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Unveiling the Effects of Foreign Exchange Interventions: Evidence from the Kyrgyz Republic

by Tigran Poghosyan

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Unveiling the Effects of Foreign Exchange Interventions: Evidence from the Kyrgyz Republic

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Abstract

This paper analyzes determinants and consequences of FX interventions in the Kyrgyz Republic. Most of the literature on the topic focuses on advanced and emerging economies and this paper provides new evidence from a low-income country. We find that FX interventions take place in response to movements in the exchange rate and its volatility. There is also evidence of "leaning against the wind", which is more pronounced for relatively larger FX sales and purchases. The "leaning against the wind" is asymmetric toward FX sales and largely reflects leaning against depreciation of domestic currency. We document a varying degree of *de-facto* exchange rate stability despite the *de-jure* floating exchange rate regime. During most of the sample, the exchange rate management index was relatively low in line with the floating exchange rate regime, with the exception of the period from 2018 Q4 until the COVID-19 shock, during which the exchange rate management index was relatively high.

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I. INTRODUCTION

Despite the prevalent move to de jure floating exchange rate regimes, foreign exchange (FX) interventions remain one of the most widely used monetary policy instruments in low-income countries. What are the motivations of central banks to resort to FX interventions? Are FX interventions effective in influencing exchange rate movements and their volatility? Most of the literature addressing these questions focuses on advanced and emerging economies. Evidence from low-income countries is scant.

The objective of this paper is to fill this gap by providing empirical evidence from the Kyrgyz Republic. FX interventions in low-income countries are typically rationalized by the intention to influence exchange rate changes ("leaning against the wind") and their variability ("calm disorderly markets"), as well as accumulation of FX reserves (Reinhart and Reinhart, 2008; Aizenman and Lee, 2008; Ghosh and others, 2012; Adler and Tovar, 2014). While flexible exchange rates help cushion external shocks, balance sheet effects may dominate the competitiveness channel making the exchange rate act as a shock amplifier and requiring the central banks to intervene to smooth excessive exchange rate movements (Hofman and others, 2020). However, whether FX interventions are successful in meeting these goals is an empirical question. Unfortunately, most low-income countries do not publish high frequency data on FX interventions for the empirical analysis. We use publicly available information from the National Bank of the Kyrgyz Republic (NBKR) to shed light on this question.

Our results can be summarized as follows. *First*, FX interventions take place in response to movements in the exchange rate and its volatility. FX sales (purchases) are more (less) likely in periods when exchange rate depreciates against its 12-week moving average. In addition, FX sales (purchases) are less (more) likely in periods of high volatility of exchange rate changes over the previous 12 weeks. *Second*, FX sales (purchases) are preceded by acceleration in exchange rate depreciation (appreciation) and are followed by deceleration in exchange rate depreciation (appreciation), supporting the "leaning against the wind" hypothesis. Moreover, this association is more pronounced for relatively larger FX sales and purchases (above their respective 75th percentiles). *Third*, we find some evidence on the asymmetry in FX interventions with larger proportion of FX sales. This suggests that "leaning against the wind" largely reflects leaning against depreciation of domestic currency. *Finally*, we document a varying degree of *de-facto* exchange rate stability despite the *de-jure* floating exchange rate regime. During most of the sample, the exchange rate management index was relatively low, providing support to the announced floating exchange rate regime. The exception is the period from end-2018 until the COVID-19 shock, during which the exchange rate management index was about twice higher compared to the rest of the sample.

The remainder of the paper is structured as follows. Section II reviews relevant literature. Section III illustrates the institutional setup of the foreign exchange market in the Kyrgyz Republic. Section IV presents the data and stylized facts. Section V presents the estimation results. The last section concludes.

II. LITERATURE REVIEW

Most empirical studies on FX interventions cover advanced economies (see surveys by Sarno and Taylor, 2001; Neely, 2005; Menkhoff, 2010). These studies identify two key channels through which FX interventions may affect the exchange rate: (i) the portfolio balance channel, and (ii) the signaling channel:

- *Portfolio balance channel* operates in an environment of imperfect substitutability between domestic and foreign assets. The (sterilized) expansion of domestic assets increases the risk premium while keeping the domestic rate unchanged. This in turn gives raise to arbitrage through the interest parity condition and leads to exchange rate depreciation.

- *Signaling channel* works through the central banks revealing information about their future policy stance. For instance, the purchase of foreign currency could indicate that the central bank considers domestic currency overvalued and is willing to use its instruments to reduce this overvaluation. This could also help market participants coordinate their expectations about the appropriate level of the exchange rate, especially if market participants believe that the central bank has informational advantage.

The evidence on the effectiveness of FX interventions in advanced economies is mixed. Some studies find that the effectiveness of FX interventions is limited, unless interventions are coordinated across major central banks (Dominguez, 1990 and 1998; Ghosh, 1992; Dominguez and Frankel, 1993; Kaminsky and Lewis, 1996; Neely, 2008). Others have been more supportive to the effectiveness of FX interventions (see Menkhoff, 2010 for review and Fratzscher and others, 2019 for the most recent evidence).

The literature on the effectiveness of FX interventions in emerging economies is less voluminous (see surveys by BIS, 2005; Menkhoff, 2013; Chamon and others, 2019).[2] These studies are plagued by severe data limitations and frequent structural breaks. Using a detailed survey of FX interventions in emerging economies, Canales-Kriljenko (2003) argues that FX interventions in these countries may be more effective compared to advanced economies due to the following reasons: (i) FX interventions are not always fully sterilized, (ii) the size of FX interventions is large relative to FX market turnover, (iii) moral suasion plays an important role, and (iv) the central banks have bigger informational advantage relative to market participants. In addition, FX interventions in emerging economies may have unintended consequences in the form of excessive exchange rate rigidity that could hamper the effectiveness of the exchange rate as a shock-absorbing mechanism and reduction of incentives for the private sector to develop FX risk hedging instruments.

[2] To our best knowledge, studies on low-income countries have not been surveyed separately.

In terms of channels, Galati and Melick (2002) argue that the *portfolio channel* may be more relevant for emerging markets because they are likely to have large FX portfolios relative to FX market turnover or the stock of domestic bonds outstanding. By contrast, the *signaling channel* is likely to be weaker in emerging market economies due to a shorter history of institutional and policy credibility of central banks and the central banks in emerging economies tend to make up for this by undertaking relatively larger FX interventions (Canales-Kriljenko and others, 2003).

Several empirical methodologies have been used to assess the effectiveness of FX interventions in influencing exchange rate movements and/or their volatility, including *two-stage IV models* (Disyatat and Galati, 2007; Adler and Tovar, 2014; Adler and others, 2019), *ARDL models* (Dominguez and others, 2013), *GARCH-type models* (Ardic and Selcuk, 2006; Edison and others, 2006; Egert and Komarek, 2006; Egert and Lang, 2006; Gersl and Holub, 2006), *Markov-switching models* (Humala and Rodriguez, 2010), and *time-varying parameter models* (Akinci and others, 2006). The challenge for time-series analysis of high frequency data is that exchange rates are typically highly volatile on a day-to-day basis and FX interventions take place sporadically over the sample period (Fatum and Hutchison, 2003). Therefore, it is not surprising that time-series based studies tend to fail finding strong evidence on a systematic link between exchange rate movements and FX interventions.

As an alternative to time-series models, some authors argue in favor of using the *event-study methodology* to explore the behavior of exchange rates around periods of FX interventions. In one of the earliest papers using the event-study methodology, Fatum and Hutchison (2003) analyze the effectiveness of FX interventions by the Bundesbank and the U.S. authorities. They find evidence in support of the effectiveness of sterilized interventions in systematically affecting the exchange rates in the short run. Other studies employing the event-study methodology include Akinci and others (2006) for Turkey, Cashin and others (2006) for Australia, Egert (2007) for CEE countries, and Egert and Komarek (2006) for the Czech Republic. The main advantage of this approach is that it is semi-parametric and does not require any assumptions regarding the functional form of the relationship between FX interventions and exchange rate changes.

