When a Market Changes Hands

Dollar Funding and the Price of a Domestic Safe Asset

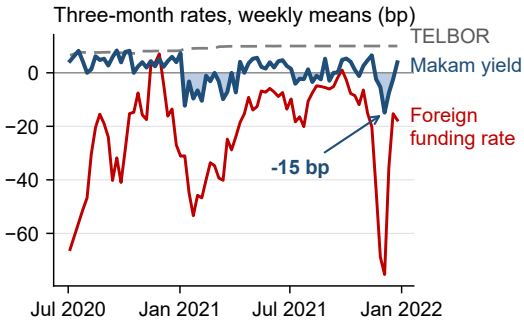
Nadav Ben Zeev Noam Ben-Ze'ev Daniel Nathan

Ben-Gurion University • Bank of Israel • The Hong Kong Polytechnic University

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

Israel's central-bank bills yielded below zero while banks earned a positive rate



- Makam, the Bank of Israel's own short-term bills
  - Zero coupon, three and twelve months
  - De facto benchmark, more liquid than short government bonds
- Below zero in 25 of 79 weeks
  - Lowest −15 bp, when TELBOR, the interbank rate, was 10 bp
- Why hold a bill that pays less than a deposit at the same central bank?

July 2020–December 2021, weekly means of three-month rates. Shading marks weeks with a negative Makam yield.

Bank of Israel and LSEG.

Part of a bill's convenience yield is the funding cost of its foreign investors

- Safe bills usually pay less than the interbank rate
  - The yield investors give up for safety and liquidity is called the convenience yield
- Our answer for Makam
  - Foreign investors get shekels below TELBOR through currency swaps
  - Domestic holders compare Makam with TELBOR, foreigners with their funding rate
  - The bigger the foreign part, the closer the yield to their funding rate
    - The group most ready to buy or sell holds the yield near its own rate
    - We show that banks played this role until they sold their bills to foreign investors

Headline

In January–September 2022, Makam yielded 51 bp less than TELBOR. If foreign investors could have funded at TELBOR, the Makam yield would have been 34 bp higher.

A measured convenience yield is not always about safety and liquidity

- A bill spread measures convenience only against the holders' own alternative
  - Banks compare the bill with a central-bank deposit, about TELBOR
  - Hedged foreign investors compare it with their funding rate, below TELBOR
- When holders' alternatives differ from the benchmark, the spread mixes convenience with that difference
  - Here, dollar funding: 34 of 51 bp in Israel in 2022, and the same pattern in Mexico and Japan
  - Elsewhere, central-bank access, taxes or regulation

Before reading a bill spread as a convenience yield, ask who holds the bills and what else they could do with the money.

What we add

- **Convenience yields.** Part of a measured convenience yield can be the dollar funding cost of the bill's foreign holders

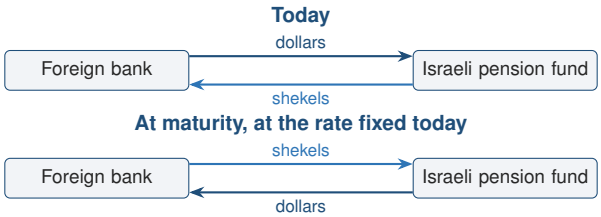
  Krishnamurthy and Vissing-Jorgensen (2012), Nagel (2016), Du, Im and Schreger (2018), Jiang, Krishnamurthy and Lustig (2021)
- **CIP deviations.** Read from the other side, as the cost of local currency for foreign holders, they price a local safe asset

  Ivashina, Scharfstein and Stein (2015), Du, Tepper and Verdelhan (2018)
- **Who holds sovereign debt.** Each group of holders values the bill against its own rate, so a new investor base changes which rate the price follows

  Koijen and Yogo (2019), Fang, Hardy and Lewis (2025)
- **Local-currency borrowing.** Borrowing in your own currency does not shield you from conditions abroad. Unhedged foreign holders bring in exchange-rate shocks. Hedged ones bring in dollar funding shocks

