THE IMMEDIATE IMPACT AND PERSISTENT EFFECT OF UNEXPECTED FX PURCHASES ON THE EXCHANGE RATE

Itamar Caspi, Amit Friedman, and Sigal Ribon

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Disclaimer

The views expressed herein are solely those of the authors and do not necessarily reflect the views of the Bank of Israel.

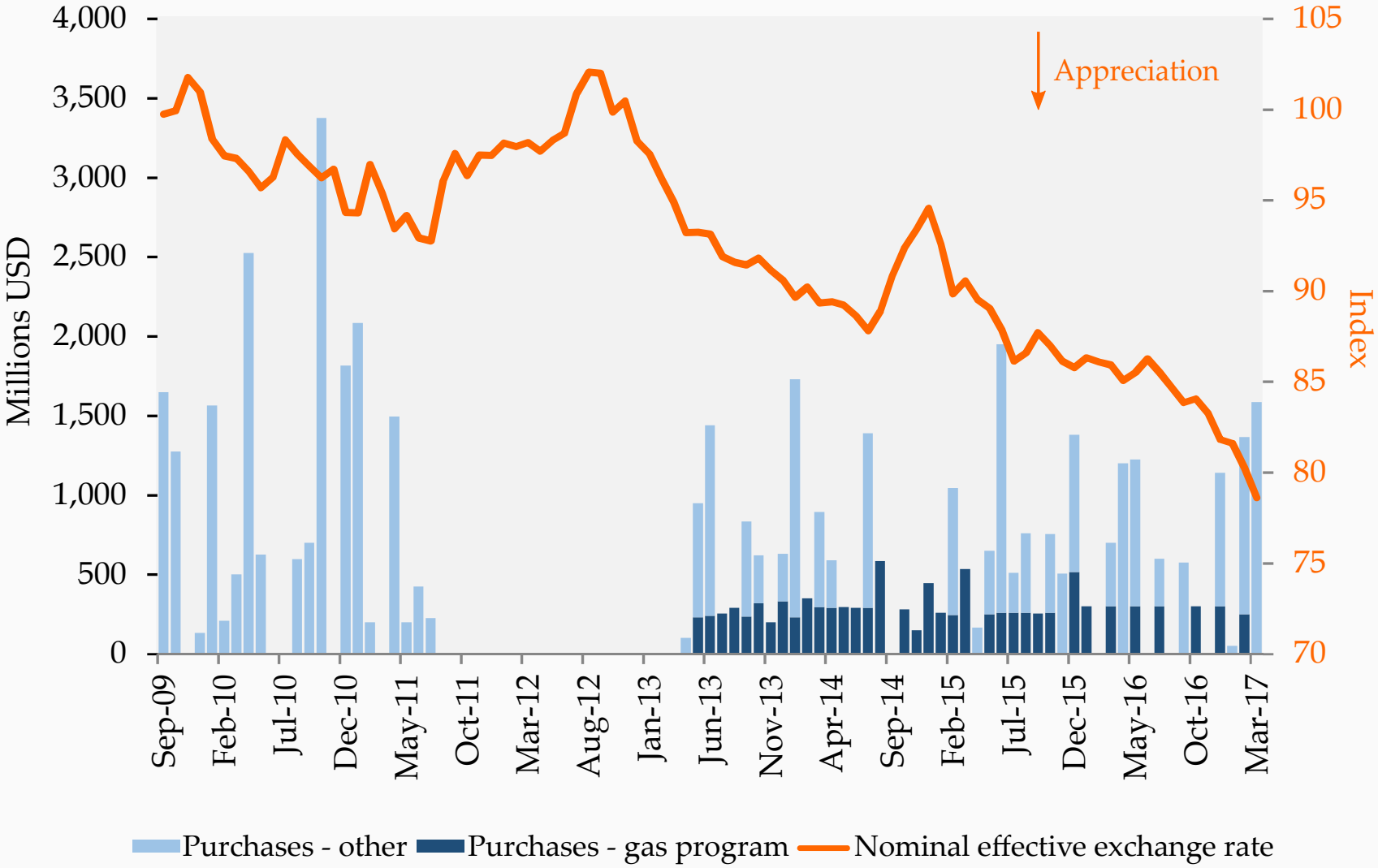
Introduction

Background

- The Bank of Israel's (BoI) main objective is to maintain price stability, defined in terms of an inflation target
- Since March 2008 the BoI has been purchasing foreign exchange (FX) and since August 2009, purchases are discretionary
- Purchases that amount to $82 billion, are of a macroeconomic scale (25% of GDP), and ongoing