The key issue in assessing the effectiveness of FX interventions is the *endogeneity* of the decision by the central banks to intervene (Chamon and others, 2019). While the hypothesis is that FX interventions affect the exchange rate, the decision to intervene depends on the movement of the exchange rate. Several empirical methodologies were used to address the issue of endogeneity. Kearns and Rigobon (2005) use an *identification method based on the shift of intervention policy* from small and frequent interventions to large and infrequent interventions in Japan and Australia. Based on this identification assumption, they find that the effect of FX interventions on exchange rate movements is economically and statistically significant with the correct sign. Fatum and Hutchison (2018) use the *propensity-score matching* techniques to assess the treatment effect of FX interventions. They match intervention periods (treatment) with no-intervention periods with similar observable

characteristics (control) to assess the effectiveness of FX interventions in Japan. The results provide support to the effectiveness of FX interventions in certain intervals of the sample. Pontines (2018) uses the *inverse probability weighting estimator* developed by Jorda and Taylor (2015). The results suggest that large, infrequent, and sporadic FX interventions in Japan were effective in moving the exchange rate in the desired direction.

Overall, the evidence on the effectiveness of FX interventions in advanced and emerging economies is mixed. There is lack of evidence from low-income countries. Nevertheless, there is growing perception that as part of an Integrated Policy Framework, FX interventions could potentially be used among other policy instruments (macroprudential instruments, capital flow measures) to respond to various shocks hitting the economies even in the presence of an inflation targeting framework (Adrian and others, 2020; Basu and others, 2020). Therefore, the analysis of effects of FX interventions remains an important research area.

III. Institutional Setup of Foreign Exchange Market in the Kyrgyz Republic

The Kyrgyz Republic is a low-income country that adopted a floating exchange rate regime from its independence in early 1990s. It has one of the most liberalized foreign exchange markets in the region. Transactions involving the purchase and sale (exchange) of cash and non-cash domestic and/or foreign currency within the Kyrgyz Republic may be performed by banks, specialized financial institutions, microfinance companies, microcredit companies, credit unions, and exchange bureaus licensed by the NBKR. At the moment, there are 23 licensed commercial banks (including one branch of a foreign bank), 401 foreign currency exchange bureaus, 9 microfinance companies licensed to perform certain banking operations in foreign currency, and 2 microcredit companies licensed to perform the purchase and sale of foreign currency on their own behalf.

The NBKR intervenes in the interbank foreign exchange market to smooth out excessive fluctuations in the exchange rate as necessary. Information on FX interventions is published on NBKR's website on the day of intervention, after the close of the trading day.

The foreign exchange market operates within the framework of the Automated Trading System (ATS). Electronic trading is carried out daily from 10:00 a.m. to 5:00 p.m. (except for weekends). To become a participant in the interbank foreign exchange market, a financial institution must obtain a license for foreign exchange transactions and sign the agreement on participation in the ATS. The NBKR granted licenses for foreign exchange transactions and participation in the ATS to 23 commercial banks (including one branch of a foreign bank). There are no limits on the bid-ask spreads, nor are there any commissions. The NBKR performs transactions directly with market participants at their quoted rates. Market participants continuously report bid and ask prices and volumes to other market participants. The minimum allowable volume of an ATS bid for US dollars is USD 50,000.

Since 2010, the official exchange rate of the US dollar against the Kyrgyz som (KGS) has been calculated daily as the weighted average of the exchange rates used in US dollar purchase and sale transactions carried out in the exchange market through the ATS for the reporting period from 3:00 p.m. of the previous trading day until 3:00 p.m. of the current trading day. The official exchange rates of other foreign currencies are determined on a weekly basis, based on the cross-rates of quotes for these currencies against the US dollar in international financial markets.

The official exchange rate is determined and announced by the NBKR with an obligation on the part of the NBKR to purchase and sell foreign currency at the announced exchange rates. The spot exchange rate and other market rates are freely determined between the seller and the buyer.

The NBKR is in the process of transition to an inflation targeting regime starting from March 2014. According to Kyrgyz Republic's Law on the NBKR, Banks, and Banking, the *ultimate goal* of monetary policy is to achieve and maintain price stability, with the target inflation range of 5-7 percent per annum. The *intermediate target* of monetary policy is the inflation forecast based on an analysis of the macroeconomic situation in the Kyrgyz Republic and external environment. Short-term money market interest rates serve as an *operational target* of monetary policy. The NBKR's discount rate is the main *monetary policy instrument* and serves as a benchmark for the money market rates. Other instruments of monetary policy include operations with NBKR notes, outright purchases of securities, REPO operations, standing facilities (deposits and credits), and FX interventions.

The monetary policy framework continues to evolve, but challenges remain. One of the issues is structural excess liquidity, which the NBKR addresses by issuing notes. Progress was made in narrowing down the difference between the policy rate and the repo rate in the interbank market, helping banks manage their daily liquidity needs. Nevertheless, liquidity forecasting remains challenging, in part due to difficulties in projecting government transactions. The absence of a liquid secondary market for NBKR notes and government bonds and dollarization also hamper monetary policy transmission,[3] even though the NBKR has made progress in reducing deposit and loan dollarization rates (to 41 and 34 percent, respectively, as of June 2020). Another challenge is that inflation expectations are not well-anchored to NBKR's medium-term inflation target (currently 5-7 percent), but closely related to past inflation and exchange rate movements (high share of imported goods in the CPI basket). The NBKR stepped up its communication practices by including more forward-looking elements, explanations of policy decisions, and graphical illustrations in press releases and social media channels, but low financial literacy remains an obstacle.

[3] Debt instruments are typically traded in the primary market, with main players being banks and the state social security fund that tend to hold these securities until maturity.

IV. Data and Stylized Facts

We use publicly available information on daily FX interventions (FX sales and purchases) and NBKR official KGS/USD exchange rates from the NBKR website (www.nbkr.kg). The sample period is Jan 1, 2010 – July 1, 2020. FX interventions include transactions with the settlement on the date of the intervention (spot) and settlement on the date other than the date of the intervention (forward). The NBKR official KGS/USD exchange rate represents the weighted average of exchange rates used in transactions in the interbank market carried out through the ATS the previous day. We convert the data into weekly frequency by taking the sum of FX interventions and average of exchange rates.

Figure 1 presents the episodes of FX sales and purchases over the sample. FX sales took place for 156 weeks (out of 547 weeks in the sample). The FX sale volumes range between $0.35 mln and $64.6 mln, and the average volume is $14.31 mln. By contrast, FX purchases took place only for 57 weeks (out of 547 weeks in the sample). In addition, the volumes of FX purchases are smaller, ranging between $0.5 mln and $26.8 mln, with the average volume of $8.2 mln. The volume of FX interventions as a share of interbank market transactions is quite high, reaching up to 25 percent.

Figures 2 and 3 present the dynamics of NBKR official exchange rate and FX sales and FX purchases, respectively. As shown in the figures, FX sales tend to take place in periods of exchange rate depreciation, while FX purchases take place in periods of exchange rate appreciations, which is consistent with the "leaning against the wind" hypothesis. For instance, NBKR intervened to arrest rapid depreciation of the currency following the oil price shock and depreciation of the Russian ruble in 2014-15 and COVID shock in March-April 2020. In the meantime, NBKR was building up reserves to maintain prudent reserve adequacy metrics in line with IMF program conditionality through FX purchases in periods of exchange rate appreciation. It is also notable that NBKR has not purchased foreign currency from early 2018 but continued building up FX reserves through purchases of monetary gold.

Figure 4 plots the dynamics of 12-week moving average of NBKR official exchange rate changes. Average exchange rate changes fluctuate between -1.0 and 1.7 percent. Periods of large exchange rate depreciations in 2013, 2014, 2015 and 2020 tend to follow by appreciations, in line with the floating regime. The percentage rate of depreciations tends to be on average larger than the percentage rate of appreciations, pushing the level of the exchange rate up over time. A period of stability was observed from end-2018 until the COVID-19 shock, when the KGS/USD exchange rate was fluctuating at a level slightly below 70.

Figure 5 shows the dynamics of 12-week moving average of standard deviation of NBKR official exchange rate changes. The dynamic suggests that exchange rate changes have displayed pockets of volatility during the oil price shock in 2014-2015 and consequent depreciation of the Russian ruble, but the largest volatility was observed following the

COVID-19 shock in early-2020. Both the average level of FX rate changes and their volatility could be potential factors in the decision to intervene in the FX market, which we will analyze next.