  Carstens and Shin (2019), Hofmann, Shim and Shin (2020)

An FX swap exchanges currencies today and back at a rate fixed today

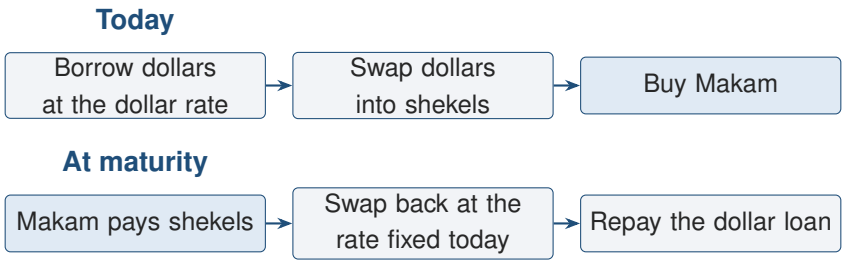


- The rate fixed today sets the shekel rate the foreign bank pays, the foreign funding rate
- Covered interest parity (CIP) says that rate should equal TELBOR
  - Pension funds hedging foreign assets sell dollars forward, USD 32 bn in 2018–19 and 81 bn in 2022, so the rate is below TELBOR
  - TELBOR minus the foreign funding rate, the CIP deviation, was 27 bp in 2018–19 and 95 bp in 2022

CIP deviations are usually read as the cost of dollars. Here they are the cost of shekels for foreign holders of Makam.

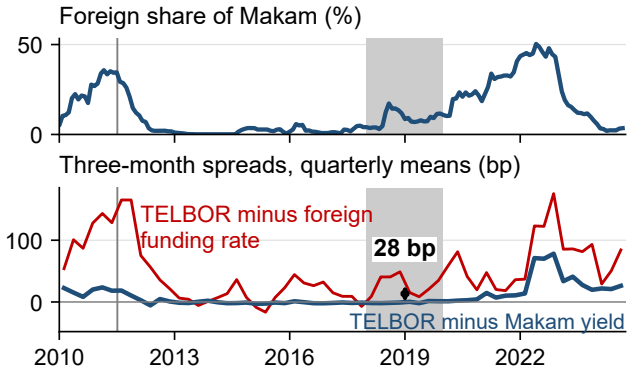
Foreign banks used the swap to hold Makam

- The opportunity. Israeli hedgers' demand for dollars let foreign banks get shekels below TELBOR



- Profit is the Makam yield minus the foreign funding rate, with no currency risk
- Worth doing whenever Makam beats the foreign funding rate, even below TELBOR
- Each position uses the bank's balance sheet, so banks take only so much

In 2018–19 foreign investors could earn 28 bp, yet Makam yielded TELBOR



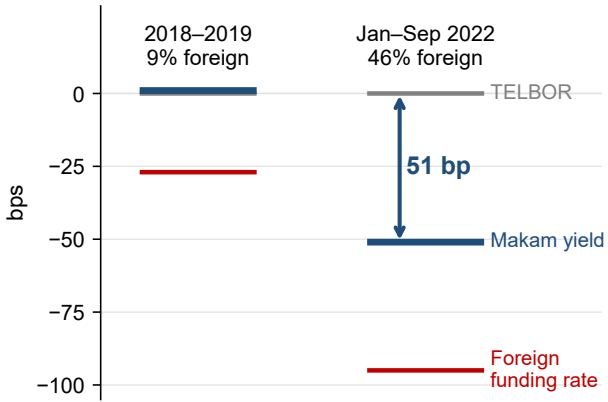
- Foreign investors held only 9% of Makam
- Global banks could have taken the trade
  - Capital rules make each position costly, so they took few

While foreign investors were few, domestic holders set the price.

Three-month rates. Shading marks 2018–19. The vertical line marks the end of nonresidents' tax exemption in 2011.

Bank of Israel and LSEG.