FX interventions have become a regular monetary instrument

BoI purchases and the exchange rate (Sep 2009 - May 2017)



What we do

We study the effect of BoI's unanticipated FX intervention shocks on the nominal effective exchange rate (NEER) during the discretionary purchases regime

In particular, we

- use minute-by-minute data to estimate the immediate change in the exchange rate around FX interventions
- use the above measure to estimate the persistence of this effect using regressions with daily data
- combine our measures of persistence with actual data on interventions to quantify the overall effect of interventions on the exchange rate over time

Main findings

BoI's FX intervention shocks were effective in the sense that:

- 90% of interventions caused depreciation on impact
- the effect was persistent and lasted for 40-60 trading days
- interventions depreciated the level of the nominal effective exchange rate by 1.5-3 percent, on average

Reservation

We remain silent on the effect of the discretionary interventions regime itself

Outline

1. Introduction
2. Theory and evidence
3. Method
4. Data and results

Theory and evidence

How does sterilized FX intervention work in theory?

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Empirical literature

Surveys

- Sarno and Taylor (2001), Neely (2005, 2011), Menkhoff (2013), and Engel (2014).

Recent and closely related evidence:

- Fratzscher, et al. (2017) - analyze a novel dataset on daily interventions (actual and oral) from a broad cross section of 33 countries (including Israel) and find that intervention can be a highly effective policy tool.
- Kuersteiner, et al. (2016) investigate the effectiveness of sterilized foreign exchange interventions by exploiting a discontinuous policy rule used by the Central Bank of Colombia. They find an effect that lasts for 2-3 weeks.

Method

Interventions in an ideal experiment

Imagine that the central bank intervenes randomly. let ε_t denote a random intervention "shock" to the exchange rate at day t.

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Definition (cumulative causal effect)

the cumulative causal effect of a 1-unit intervention shock at time t on the level of the exchange rate, y_{t+h}, h periods ahead, is defined as

$$\beta_{(h)} \equiv \mathrm{E}(y_{t+h} - y_{t-1}|\varepsilon_t = 1) - \mathrm{E}(y_{t+h} - y_{t-1}|\varepsilon_t = 0)$$

where y_{t-1} is used to benchmark the cumulative change.

Estimating the causal effect of intervention shocks

Assuming linearity (as we do throughout), the h-period ahead cumulative causal effect can be estimated using

$$y_{t-1+h} - y_{t-1} = \alpha_{(h)} + \beta_{(h)}\varepsilon_t + u_{(h),t-1+h}$$

Definition (CIRF)