V. Empirical Specification and Estimation Results

This section presents estimations aimed at analyzing determinants and consequences of FX interventions. We check whether FX interventions are symmetric to exchange rate fluctuations, estimate the exchange rate management index, analyze the determinants of FX interventions, and evaluate what happens with the exchange rate around FX interventions.

A. Are FX interventions symmetric to exchange rate fluctuations?

In this section, we check whether FX interventions are symmetric in dampening exchange rate fluctuations in both directions, or asymmetrically leaning against appreciation or depreciation. The degree of symmetry is relevant for understanding the underlying motives for intervening in FX markets and for their macroeconomic effects since symmetric and asymmetric interventions are likely to have different impact on exchange rates and inflation.

Following Adler and others (2020), we construct an index of symmetry of FX interventions:

$$IS_t = \sum_{i=1}^{M} \left[\frac{FXI_{t-i+1}}{GDP_{t-i+1}}\right] / \sum_{i=1}^{M} abs\left[\frac{FXI_{t-i+1}}{GDP_{t-i+1}}\right]$$

where *M* is the rolling-window interval (90 days), *FXI* is the volume of net FX interventions in USD (FX purchases minus FX sales), and GDP is the annual GDP in USD. The index of symmetry *IS* takes the value of 0 if interventions are fully symmetric, and 1(-1) if they have asymmetry toward purchases (sales).

Figure 6 plots the relationship between the numerator and denominator of the above expression. As shown in the picture, there is an asymmetry toward FX sales. This provides an indirect indication that FX interventions asymmetrically lean against depreciations of domestic currency. Nevertheless, this asymmetry has not led to deterioration of reserve adequacy metrics and import coverage of FX reserves exceeded the 3 months adequacy level over the 2010-2020 period.

B. What is the degree of exchange rate management?

The above analysis provides a useful description of the extent of the use of FX interventions. However, it may not properly reflect the difference in exchange rate management over time, as the country may face different types of shocks and the use of FX interventions may reflect that.

Therefore, following Adler and others (2020), we construct an alternative metric to measure the degree of exchange rate management:

$$\rho_t = \frac{\sigma_t^{fxi}}{\sigma_t^e + \sigma_t^{fxi}}$$

where σ^e is the standard deviation of daily changes in the KGS/USD exchange rate during the quarter and σ^{fxi} is the standard deviation of daily FX intervention/GDP ratio computed over the same quarter. This index varies between 0 (floating exchange rate) and 1 (fixed exchange rate), with the continuum between the two extremes reflecting the degree of exchange rate management.

Figure 7 displays the dynamics of quarterly exchange rate management index. As shown in the figure, the exchange rate management index was ranging between 0.1 and 0.2 until 2018 Q3 suggesting a relatively free-floating regime. Starting from end-2018 exchange rate movements have stabilized markedly, pushing the exchange rate management index above 0.4. From 2020 Q1, exchange rate volatility has increased following the COVID shock and the exchange rate management index has declined to below 0.1.

The average value of exchange rate management index in the Kyrgyz Republic is estimated at 0.22 for the whole sample. Comparing these estimates to those reported by Adler and others (2020), we find that the exchange rate management index in the Kyrgyz Republic is higher than the estimates for advanced economies (0.12-0.13), but lower than the estimates for emerging economies (0.40-0.42). This confirms that the level of exchange rate management in the Kyrgyz Republic is relatively modest and consistent with the announced floating regime and transition to inflation targeting.

C. What are the determinants of FX interventions?

Following Gerlach (2007), we use an ordered logit model to assess the determinants of FX interventions.[4] We have three categorical values for the FX interventions variable (*y*): FX purchase = -1, no intervention = 0, and FX sale = 1. Following Chmelarova and Schnabl (2006), the factors affecting the decision to intervene are the percentage deviation of the level of the exchange rate relative to its 12-week moving average (*er*) and the 12-week standard deviation of exchange rate changes as a proxy for volatility (*vol*).

The empirical specification takes the following form:

$$y_t^* = \alpha + \beta er_t + \gamma vol_t + \varepsilon_t$$

[4] Gerlach (2007) has used the ordered logit model to assess the likelihood of ECB policy rate changes.

where α, β, and γ are coefficients to be estimated, and ε is the residual. The predicted probabilities are estimated as:

$$P(y_t = "FX\ purchase") = P(y_t^* \leq \tau_1)$$

$$P(y_t = "no\ intervention") = P(\tau_1 \leq y_t^* \leq \tau_2)$$

$$P(y_t = "FX\ purchase") = P(\tau_2 \leq y_t^*)$$

where τ_1 and τ_2 are the cut-off values of y^* associated with respective probabilities of FX interventions that need to be estimated.

Table 1 presents estimation results from the ordered logit model. Both determinants of interventions are significant. FX sales (purchases) are more (less) likely in periods when exchange rate depreciates against its 12-week moving average. FX sales (purchases) are less (more) likely in periods of high volatility of exchange rate changes. The latter could be explained by the precautionary motive and willingness to building up FX reserves in periods of exchange rate volatility triggered by external shocks (drop in oil prices, depreciation of the Russian ruble, decline in remittances).

Using these estimation results, we predict the likelihood of FX interventions and plot them over time (Figure 8). The average probability of no exchange rate interventions over the total sample is 64 percent, followed by the average probability of sales of 26 percent, and the average probability of purchases of 10 percent. The probability of FX sales has increased during 2014-15 period when oil prices have dropped and Russian ruble has depreciated markedly. Most recently, the probability of sales has increased sharply in March-April 2020 following the COVID shock.

D. What happens with exchange rate around FX interventions? Event-study analysis

Following Gourinchas and Obstfeld (2012), we use an event study approach to assess what happens with the exchange rate around FX interventions.[5] The empirical specification takes the following form:

$$\Delta er_t = \alpha_0 + \sum_{j=-3}^{3} \beta_j S_{t+j} + \sum_{j=-3}^{3} \gamma_j P_{t+j} + \varepsilon_{i,t}$$

where t denotes time (weeks), Δer is the logarithmic difference of the KGS/USD exchange rate times 100, S is a dummy variable that takes the value 1 in periods of FX sales, P is a dummy variable that takes the value 1 in periods of FX purchases, and ε is the i.i.d. error term. Estimations are performed using the Newey-West estimator, that controls for heteroskedasticity and autocorrelation of up to 3 lags.

[5] Gourinchas and Obstfeld (2012) have used the event study approach to assess what happens with macroeconomic variables around economic crises.

Backward and forward lags *j=[-3; 3]* allow measuring the association between FX sales (purchases) and exchange rate changes 3 weeks around the intervention episode. This association is measured by coefficients β_j and γ_j, respectively, which quantify the conditional differences of exchange rate changes cover the *j=[-3,3]* interval relative to the no-intervention ("normal") periods beyond this interval.

Estimation results presented in Figure 9 provide evidence of "leaning against the wind":

- FX sales happen in weeks following those where exchange rate depreciates relative to normal periods by about 0.4 percent (upper chart). On the week of the sale, this relative depreciation comes down to 0.2 percent. Starting from the first week following the sale, the difference comes down further and becomes not significantly different from zero.

- FX purchases happen in weeks following those where exchange rate appreciates relative to normal periods by about 0.5 percent (lower chart). On the week of the purchase, this relative appreciation comes down to 0.4 percent. Starting from the first week following the purchase, the difference comes down further and becomes not significantly different from zero.

In the next step, we check whether exchange rate movements around FX interventions are affected by the size of FX interventions. For this purpose, we add interaction terms to the event study specification:

$$\Delta er_t = \alpha_0 + \sum_{j=-3}^{3} \beta_j S_{t+j} + \sum_{j=-3}^{3} \gamma_j P_{t+j} + \sum_{j=-3}^{3} \eta_j SL_{t+j} + \sum_{j=-3}^{3} \lambda_j PL_{t+j} \varepsilon_{i,t}$$

where *SL* is a dummy variable that takes the value 1 in periods of large FX sales, and *PL* is a dummy variable that takes the value 1 in periods of large FX purchases. Interventions are defined as large if they exceed 75th percentile of their respective distributions.

Estimation results presented in Figure 10 confirm the "leaning against the wind" hypothesis.

- FX sales happen in weeks where exchange rate is depreciated relative to normal periods (panel A, top chart). This relative depreciation comes down in the weeks after the FX sale.