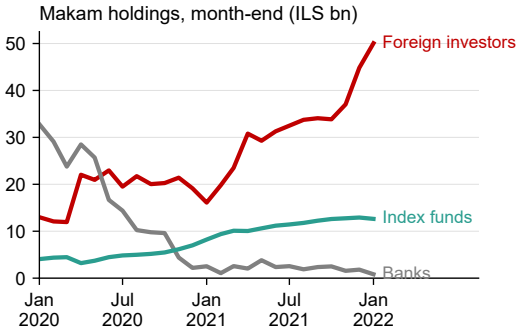
Foreigners held almost half in 2022, and Makam yielded 51 bp below TELBOR



More foreign ownership, Makam closer to the foreign funding rate

Three-month rates, means over January 2018–December 2019 and January–September 2022. Bank of Israel and LSEG.

Banks sold to foreign investors, so domestic demand did not widen the gap

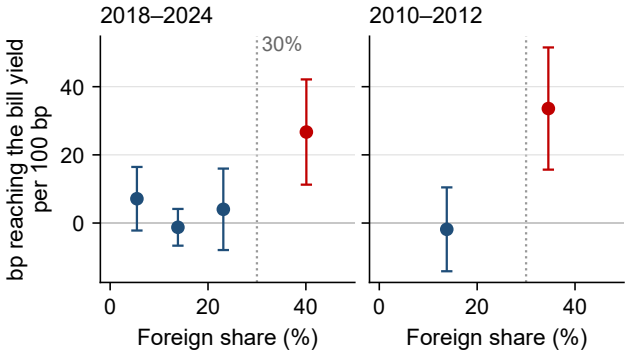


- Banks sold as the yield fell below TELBOR
  - Banks −ILS 32.0 bn, foreign investors +ILS 37.1 bn
- Index funds kept buying, +ILS 8.2 bn
  - They track foreign stocks with futures and hold shekel bills as collateral
- Owning a lot ≠ setting the yield. Each group's pull depends on how much its holdings respond

The gap widened as foreign demand grew and yield-sensitive banks left.

Holdings December 2019–December 2021. Index-fund change from May 2020. Bank of Israel.

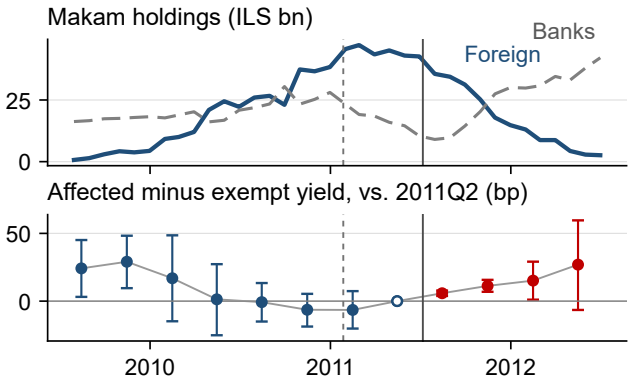
Once foreign investors hold over 30%, the Makam yield follows their funding rate



- How closely does the Makam yield track the foreign funding rate? Of each 100 bp move, how many bp reach it?
- Under 30% foreign, close to zero
- Over 30%, 26.7 bp
- Same pattern a decade earlier, 2010–2012: 33.6 bp
  - It ended with the 2011 tax change

Weekly three-month changes, TELBOR held fixed. 95% Newey–West intervals. Robust to a time trend, the bank share and week effects.

Causal test: ending the 2011 tax exemption raised Makam yields 12.8 bp

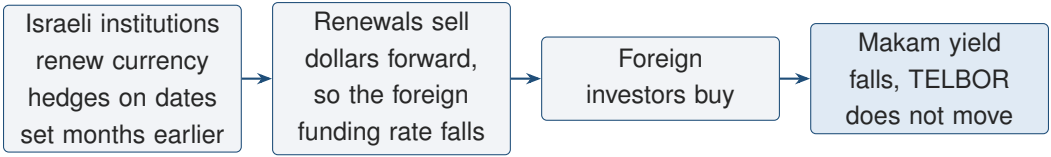


- The exemption ended for Makam and stayed for similar government bonds
- Foreign holdings fell from ILS 42.6 bn to 2.6 bn in a year
- Makam yields rose 12.8 bp relative to the exempt bonds
- Before 2011 they fell as foreigners entered, correlation -0.92 with holdings

Same bills, different holders, different price.