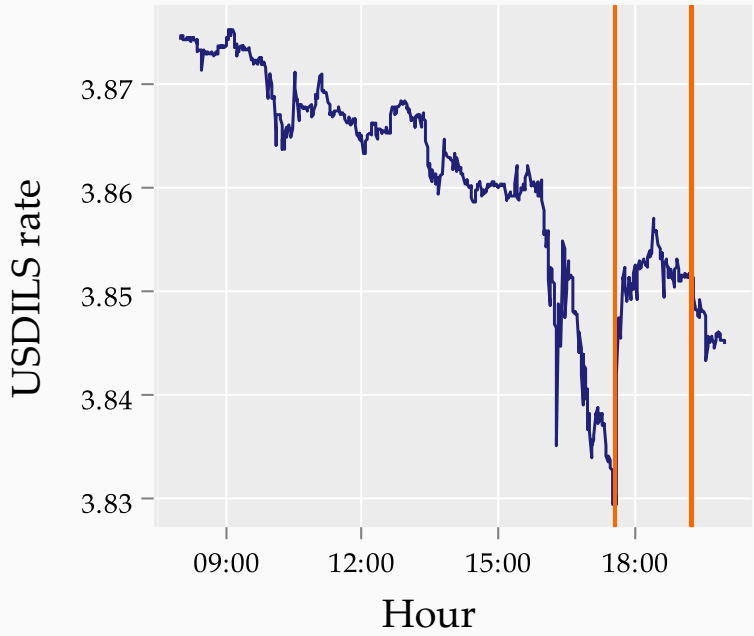
The sequence

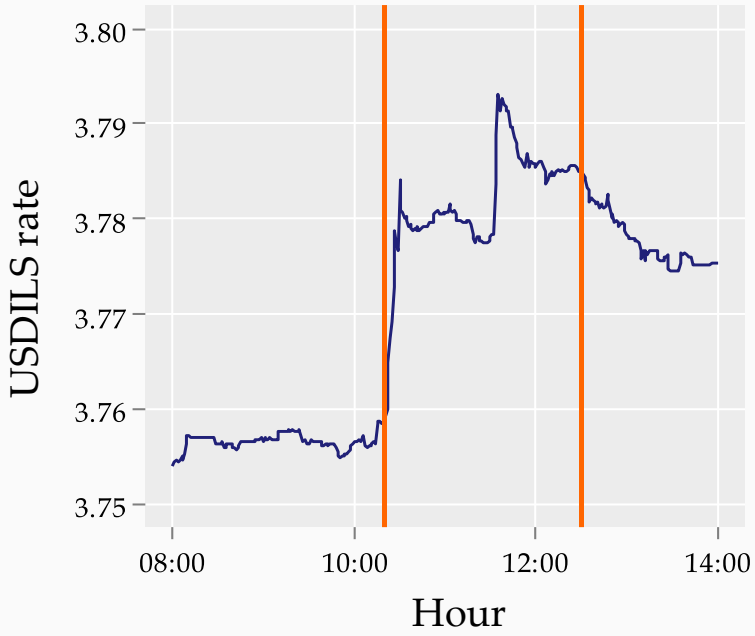
$$\beta_{(1)}, \beta_{(2)}, \ldots, \beta_{(H)}$$

is the cumulative impulse response function (CIRF) of a 1 unit intervention shock at time t.

In search of an intervention shock

Two examples (minute-by-minute data):

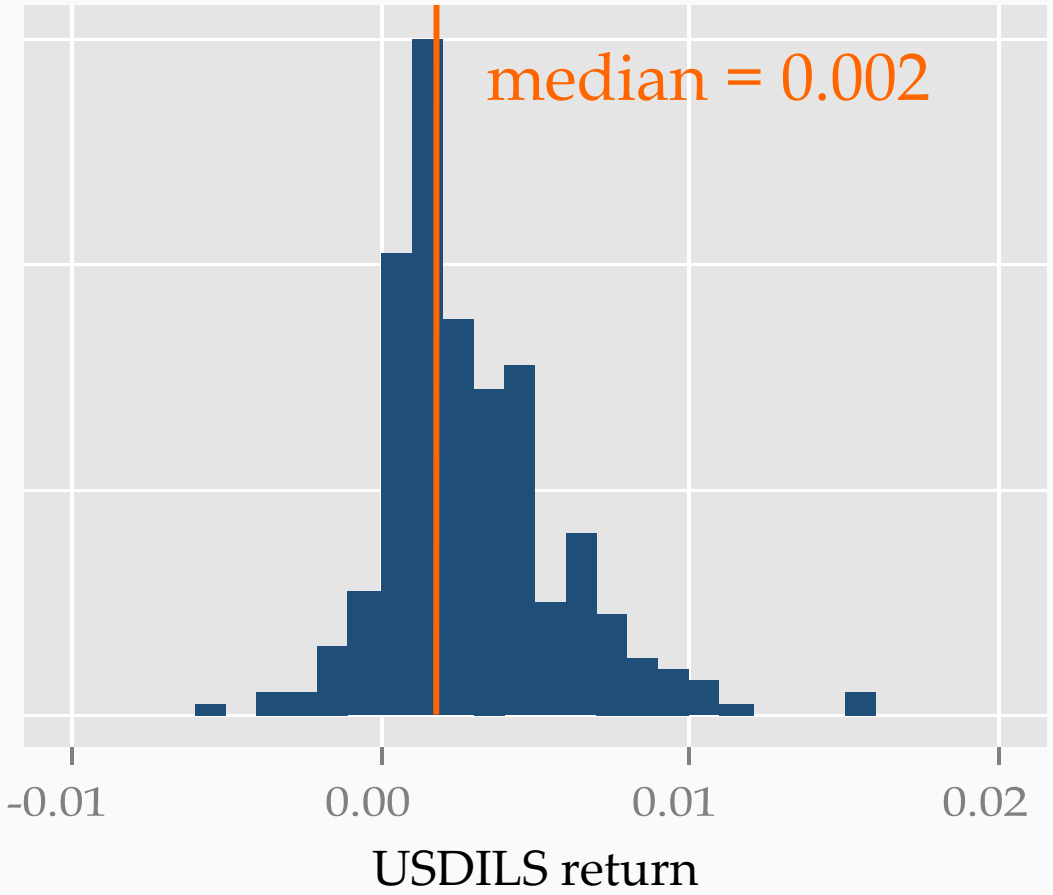




Denote by FXI_t the USDILS *return* during an intraday intervention window at day t (equal to zero if no intervention took place)