- FX purchases happen in weeks where exchange rate is appreciated relative to normal periods (panel B, top chart). This relative appreciation comes down in the weeks after the FX purchase.

In addition, the estimations suggest that larger FX interventions are more effective in "leaning against the wind":

- The relative depreciation comes down even faster following large FX sales (panel A, bottom chart). The additional effect is about 0.4 percent on the week of the sale.

- The relative appreciation comes down even faster following large FX purchases (panel B, bottom chart). The additional effect is about 0.5 percent on the week of the purchase.

These estimates suggest that there is an association between FX interventions and FX rate movements. However, it is difficult to gauge whether this association is causal due to the endogeneity issues mentioned above.

VI. CONCLUSIONS

This paper provides evidence on determinants of FX interventions and their consequences for the exchange rate in the Kyrgyz Republic. Most of the literature addressing these important questions focuses on advanced and emerging economies, while evidence from low-income countries is scant. The objective of this paper is to fill this gap by providing empirical evidence from a low-income country.

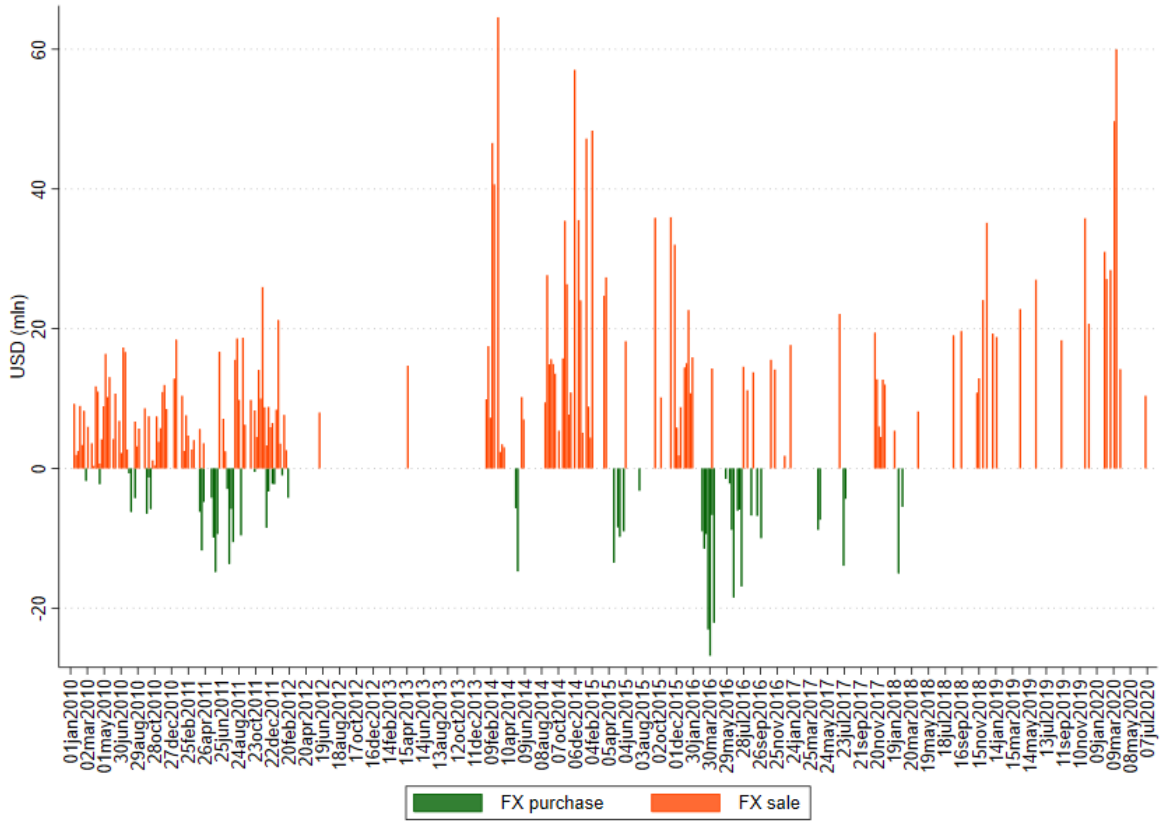
In terms of determinants, we find that FX interventions take place in response to movements in the exchange rate and its volatility. FX sales (purchases) are more (less) likely in periods when exchange rate depreciates against its 12-week moving average. In addition, FX sales (purchases) are less (more) likely in periods of high volatility of exchange rate changes over the previous 12 weeks.

We also find evidence of "leaning against the wind". FX sales (purchases) are preceded by acceleration in exchange rate depreciation (appreciation) and are followed by deceleration in exchange rate depreciation (appreciation). Moreover, this association is more pronounced for relatively larger FX sales and purchases (above their respective 75th percentiles). The "leaning against the wind" is skewed asymmetrically to leaning against depreciation of domestic currency and larger proportion of FX sales.

Finally, we document a varying degree of de-facto exchange rate stability despite the de-jure floating exchange rate regime. During most of the sample, the exchange rate management index was relatively low, providing support to the announced floating exchange rate regime. The exception is the period from 2018 Q4 until the COVID-19 shock, during which the exchange rate management index was about twice higher compared to the rest of the sample.

The empirical analysis presented in this study reflects average associations over the total sample period and does not test for the presence of possible structural breaks or policy shifts. In addition, it does not assess the role of monetary gold purchases as an alternative instrument to build FX reserves. Future work is needed to shed light on these issues and to provide evidence also from other countries in the Caucasus and Central Asia to check how it relates to the existing work in a broader set of emerging and low-income countries.

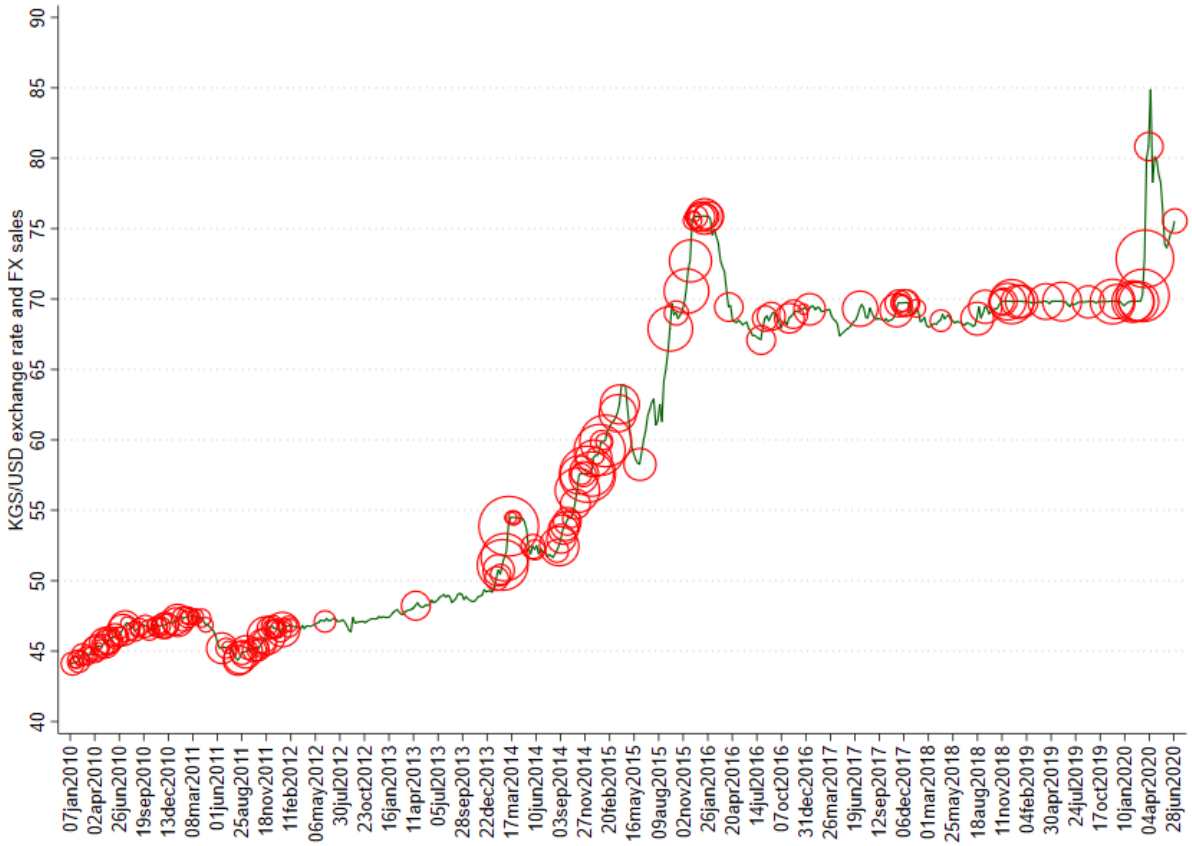
Figure 1. The volume of FX sales and purchases



Source: NBKR and IMF Staff calculations.

