053)	(0.057)	(5.362)
Broad Band	0.414	0.712	0.583	0.487	54.490
	(0.024)	(0.028)	(0.033)	(0.035)	(3.142)
Narrow Band	0.213	0.745	0.594	0.499	48.316
	(0.012)	(0.018)	(0.021)	(0.021)	(1.876)
Other Regime	0.133	0.835	0.738	0.660	53.938
	(0.021)	(0.031)	(0.037)	(0.041)	(3.856)
Intervention characteristics					
Average intervention size in % of GDP	0.330	0.115	0.176	0.150	30.940
	(0.104)	(0.077)	(0.097)	(0.119)	(10.382)
Intervention with prior 2 weeks' trend	0.099	-0.065	-0.037	-0.014	1.862
	(0.015)	(0.028)	(0.031)	(0.032)	(2.908)
Intervention towards fundamental	0.004	0.001	0.001	0.002	0.250
(based on distance to 3Y-MA)	(0.001)	(0.001)	(0.001)	(0.001)	(0.119)
Share of max. local volatility	0.004	0.215	0.281	0.301	9.186
	(0.041)	(0.050)	(0.060)	(0.065)	(6.014)
Observations	4,549	1,787	1,787	1,787	1,781
R-squared	0.373	0.800	0.691	0.612	0.629

Notes: The table provides evidence of the probability of success in achieving different levels of exchange rate smoothing. Free floating regimes only. Heteroskedasticity-robust standard errors in parentheses. The event and smoothing criteria are identical to above. The "decrease in slope" criteria take the value of 1 if the absolute slope decreases by at least the indicate percentage number and if the smoothing criterion is defined for this intervention episode. The "percentage point decrease in slope" criterion take the value 0 if smoothing is unsuccessful, 1 if the direction of the exchange rate is changed succesfully and values between 0 and 100 for the percentage point decrease in the slope relative to the reference period that is also used for the smoothing criterion. Currency regime fixed effects are dummy variables based on the Reinhart and Rogoff (2004) classification.

V. References

Fischer, Andreas M. and Mathias Zurlinden. 1999. "Exchange Rate Effects of Central Bank Interventions: An Analysis of Transaction Prices." Economic Journal, 109(459), 662-676.

Fatum, Rasmus and Michael M. Hutchison. 2003. "Is Sterilized FX Intervention Effective after All? An Event Study Approach." Economic Journal, 113(487), 390-411.

Fatum, Rasmus and Michael M. Hutchison. 2010. "Evaluating FX Market Intervention: Self-selection, Counterfactuals and Average Treatment Effects." Journal of International Money and Finance, 29(3), 570-584.

Menkhoff, Lukas. 2010. "High-Frequency Analysis of FX Interventions: What Do We Learn?" Journal of Economic Surveys, 24(1), 85-112.

Payne, Richard and Paolo Vitale. 2003. "A Transaction Level Study of the Effects of Central Bank Intervention on Exchange Rates." Journal of International Economics, 61(2), 331-352.

Reinhart, Carmen M. and Kenneth S. Rogoff. 2004. "The Modern History of Exchange Rate Arrangements: A Reinterpretation." Quarterly Journal of Economics, 119(1), 1-48.

Rossi, Barbara. 2013. "Exchange Rate Predictability." Journal of Economic Literature, 51(4), 1063-1119.