When a Market Changes Hands

Dollar Funding and the Price of a Domestic Safe Asset

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Abstract

Government bills' convenience yields are commonly attributed to safety and liquidity. We show that foreign investors' funding costs also matter. When covered-interest-parity deviations allow foreigners to fund local-currency bills below domestic money-market rates, greater foreign ownership makes bill yields more sensitive to foreign funding rates. In Israel, central-bank bills yielded below zero despite a positive policy rate. As foreign ownership rose from 9% to 46%, the convenience yield rose from zero to 51 basis points. Our model attributes 34 basis points to foreign funding. A tax change and hedge maturities provide causal evidence. Mexico and Japan show the same relation.

JEL classification: E43, E52, F31, F32, G12, G15, G21, G23.

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Government bills often yield less than a benchmark money-market rate, and the gap is called the bills' convenience yield. The standard explanation attributes the convenience yield to the safety and liquidity that investors value in the bills (Krishnamurthy and Vissing-Jorgensen (2012), Nagel (2016)). That reading assumes that the bills' holders could otherwise earn the benchmark rate, so that the gap is what they give up for the bills' services. We show that part of the gap can come from foreign investors financing the bills more cheaply than local investors. Foreign investors swap dollars into the local currency, at a rate that deviations from covered interest parity can push below the benchmark. The more of a bill market foreign investors hold, the more closely the bill's yield follows that rate, and the measured convenience yield rises although the bill is no safer and no more liquid than before. Safety and liquidity still matter, but the measured gap also records how cheaply foreign investors finance the bills.

We show how foreign investors' cheaper funding moves bill yields in the market for Makam, bills issued by the Bank of Israel. Domestic banks and foreign investors can both hold Makam, but each compares the bill with a different rate. A domestic bank can instead leave its shekels on deposit at the Bank of Israel, at about the policy rate. TELBOR, the Israeli interbank rate and our benchmark, tracks that rate closely, so a bank holds Makam only if Makam yields about TELBOR. A foreign investor obtains its shekels differently. It exchanges dollars for shekels today and agrees to exchange them back at a fixed rate later, a currency swap that removes the currency risk. The swap's prices imply an interest rate on the shekels the investor holds, which we call the *foreign funding rate*. The investor gains from holding Makam when Makam yields more than the foreign funding rate. Covered interest parity says the foreign funding rate should equal TELBOR, but parity has failed persistently since 2008 (Du, Tepper, and Verdelhan (2018)), and in every period we study the swap market supplied foreign investors with shekels below both TELBOR and the Makam yield, on average. Makam can then yield less than the deposit, a yield no domestic bank would accept, and still pay foreign investors more than their funding rate.

Foreign investors came to hold more of Makam once Israel's deviation from covered interest parity became larger than the deviations in other currencies, and the Makam yield then moved from TELBOR toward the foreign funding rate. Between 2013 and 2017, when foreign investors held at most 6% of Makam, the bills yielded about TELBOR. From January to September 2022, when foreign investors held 46%, the bills yielded 51 basis points less than TELBOR and 44 basis points more than the foreign funding rate. From 2020 to 2021 the three-month Makam yield was even negative while the deposit rate stayed positive. Makam lets us read TELBOR minus the Makam yield, the bills' convenience yield, cleanly. The gap involves no difference in issuer or credit risk, because Makam and the deposit that TELBOR

tracks are both claims on the Bank of Israel. Both rates that holders compare the bill with are observed, TELBOR directly and the foreign funding rate in the prices of currency swaps.

Foreign investors did not buy until the Makam yield fell to their funding rate. A global bank that borrows dollars, swaps them into shekels, and holds Makam pays a regulatory cost on the balance-sheet capacity it uses (Avdjiev, Du, Koch, and Shin (2019), Cenedese, Della Corte, and Wang (2021)). From 2018 to 2019 Makam paid foreign investors about 28 basis points over their funding rate, and similar spreads were available in other currencies, where the dollar-funded rate fell short of the local overnight-index-swap rate by 22 basis points in euros and 35 in yen. Foreign investors held only 9% of Makam, and its yield stayed close to TELBOR. Israeli banks could earn the shekel deviation themselves, but they fund dollar positions mainly from their own dollar deposits, so they can earn it only on a limited scale (Ben Zeev and Nathan (2024b)). While foreign investors were few, domestic holders, who value the bill against TELBOR, set the price of Makam. Foreign investors' demand set the price only once they held more of the market.