Note: Weekly interventions reflect the sum of daily interventions during the week. Both spot and forward interventions are included.

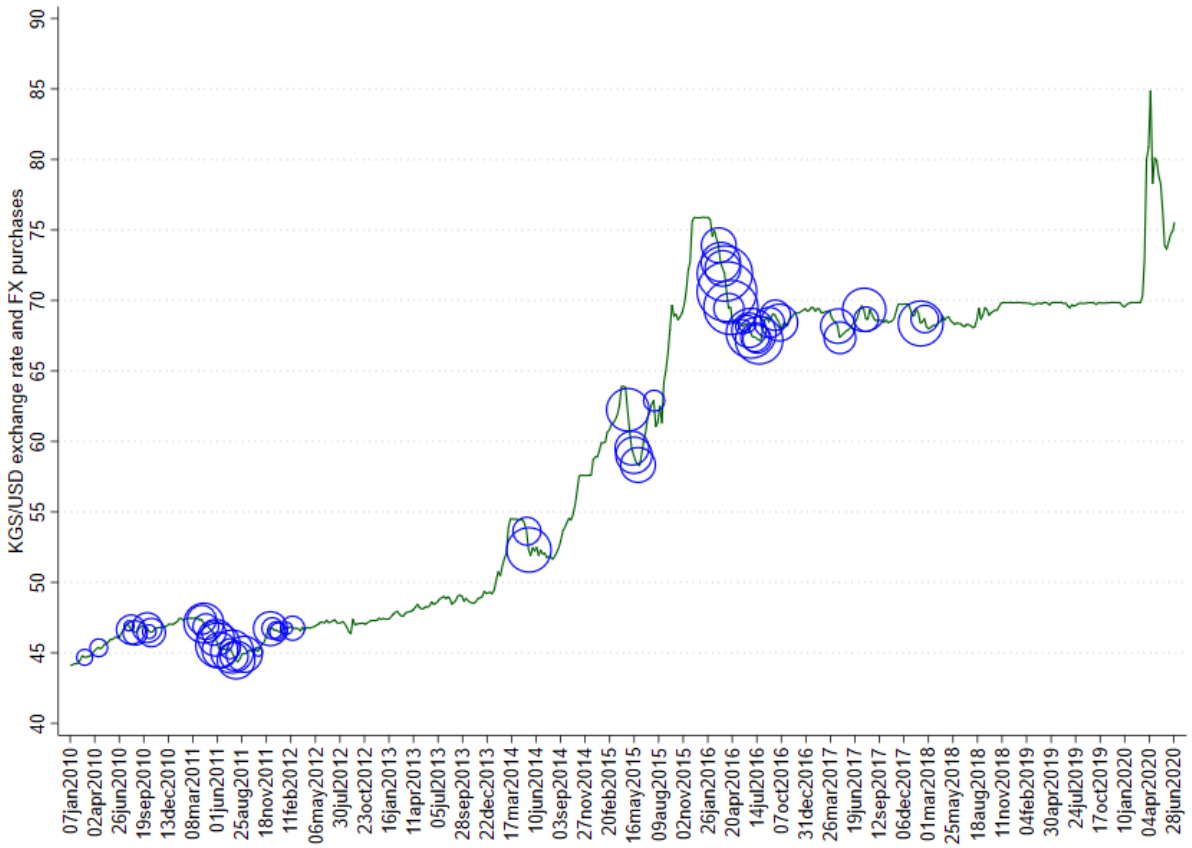
Figure 2. Exchange rate dynamics and FX sales



Source: NBKR and IMF Staff calculations.

Note: The size of the circle indicates the volume of the FX sale in US dollars.

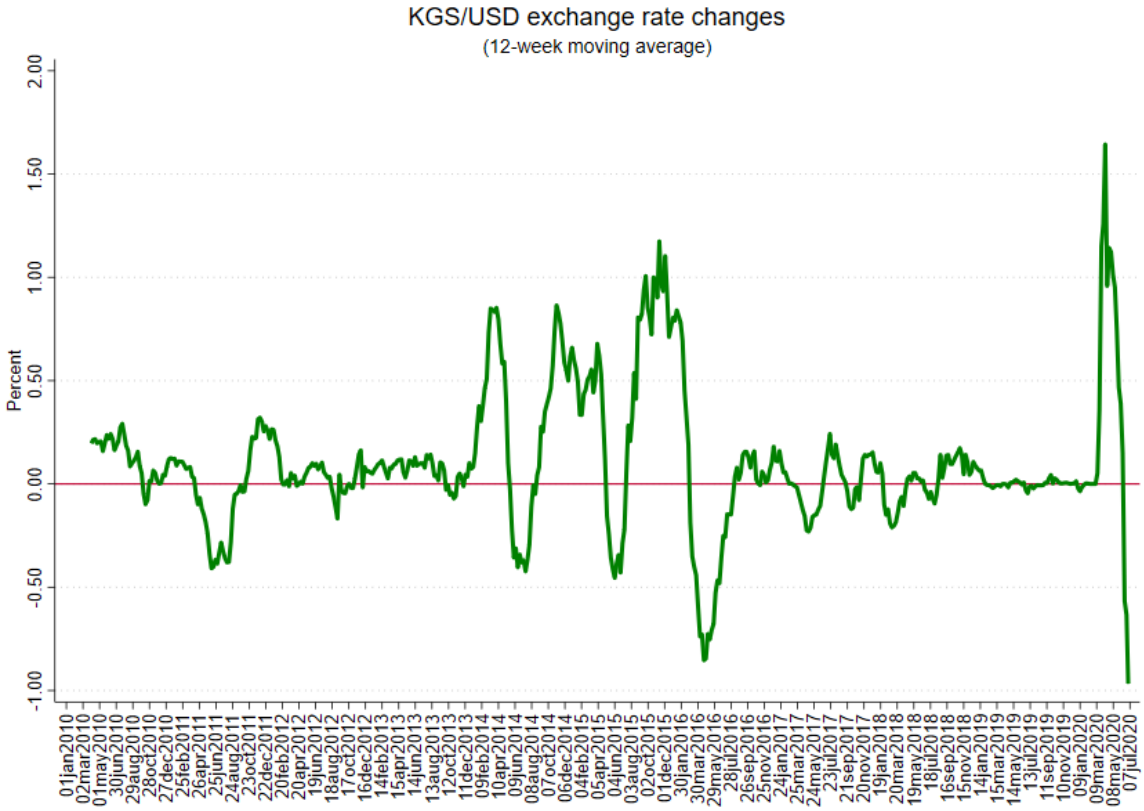
Figure 3. Exchange rate dynamics and FX purchases



Source: NBKR and IMF Staff calculations.

Note: The size of the circle indicates the volume of the FX purchase in US dollars.