$FXI_t \stackrel{?}{=} \varepsilon_t$

The empirical distribution of FXI_t:



90% of FXI_t values are positive

Reaction function interpretation

Consider a typical linear reaction function for FXI_t (e.g., Sarno and Taylor, 2003):

$$FXI_t = \boldsymbol{\theta}' \boldsymbol{X}_t + \varepsilon_t$$

where $\boldsymbol{X}_t$ may include

- a desired target level of the exchange rate
- lagged changes of the exchange rate
- lagged FXI_t
- other predetermined economic factors

We interpret ε_t as being the unsystematic part of the Bank's reaction function

Identifying assumptions

We assume throughout that *conditioned* on X_t, FXI_t is

- UNEXPECTED - "as good as randomly assigned"
- DOMINANT - contemporaneously uncorrelated with other shocks

This enables us to get an unbiased estimate of $\beta_{(h)}$ using the following regression

$$y_{t-1+h} - y_{t-1} = \alpha_{(h)} + \beta_{(h)} FXI_t + \gamma_{(h)} X_t + u_{(h),t-1+h}$$

▸ formal

Data and results

Data and estimation

Sample

- discretionary purchases phase (Sep. 2009 - May 2017)
- over 1,800 trading days and hundreds of interventions

Data

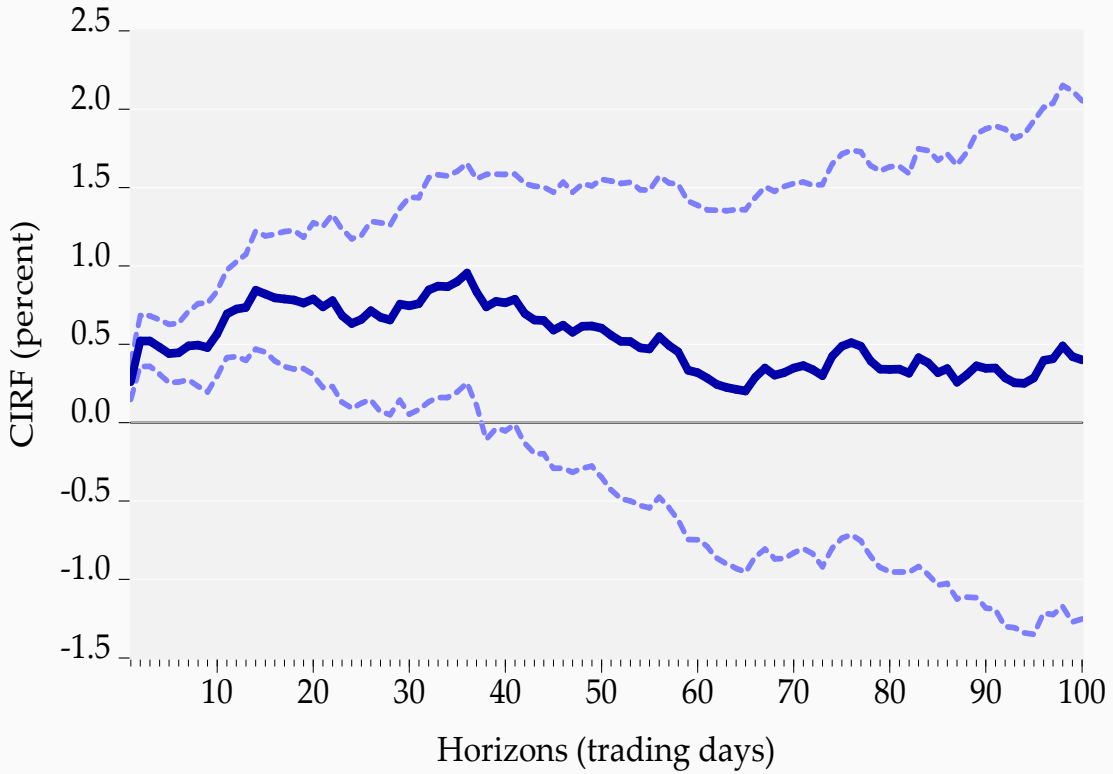
- y_t - daily level of the NEER (representative rate $\sim$2pm)
- FXI_t - day t's intraday return to intervention in USDILS terms (window = entire intervention spell)
- control variables - lagged y_t, Δy_t and FXI_t, interest rate spread (BoI vs. FED)