The Israeli records show who held the bills and how those holders funded their positions. To our knowledge, ours is the first study to observe, for a single safe asset, both the foreign investors' purchases and the forward dollar purchases that hedge them, together with the currency hedges of the domestic institutions on the other side of the swap market. From 2017 through August 2022 we see every foreign purchase, sale, and redemption of Makam, the holdings of every other holder by sector, and domestic funds' portfolios. The foreign investors include the global banks that conduct covered-interest arbitrage across the major currencies (Rime, Schrimpf, and Syrstad (2022)). When we match institutions across the records, foreign investors' Makam purchases come with their own forward dollar purchases in the same week. The foreign-exchange records also give the maturity date of every domestic currency hedge, fixed months in advance.

We first document that the Makam yield moves with the foreign funding rate only when foreign investors hold a large share of the market. We measure how closely the Makam yield tracks the foreign funding rate, holding TELBOR fixed, and call this *foreign-rate pass-through*. From 2018 to 2019, when foreign investors held 9% of Makam, the three-month Makam yield barely moved with the foreign funding rate. In 2022, when foreign investors held 46%, the three-month yield fell 26 basis points with each 100-basis-point fall in the foreign funding rate. The same pattern appears a decade earlier, in an episode that we also use to measure how foreign demand moves the Makam yield. Foreign investors held 22% of Makam on average from January 2010 to June 2011 and left after Israel ended their tax exemption on Makam. In both episodes the Makam yield barely tracked the foreign funding rate while foreign investors held a small share of the market and tracked it closely once they held a big one.

The Makam yield, the foreign funding rate, and foreign holdings can move together for reasons that have nothing to do with foreign funding. A global shortage of dollars can raise the foreign funding rate and also lead foreign investors to sell bills, and a rise in domestic demand for safe bills can lower the Makam yield on its own. We establish causality in two ways. A tax change removed foreign holders without changing the rate at which they fund, so it tests whether who holds Makam affects its price. The maturity dates of domestic institutions' currency hedges changed the foreign funding rate without changing who could hold Makam, so they test whether the foreign funding rate moves the Makam yield. Neither the tax change nor the maturity dates were set in response to Makam prices. In 2011 Israel ended nonresidents' tax exemption on Makam and kept it on government bonds of similar remaining maturity. Foreign investors left Makam, and domestic holders took the bills. If the price of a bill did not depend on who held it, Makam yields would not have moved relative to the exempt bonds. They rose by 12.8 basis points, about as much as TELBOR minus the Makam yield, which averaged 18 basis points before the change.

To isolate the effect of the foreign funding rate, we use the dates on which domestic institutions' currency hedges mature. Israeli institutional investors, such as pension funds, hold foreign assets in dollars. To protect the shekel value of those assets, they sell dollars forward, agreeing today to deliver dollars for shekels at a fixed exchange rate on a date a few months ahead. When that date arrives, the contract settles, and because the institution still holds its foreign assets, it sells dollars forward again. The new sales add to the supply of dollars for future delivery and lower the forward exchange rate. A foreign investor who swaps dollars into shekels buys its dollars back at that forward rate, so a lower forward rate means a lower foreign funding rate. From 2020 to 2022, in weeks in which more hedges were scheduled to mature, the foreign funding rate fell, foreign investors bought Makam, and the Makam yield fell, while TELBOR did not move.

With the maturity calendar as an instrument, a 100-basis-point fall in the foreign funding rate lowered the three-month Makam yield by 21 basis points, close to the estimate without the instrument. The calendar is a strong instrument for the foreign funding rate, with a first-stage F statistic of 15.8. Our identifying assumption is that scheduled maturities affect the Makam yield only through their effect on the foreign funding rate, and not through domestic demand for Makam or the supply of bills. Because the maturity dates were fixed when the contracts were signed, months earlier, the calendar cannot respond to conditions in the Makam market in the weeks the contracts mature. The data also support the exclusion restriction. Domestic institutions do sell Makam in weeks of heavy maturities, but they sell the same amount whether the maturing hedges leave them owing or receiving shekels, and net issuance does not respond.