Dashed line, announcement. Solid line, implementation. 95% intervals, 2011Q2 = 0. Effect $t = 3.8$. Bank of Israel.

Causal test: hedge renewals on preset dates move the Makam yield



21 bp

fall in the Makam yield per 100 bp fall in the foreign funding rate,

when foreign investors held about 28% of Makam,

close to the 24 bp without the instrument

The dates were set months before, so they are not a response to Makam demand. They work like a natural experiment.

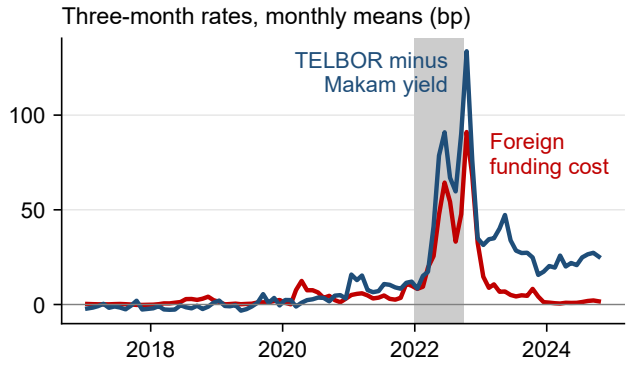
June 2020–August 2022, weekly, instrumental variables. First-stage $F = 15.8$. Bank of Israel and LSEG.

A model of who holds the bill does two things

1. **The intuition for what we see**
   - Banks value the bill against TELBOR, hedged foreign investors against their funding rate
   - The yield is a weighted average of the two rates. Each weight is how strongly that group's holdings respond to the yield
   - Few foreign holders: the yield stays at TELBOR, even with a large funding advantage. Many: it moves toward their funding rate
2. **Counterfactuals**
   - Two ownership states. A 100 bp fall in the foreign funding rate lowers the Makam yield by 3.2 bp at 5.9% foreign and 14.1 bp at 26.4%
   - Had foreign investors funded at TELBOR, the Makam yield would have been 34 bp higher in January–September 2022

Who holds the bill decides which rate it follows, wherever holders' alternatives differ: dollar funding, taxes, central-bank access.

Foreign funding cost explains 34 of the 51 bp in 2022



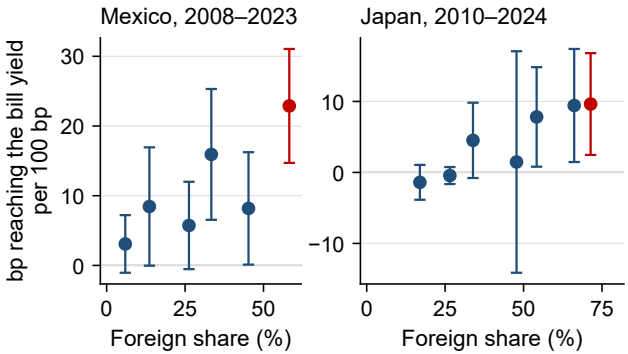
- **Foreign funding cost**, how much the Makam yield would rise if foreign investors could fund at TELBOR
- Same advantage, fewer foreign holders
  - 2022: 95 bp advantage, 46% foreign, 34 bp
  - 2023: 85 bp advantage, 15% foreign, 7 bp

A funding advantage moves the bill's yield only when foreign investors hold the bill.

Estimated demand model, monthly means. Student-t shocks. Price impact 2.80 bp per ILS bn, from the hedge dates.