Estimation

- Local Projections (Jordà, 2005)
- HAC standard errors (Newey and West, 1987)

Cumulative response of log NEER to a 1-unit intervention shock

The NEER significantly depreciates on impact and remains significantly depreciated for 40 trading days ($\sim$ 2 calender months):



Note: Results from a regression without controls (with a 90% HAC confidence band)

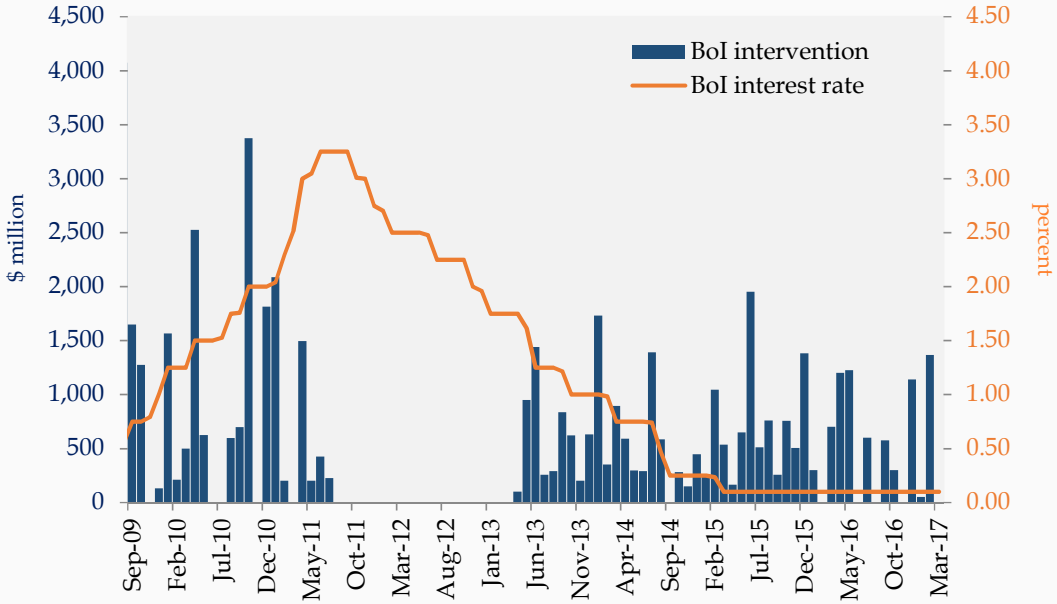
Adding controls

Cumulative response of the NEER to a 1-unit intervention shock

Horizon (trading days)	Model			
	(1)	(2)	(3)	(4)
1	0.26	0.24	0.23	0.25
	(0.07)	(0.07)	(0.07)	(0.07)
10	0.57	0.52	0.52	0.6
	(0.16)	(0.15)	(0.15)	(0.15)
25	0.66	0.62	0.61	0.84
	(0.32)	(0.29)	(0.29)	(0.26)
50	0.60	0.58	0.55	1.00
	(0.57)	(0.52)	(0.52)	(0.41)
	control variables			
lagged FXI_t	✗	✓	✓	✓
lagged Δy_t	✗	✗	✓	✓
interest spread	✗	✗	✗	✓

Note: Newey-West HAC standard errors in parentheses

The effect is sensitive to interest rate path



Estimating the overall effect on the level of the NEER

$$\text{Overall effect on day } t \equiv \sum_{h=1}^{H} \beta_{(h)} FXI_{t+1-h}$$