We consider several alternative explanations. The standard one is that domestic investors came to value Makam's safety and liquidity more. Their demand would then have lowered the yield, Makam would have paid foreign investors less over their funding rate, and foreign investors would have sold. In weeks of heavy hedge maturities, however, foreign investors bought Makam and domestic institutions sold it to them. The Makam yield might also have come to track the foreign funding rate more closely over time, as the Israeli market became more closely tied to dollar funding. A trend, however, would not reverse, and in both episodes the yield tracked the foreign funding rate less closely again when foreign investors left. Allowing for a time trend leaves the closer tracking at high foreign ownership unchanged. The departure of banks, the domestic holders whose holdings respond most to the yield, would also make the yield more sensitive to foreign demand. Yet from 2010 to 2011 the yield tracked the foreign funding rate closely while banks still held a substantial share of Makam. Scarcity of bills would explain the pattern only if issuance fell when the foreign funding rate fell. Net issuance did not respond to hedge maturities, and from December 2021 to September 2022 Makam outstanding rose by more than foreign holdings. Foreign investors who buy more when dollar funding is cheap can themselves make Makam scarce, and that scarcity is what this paper studies.

A model shows why the Makam yield follows the foreign funding rate more closely as foreign investors hold more of the bills. Domestic banks value Makam against deposits at the Bank of Israel, foreign investors value Makam against the foreign funding rate, and neither group will hold unlimited amounts. The Makam yield then combines TELBOR and the foreign funding rate, weighting each rate by how strongly the holdings of the group that uses it respond to the yield. When foreign investors hold a small part of the market, a fall in their funding rate raises their demand a little, domestic holders sell them the bills at a slightly lower yield, and the Makam yield stays tied to TELBOR. When they hold half the market, the same fall raises their demand by much more, domestic holders must give up many more bills, and the yield moves toward the foreign funding rate.

Domestic holders differ in how much their holdings respond to the yield. Banks sold most of the bills that foreign investors bought. Funds that track foreign stock indices through futures and swaps kept buying, because they must hold short-term shekel assets as collateral whatever the yield.[1] The index funds held many bills but carried little weight in the yield, because their holdings did not respond to it. The measured convenience yield therefore rose as the holders whose holdings respond to the yield left and the holders whose holdings do not respond remained, although no domestic investor valued the bills more than before.

[1]In December 2021 funds that track foreign stock indices held 42% of their assets in Makam and 4% in foreign stocks and exchange-traded funds (Internet Appendix Section IA.1.7).

The model also measures how much of the gap foreign funding accounts for. The hedge-maturity calendar gives the effect of the foreign funding rate on the Makam yield at the foreign ownership of 2020 to 2022. The model, in which that effect rises with the foreign share, gives the effect at the 46% that foreign investors held in 2022. Had foreign investors funded at TELBOR, the Makam yield would have been 34 basis points higher from January to September 2022, out of the 51 basis points by which it yielded less than TELBOR. Part of what is usually read as the bills' convenience yield was the funding cost of their foreign holders. Most of the rise in the effect with ownership comes from the growth of rate-sensitive foreign demand, and the rest from the departure of domestic holders, mainly banks.

A bill's yield should follow the foreign funding rate wherever hedged, dollar-funded investors hold a large share of a local bill market and domestic holders cannot absorb their demand without a change in the yield. Mexican and Japanese government bills meet both conditions. In Mexico the Treasury issues the bills, and foreign ownership rose and fell on a timetable unrelated to Israel's. The Mexican bill yield tracks the foreign funding rate more closely as foreign ownership rises. In Japan foreign investors came to hold most of the bills in a large market. The Japanese bill yield also tracks the foreign funding rate more closely as foreign ownership rises, and foreign funding accounts for about 17% of the gap between the yen overnight-index-swap rate and the bill yield from 2016 to 2024, and for 34% in 2019, when the foreign share peaked.