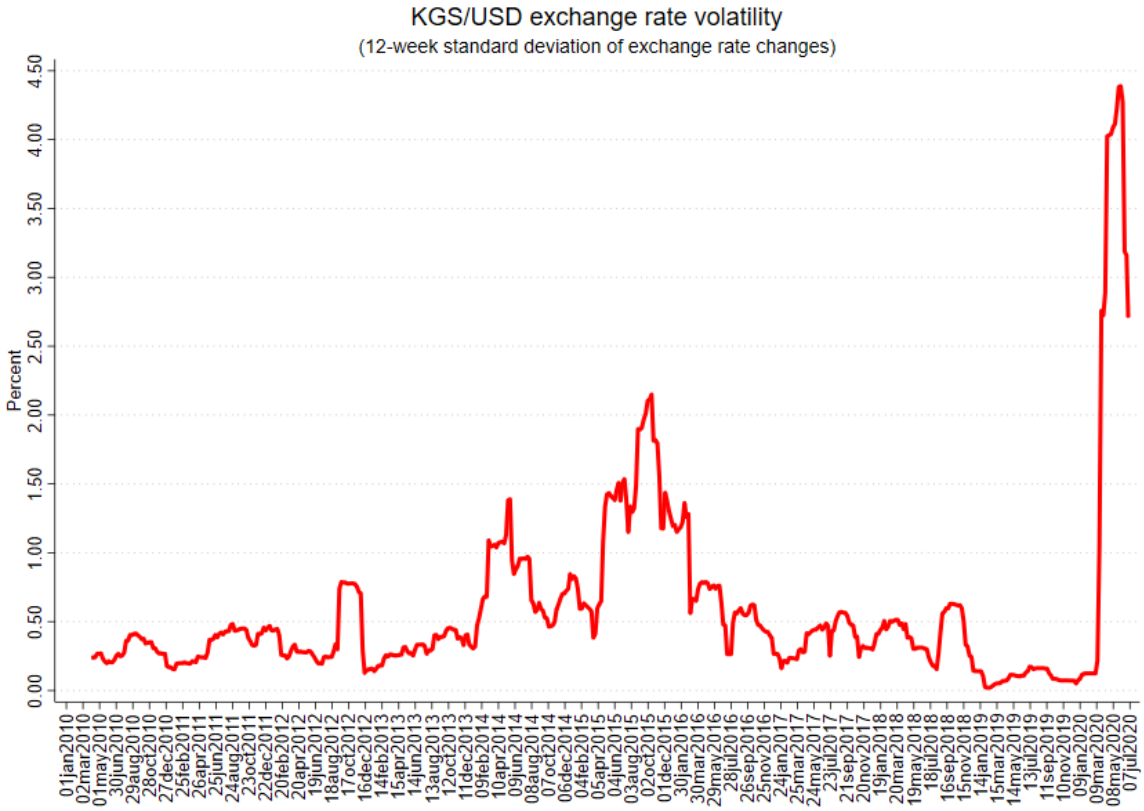
Figure 4. Moving average of exchange rate changes



Source: NBKR and IMF Staff calculations.

Note: Reported is a 12-week rolling-window average of KGS/USD exchange rate changes (in percent).

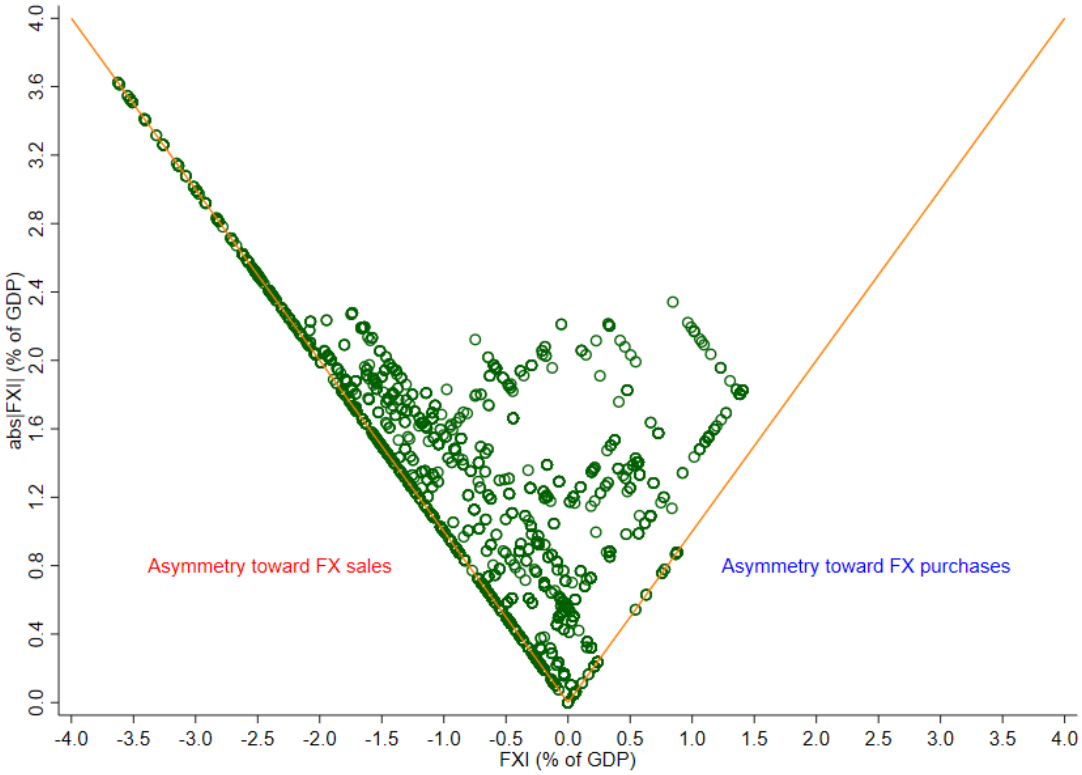
Figure 5. Moving average of volatility of exchange rate changes



Source: NBKR and IMF Staff calculations.

Note: Reported is a 12-week rolling-window average of standard deviation of KGS/USD exchange rate changes (in percent).

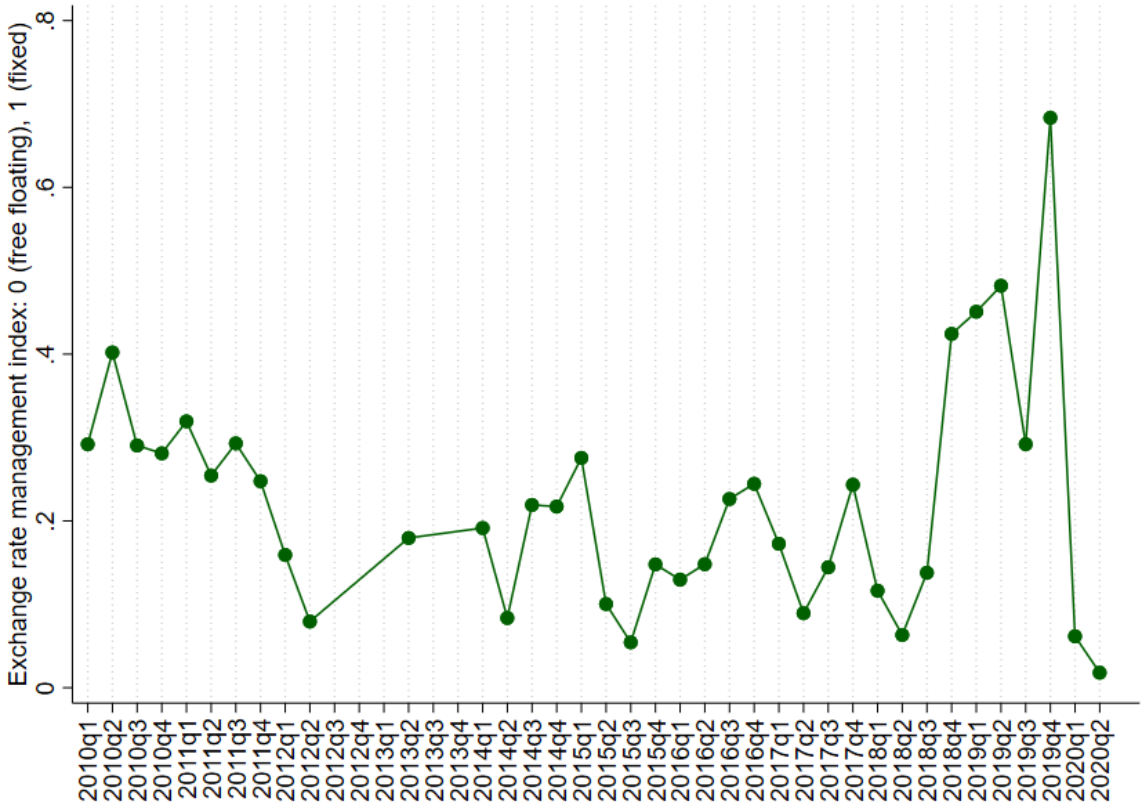
Figure 6. Symmetry of FX interventions



Source: NBKR and IMF Staff calculations.