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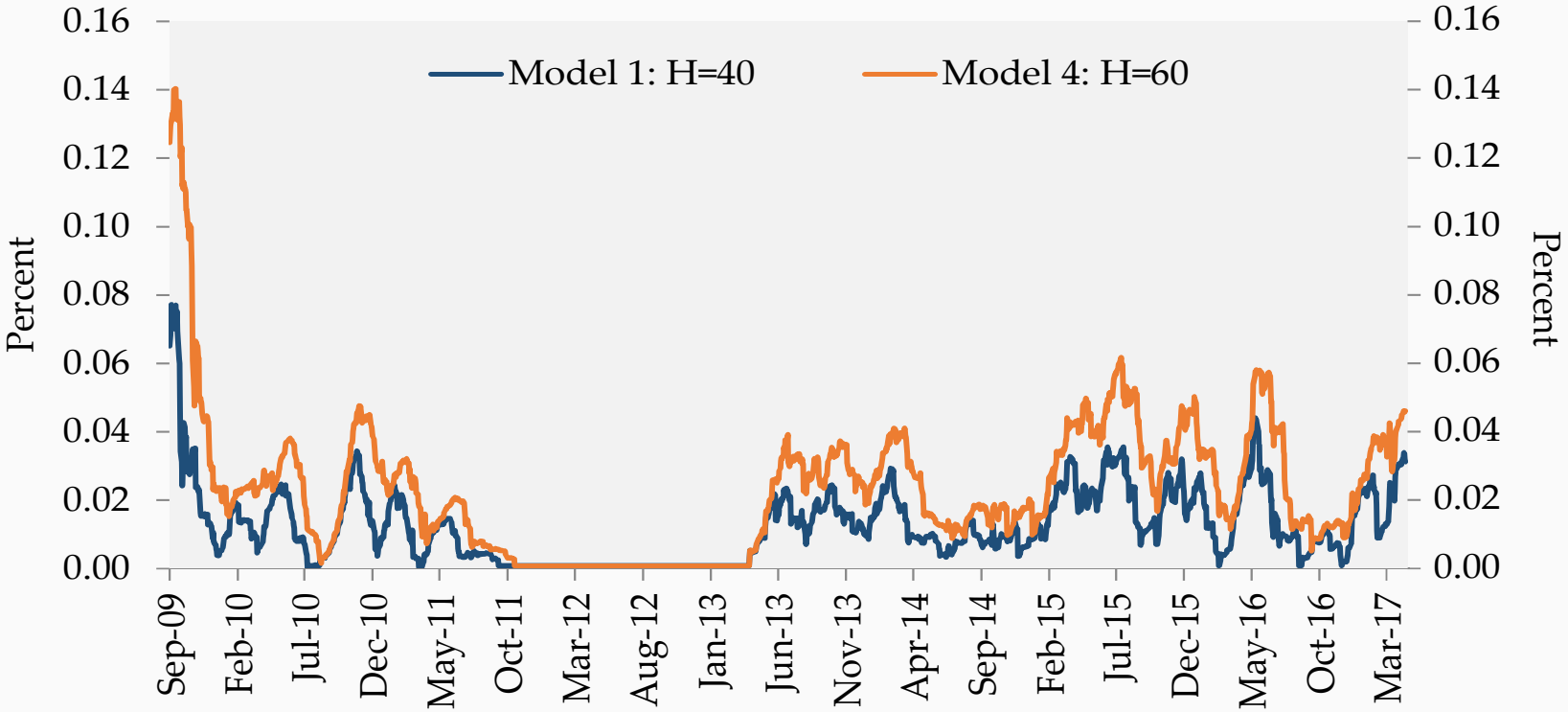


Since June 2013, we find an average effect of 1.5-3 percent when intervening. ▸ volume

Caveats and work in progress

Limitations:

- hard to extrapolate findings to different intervention regimes, episodes and countries (external validity)
- no measure of the effectiveness of the regime itself (the systematic part of the reaction function) ▸ "Fischer shock"

Work in progress:

- placebo effect
- mitigate "leftover" intraday endogeneity
- say something about the mechanism
- estimate the effect on uncertainty

Concluding remarks

- Since March 2008, BoI has been implementing an active FX intervention policy. Since August 2009, purchases are discretionary.
- In this study we examine the effectiveness of BoI's intervention shocks
- We use a high-frequency measure of changes in the exchange rate around interventions and a set of controls to estimate the persistence and overall effect of intervention shocks
- We find that BoI's intervention shocks resulted in a 90% success rate on impact, had a medium-term effect that lasted for 40-60 trading days, and an overall effect of 1.5-3% depreciation, on average, since June 2013.