For a central bank, the result means that its own bill can drift from its policy rate for reasons outside its control. Makam yielded below zero from 2020 to 2021 while TELBOR stayed positive, and from January to September 2022 foreign funding accounted for 34 of the 51 basis points by which Makam yielded less than TELBOR. Who holds and finances safe assets therefore matters for the short-rate disconnect, the gap between policy rates and bill yields (Lenel, Piazzesi, and Schneider (2019)), and for how central banks implement monetary policy (Duffie and Krishnamurthy (2016)). Borrowing in the local currency does not insulate the issuer. The foreign investors fully hedge the currency, yet the cost of financing the hedged position enters the bill's yield. Hedged foreign holders therefore transmit foreign funding conditions, much as the unhedged investors of the original-sin-redux literature transmit movements in the exchange rate (Carstens and Shin (2019), Hofmann, Shim, and Shin (2020)). The central bank can restore the tie between its bill and its policy rate by issuing more bills when foreign demand rises, so that domestic holders again set the price.

The paper contributes to four literatures. First, it adds to work that measures the convenience of safe debt from the spread between money-market rates and bill yields (Krishnamurthy and Vissing-Jorgensen (2012), Nagel (2016), d'Avernas and Vandeweyer (2024)) and from hedged spreads across currencies (Du, Im, and Schreger (2018), Jiang, Krishnamurthy,

and Lustig (2021)). We show that part of such a spread can reflect the dollar funding cost of the bill's foreign holders. The Makam yield minus the foreign funding rate is the hedged spread of Du, Im, and Schreger (2018), so the funding cost of foreign holders also bears on Du and Schreger's measure. Second, it relates to demand-based asset pricing. Demand systems value assets against a single outside asset that stands for all wealth outside the assets studied (Koijen and Yogo (2019), Gabaix and Koijen (2021)), and investors with finite demand elasticities jointly set yields (Vayanos and Vila (2021)). We give each group of holders its own observed benchmark, so a change in the investor base changes which rate the price follows as well as how the price responds to demand.

Third, the paper adds to work showing that who holds sovereign debt matters for its price and for the transmission of foreign shocks (Pandolfi and Williams (2019), Fang, Hardy, and Lewis (2025), Faia, Lewis, and Zhou (2025), Jansen, Li, and Schmid (2024)). Intermediary asset pricing studies how the constraints of marginal intermediaries affect asset prices (He and Krishnamurthy (2013)). Stein and Wallen (2025) show that, for Treasury bills, which holders are marginal shapes how yields respond to supply. As bills become scarce, the most elastic money funds sell first, and the less elastic holders that remain make bill yields more sensitive to further supply shifts. The same change in marginal holders occurs in Makam as banks sell out. Makam also lets us measure a second dimension, the rate against which each group of holders values the bill. For foreign investors that rate is observed in the prices of FX swaps and moves apart from the policy rate with the deviation from covered interest parity. The benchmark in Stein and Wallen's setting, the rate on the Federal Reserve's overnight reverse repurchase facility, is set by the central bank, and private repo rates track it closely. Because the foreign funding rate moves on its own, we can measure which rate the Makam yield follows, not only how strongly it responds to supply. In the estimated model, growing foreign demand accounts for 61 to 86% of the rise in the funding term, and banks' exit for the rest.

Fleckenstein, Klingler, and Longstaff (2026) show that money market funds, which hold most agency floating-rate notes, move the price of those notes relative to fixed-rate bonds of the same issuers, and they treat the dominant holder as the marginal investor. In Makam no group of holders sets the yield alone. Each group pulls the yield toward its own alternative rate in proportion to how strongly its holdings respond. Holders whose holdings do not respond therefore carry no weight however much they own, and a minority whose holdings respond moves the yield. The price gaps that Fleckenstein, Klingler, and Longstaff document are largely unrelated to deviations from covered interest parity and other measures of intermediary constraints. In Makam the two coincide, because the foreign investors who came to hold the bills fund them at a rate that moves with that deviation.

Fourth, it relates to work on intermediaries and dollar funding. The capacity of arbitrageurs and the hedging demand they meet govern deviations from covered interest parity (Ivashina, Scharfstein, and Stein (2015), Du, Tepper, and Verdelhan (2018), Avdjiev, Du, Koch, and Shin (2019), Cenedese, Della Corte, and Wang (2021), Rime, Schrimpf, and Syrstad (2022), Ben Zeev and Nathan (2024b), Anderson, Du, and Schlusche (2025)). Kubitza, Sigaux, and Vandeweyer (2025) show that the cost of rolling over currency hedges shifts euro-area investors' demand for dollar bonds, the asset the hedger holds. They instrument the deviation from covered interest parity with idiosyncratic shifts in investors' currency positions. We instrument with the maturity dates of hedges written months earlier, and we study the asset held by the investor on the other side of the hedge, a local bill. For that bill, the gap between TELBOR and the foreign funding rate moves TELBOR minus the bill's yield. Part of what the standard convenience measure records is the foreign holders' funding cost.