Note: FXI is the 90-day rolling-window sum of the share of net exchange rate interventions (purchase minus sale) in GDP. abs|FXI| is the 90-day rolling-window absolute sum of the share of net exchange rate interventions (purchase minus sale) in GDP. The index of symmetry is the ratio of FXI over abs|FXI|, ranging between -1 and 1.

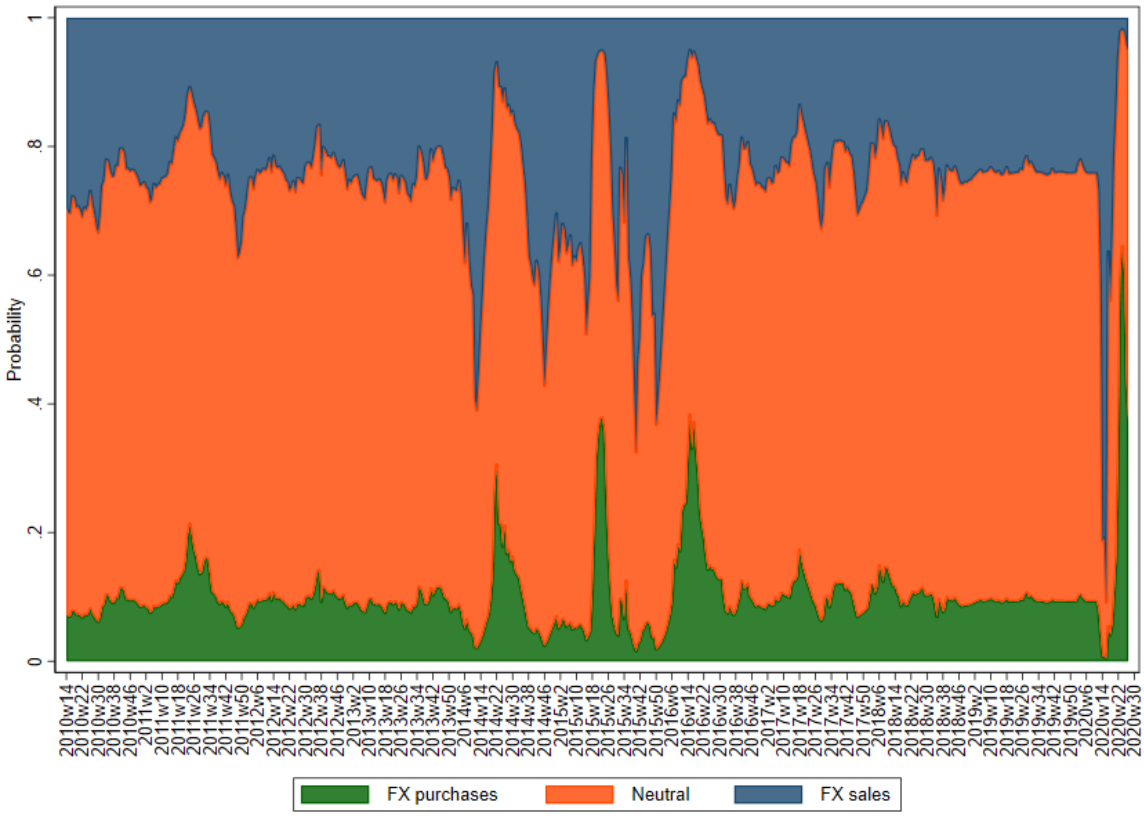
Figure 7. Exchange rate management index



Source: NBKR and IMF Staff calculations.

Note: Exchange rate management index = $\sigma^{fxi}/(\sigma^{e} + \sigma^{fxi})$, where σ^{e} is the standard deviation of exchange rate changes and σ^{fxi} is the standard deviation of the share of net foreign exchange interventions in GDP. Standard deviations are estimated for each quarter.

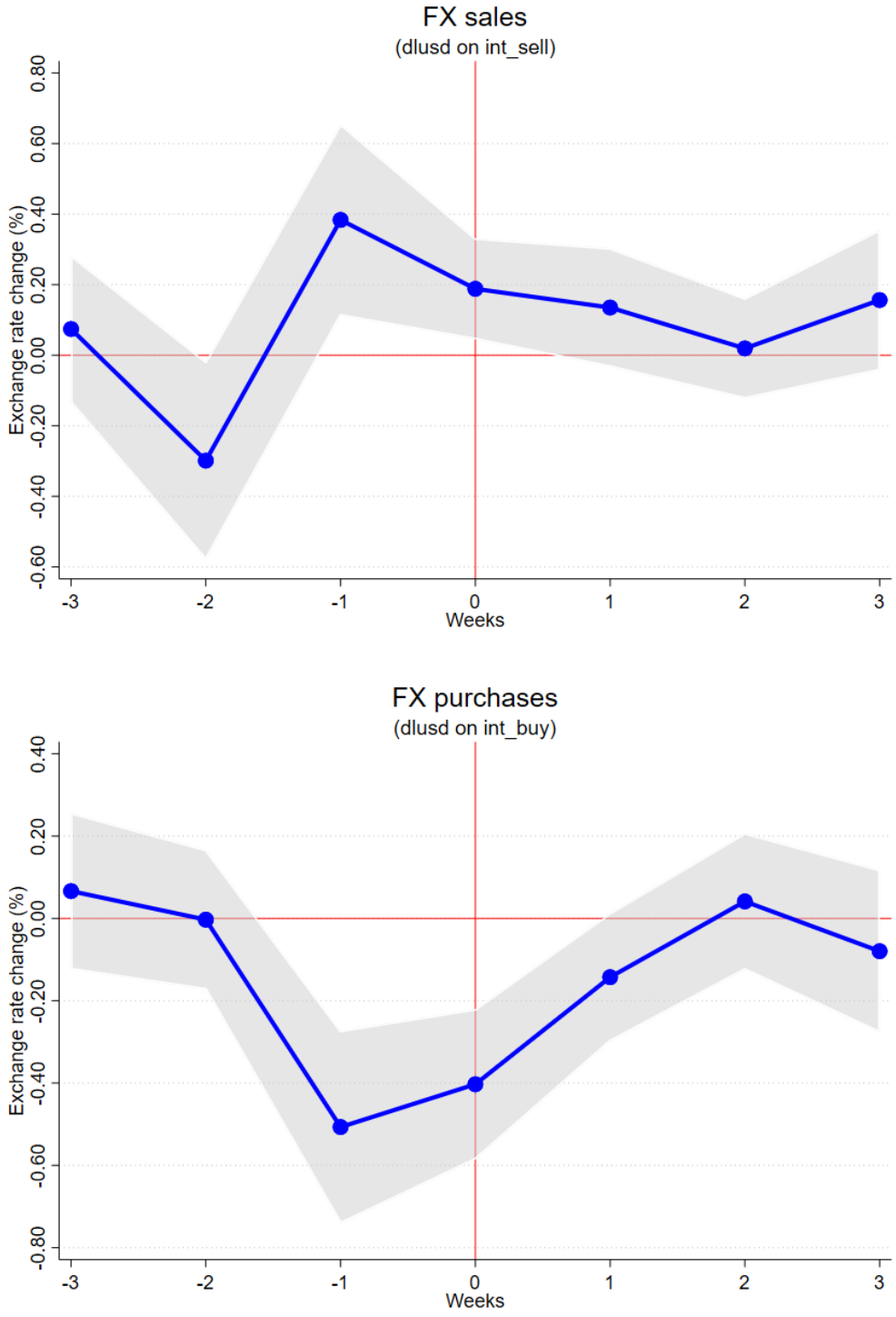
Figure 8. Estimated probabilities of FX interventions



Source: NBKR and IMF Staff calculations.

Note: Reported are estimated probabilities of FX interventions from the ordered logit model.