Growing foreign demand explains 61–86% of the rise in the foreign funding cost, banks' exit the rest.

Mexico and Japan show the same pattern



- Bill yields track the foreign funding rate more as the foreign share rises
  - Mexico, 2.9
  - Japan, 2.3
  - Israel, 7.4
- Mexican Cetes are Treasury bills, on an ownership cycle unrelated to Israel's

Rise in the bp of each 100 bp move in the foreign funding rate that reach the bill yield, for each 10 percentage points of foreign share. Domestic rates are the 91-day TIIE and three-month yen OIS. 95% Newey–West intervals. t-statistics 3.2, 3.0 and 3.3 for Mexico, Japan and Israel. Banco de México, Bank of Japan and LSEG.

Foreign holders' funding cost enters a central bank's bill yield

- Borrowing in the home currency does not insulate the issuer
  - Fully hedged foreign investors still pass their funding rate into the yield
- Part of a measured convenience yield is a funding cost, and it grows with the foreign share
- The central bank can restore the tie by issuing enough bills that domestic holders again set the price

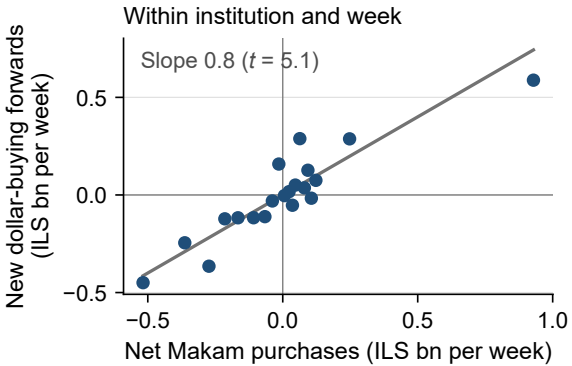
The central bank's own bill drifted from its policy rate. In 2022, 34 of the 51 bp gap came from foreign investors' dollar funding, not from Bank of Israel policy.

Conclusion

- Makam yielded 51 bp below TELBOR in January–September 2022
  - 34 bp of the gap is the funding cost of foreign investors
- The tie appears once foreign investors hold a large share
  - A similar advantage in 2023, with 15% foreign, explained only 7 bp
  - How closely the yield tracks the foreign funding rate, the 2011 tax change and the hedge-renewal dates all point the same way
  - Mexico and Japan show the same pattern
- A central bank that borrows in its own currency is still exposed to its foreign holders' funding conditions

daniel.nathan@polyu.edu.hk Feedback welcome

Backup. Foreign buyers of Makam buy dollars forward in the same week



- Makam records matched institution by institution to the Bank of Israel's transaction-level foreign-exchange data
- Institutions with dollar forwards made 87% of foreign purchases
- Each shekel of Makam bought comes with 0.8 shekels of new dollar forwards

June 2020–August 2022. Institution and week fixed effects, *t* clustered by institution and week. Bank of Israel.

Backup. The hedge dates also measure the price impact of foreign purchases

21 bp

fall in the Makam yield per 100 bp fall in r^F

$t = 3.5$, first-stage $F = 15.8$

2.80 bp

fall in the Makam yield per ILS 1 bn of foreign acquisitions

$t = 5.0$, first-stage $F = 15.5$

June 2020–August 2022, weekly, instrumental variables with Newey–West t-statistics. Left: three-month yield, least-squares co-movement 24 bp. Right: three- and six-month yields pooled.

Backup. The Makam yield is pulled toward TELBOR and the foreign funding rate

$$y = \frac{\overbrace{B}^{\text{domestic supply slope}} r^D + \overbrace{b}^{\text{foreign funding slope}} r^F + \bar{S} - \bar{D} - u}{a + B}$$

- With a small foreign investor base, b is small next to B, the yield follows TELBOR, and a positive hedged spread persists
- As the base grows, a and b grow, so funding-rate exposure $b/(a+B)$ rises
- Price impact $1/B$ does not depend on the foreign slopes, so scheduled hedge maturities measure it

$B = \delta + \phi$ is how much Makam domestic holders and the issuer supply per bp of TELBOR minus the Makam yield.