Thank you

Comments are welcome:

itamar.caspi@boi.org.il
amit.friedman@boi.rog.il
sigal.ribon@boi.org.il

Formal identifying assumptions

Borrowing from Angrist, Jordà, and Kuersteiner (2013):

Definition (potential outcome)

A potential outcome, $y^{\psi}_{t+h}(f)$, is the value that y_{t+h} would take if $FXI_t = f$, where ψ refers to the parameters of the reaction function (i.e., the regime)

Assumption (selection-on-observables)

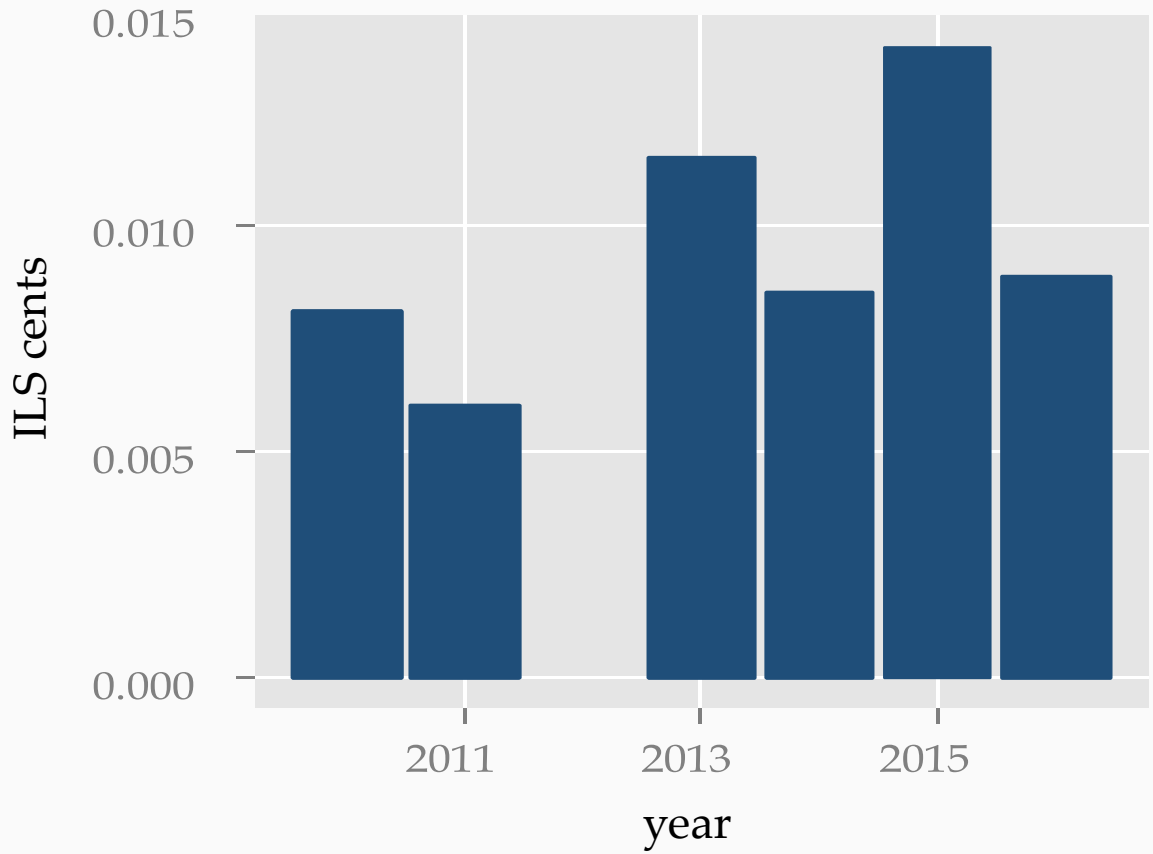
$$\left(y^{\psi}_{t+h}(f) - y_{t-1}\right) \perp FXI_t | \mathbf{X}_t \qquad \text{for all } h > 0$$

where $\mathbf{X}_t$ is a vector of control variables

◂ Back

How much did the BoI get for $100 million?

The average USDILS return on a purchase of $100 million by year:



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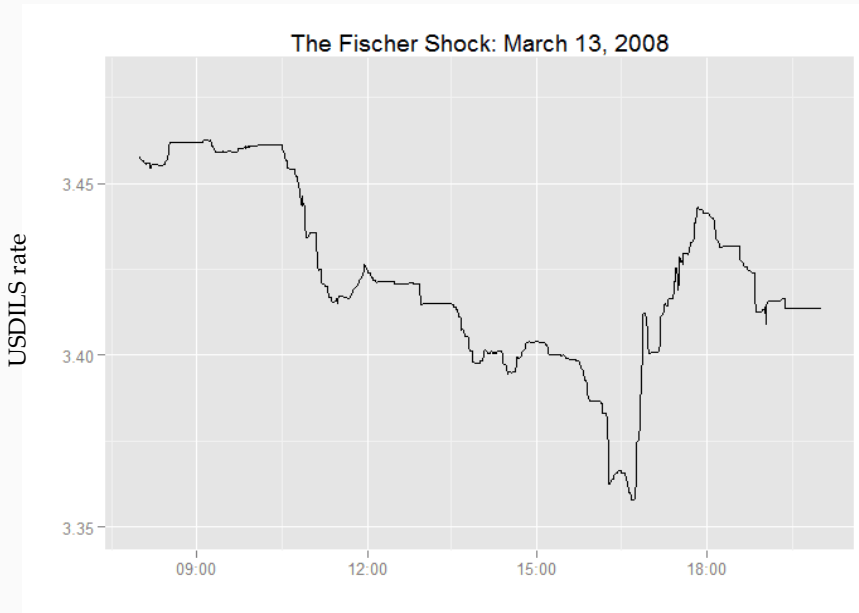
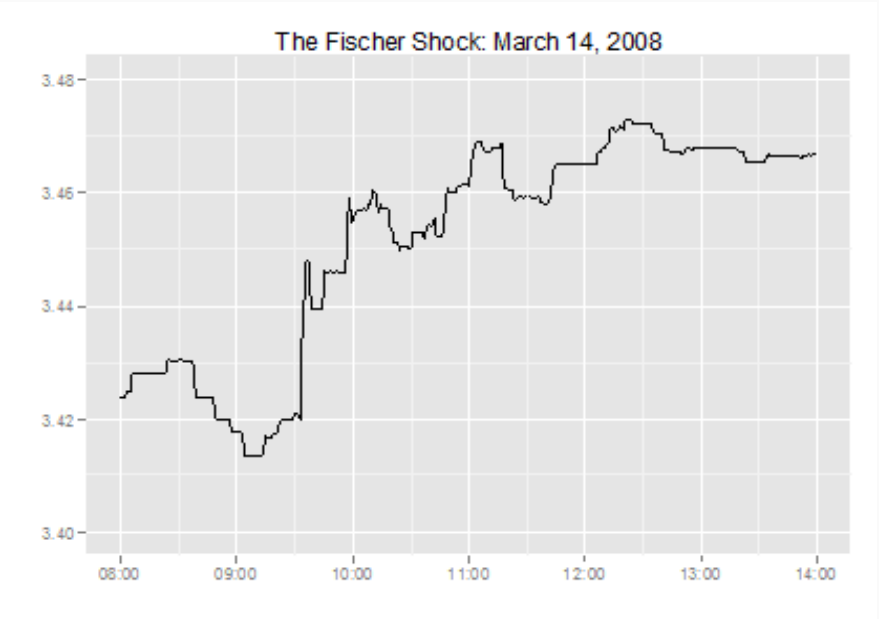
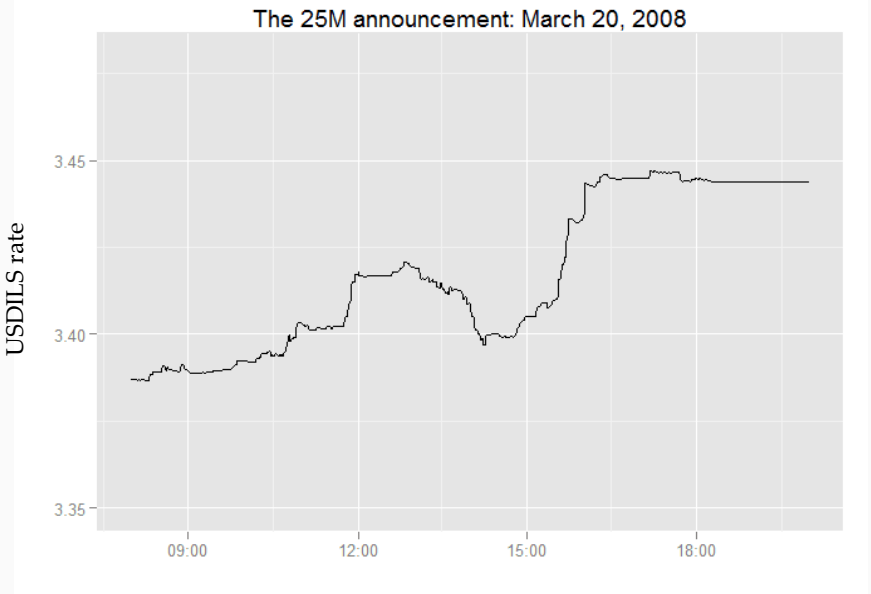
What might an unexpected regime shift look like?







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