Figure 9. Event study analysis: Exchange rate changes around FX interventions

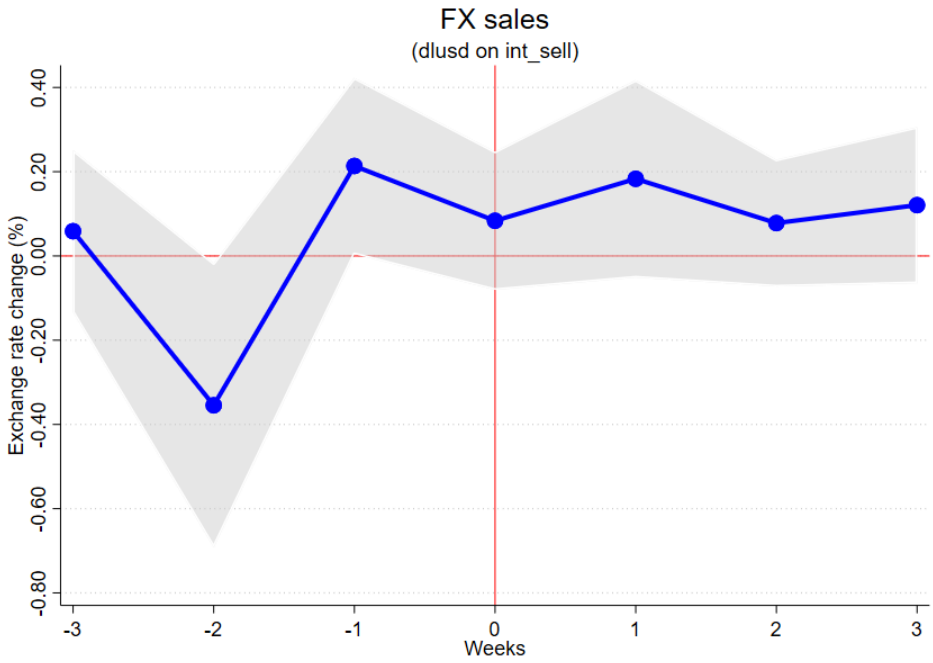


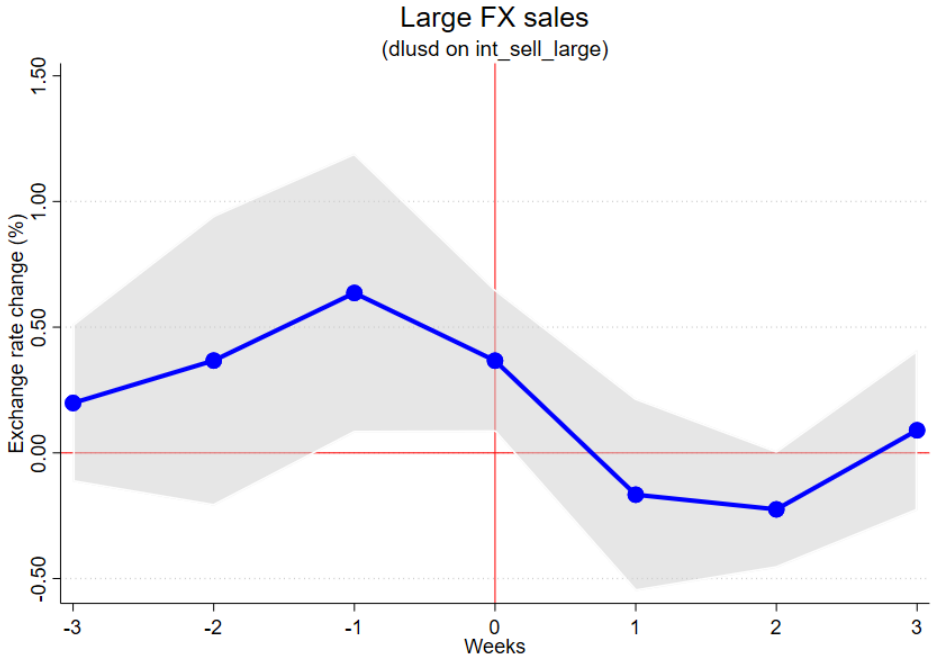
Source: NBKR and IMF Staff calculations.

Note: Time = 0 refers to the week of FX interventions.

Figure 10. Event study analysis: Exchange rate changes around FX interventions –size effects

Panel A



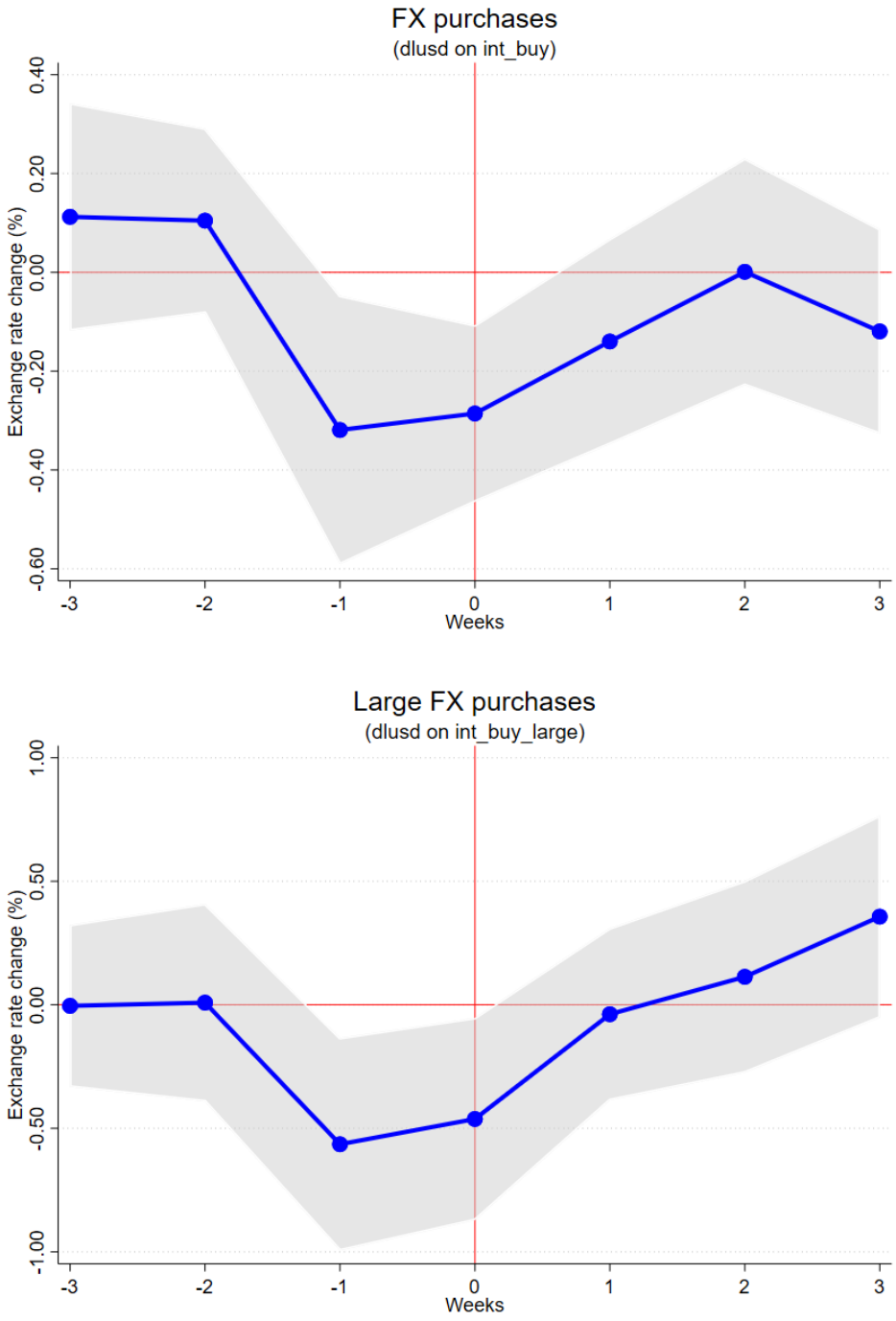


Source: NBKR and IMF Staff calculations.

Note: Time = 0 refers to the week of FX interventions.

Figure 10 (cont-ed). Event study analysis: Exchange rate changes around FX interventions – size effects

Panel B



Source: NBKR and IMF Staff calculations.

Note: Time = 0 refers to the week of FX interventions.

Table 1. Determinants of FX interventions: Ordered logit model

	(1)
Deviation of exchange rate from its 12-week moving average (percent)	0.280***
	(0.058)
12-week st. dev. of exchange rate changes (percent)	-0.282**
	(0.137)
Observations	534
Log-likelihood	-444.3
Pseudo Rsq	0.0439

Note: The dependent variable is the ordered categorical variable for FX purchases (-1), no interventions (0), and FX sales (1). Estimations are performed using the maximum likelihood estimator. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

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