When $a = b$ the yield is a weighted average of the two rates.

Backup. The Makam yield tracks the foreign funding rate 7.4 bp more per 10 pp of foreign ownership

$$\Delta y_w = \alpha + \lambda s_w + (\theta_D + \gamma_D s_w)\,\Delta r_w^D + (\theta_F + \gamma_F\, s_w)\,\Delta r_w^F + u_w$$

	γ_F, bp per 10 pp of foreign share	Sample
Baseline	7.4	2010–2024, weekly
	(3.3)	
Linear time trend, interacted	7.3	2010–2024, weekly
	(3.2)	
Bank share of Makam, interacted	9.0	2010–2024, weekly
	(2.7)	
Four maturities, week fixed effects	9.3	2010–2024, weekly
	(3.9)	
Monthly data	6.8	2010–2012, monthly
	(2.3)	

t-statistics in parentheses. Evaluated at the 9% and 46% shares, the baseline gives -1 and 26 bp per 100 bp.

Baseline wild bootstrap clustered by year, $p = 0.003$.

Backup. Each group of holders has its own demand curve

Foreign investors	$F = a\,y - b\,r^F + u$
Domestic holders	$D = \sum_j \max\{0,\ \bar{D}_j - \delta_j\,(r^D - y)\}$
Issuer	$S = \bar{S} + \phi\,(r^D - y)$
Market clearing	$F + D = S, \qquad B = \delta + \phi$

- Funding-rate exposure $\partial y / \partial r^F = b/(a + B)$ rises as the foreign investor base raises a and b
- Price impact $-dy/dF = 1/B$ does not depend on a or b
- Banks' exit lowers δ, which raises exposure and price impact together

Backup. Three restrictions separate foreign demand from the domestic side

1. **Price impact** $1/B$ from scheduled hedge maturities, 2.80 bp per ILS bn at the higher ownership state
2. **Market clearing.** The same $B(s)$ sets how domestic holdings respond to TELBOR minus the Makam yield and the weight on TELBOR
3. **Scheduled coupons** on domestic funds' bonds shift domestic demand and funding, and are excluded from foreign demand

Funding-rate exposure, bp per 100 bp of r^F	5.9% foreign	26.4% foreign
Student-t shocks	3.2	14.1
Normal shocks	3.4	13.4

With zero price impact, exposure is zero, yet the co-movement the model implies stays at 7.4 and 11.2 bp with Student-t shocks, so co-movement alone cannot reveal exposure.

Backup. Foreign holdings rise with the Makam yield and fall with the foreign funding rate

$$\Delta F_t = \alpha_{p(t)} + \beta_y\, y_{t-1} + \beta_F\, r^F_{t-1} + \rho F_{t-1} + \kappa H_{t-1} + e_t$$

- A 100 bp higher Makam yield goes with foreign holdings ILS 5.7 bn higher the next month ($t = 4.1$)
- A 100 bp higher r^F goes with foreign holdings ILS 8.6 bn lower ($t = -5.6$)
- Foreign purchases tilt toward maturities with the highest hedged spread, 1.55 pp per bp ($t = 4.2$)
- Mutual funds, pension funds and ETFs show no such tilt

Monthly, 2018–22. H is domestic institutions' dollar hedge stock.

Backup. Foreign buying pauses at year-end and the Makam yield rises

- Global banks shrink balance sheets at year-end, and they are the largest foreign buyers of Makam
- Foreign net purchases fall ILS 2.4 bn over the year-end weeks ($t = -9.3$), secondary-market purchases ILS 1.0 bn ($t = -4.0$)
- The three-month Makam yield rises 8.6 bp given TELBOR and r^F ($t = 3.2$)
- Foreign purchases do not fall at the other quarter-ends

Weeks around the first week ending on or after 11 December, against the same weeks of the other quarter-ends.

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