Section I describes the market, the data, and the two episodes of foreign ownership. Section II shows that the Makam yield tracks the foreign funding rate more closely as foreign ownership rises, and Section III studies the 2011 tax change. Section IV shows what foreign demand responds to and how funding shocks and foreign purchases move the yield. Section V explains how holders' funding rates enter the yield and quantifies funding-rate exposure. Section VI tests the relation in Mexican and Japanese government bills. Section VII develops the implications for monetary implementation and local-currency borrowing, and Section VIII concludes.

I. The market and how it changed hands

We describe the asset and its holders, the data, the two rates against which holders value Makam, and the two episodes in which the market changed hands.

A. The asset and its investors

Makam are shekel-denominated zero-coupon bills that the Bank of Israel sells at auctions, called tenders, with original maturities of up to one year. After issuance, the bills trade in the secondary market on the Tel Aviv Stock Exchange (TASE). Because the bills are short-lived, an investor who wants to keep a position must keep buying new bills as old ones mature. An investor who wants to leave the market can sell, let its bills mature without replacing them, or mix the two.

We distinguish foreign investors from banks, mutual funds, and long-term institutional investors, the three groups of domestic holders. Foreign investors are the holders that the

Bank of Israel classifies as nonresidents, and we use their holdings as a proxy for the foreign investor base. The funding mechanism we study concerns those nonresidents who fund in dollars and hedge the currency. The foreign investors include the large international banking groups that conduct covered-interest-parity arbitrage across the major currencies (Rime, Schrimpf, and Syrstad (2022)). Section I.B shows that nonresidents with dollar forward positions make most nonresident purchases of Makam.

The domestic holders hold Makam for different reasons. Banks can place their liquidity at the Bank of Israel or in other domestic money-market assets. Mutual funds hold Makam under mandates that range from cash management to passive exposure to foreign equities. Many Israeli funds that track foreign equity indices obtain the exposure through index futures or total-return swaps and hold most of their assets in short-term shekel instruments, including Makam. The short-term instruments also serve as collateral for the derivatives. These funds hold Makam because of how they obtain their exposure, not because of its yield.[2] Long-term institutional investors hold Makam alongside deposits, government bonds, and other assets.

B. Data

We measure ownership from the holder statistics that the Bank of Israel publishes, which give month-end Makam holdings at market value by sector, together with total outstanding.[3] We work with holdings rather than trades. Holdings change through every channel at once, including tenders, trades in every venue, redemptions, and valuation. A record of trades misses the investors who leave by letting their bills mature.

Transaction records then show how the holdings change. The Bank of Israel's confidential data on foreign transactions, which run through August 2022, record foreign investors' tender purchases, secondary purchases and sales, and redemptions in every venue. The Smart Money data, a commercial product of the TASE, report each security's daily exchange purchases and sales by investor type. Tender records, which the TASE and the Bank of Israel publish, give each bill's issue and redemption dates. From January 2020, confidential Bank of Israel data on monthly holdings by bill and holder sector let us split each sector's monthly change into new bills, redemptions, revaluation, and net trades in outstanding bills (Internet Appendix Section IA.1.4).

[2]In December 2021 these funds held 42% of their assets in Makam, 46% in bank deposits and cash, and 4% in foreign stocks and exchange-traded funds (Internet Appendix Section IA.1.7).

[3]From January 2020 we use the report on Makam holdings by sector that the Bank of Israel introduced in May 2025, and before 2020 the earlier report. The May 2025 report classifies holders according to international standards and removes double reporting of nonresident holdings. On the weeks both reports cover, pass-through rises by 8.0 basis points per 10 percentage points of foreign ownership with the May 2025 report and by 8.1 with the earlier report (Section II.A and Internet Appendix Section IA.1.3).

On the other side of the swap market, the Bank of Israel's confidential transaction-level foreign-exchange data record the client, dealer, dates, direction, and notional of every forward and FX swap. With the swap records we identify domestic institutions' dollar hedges and follow their rollovers (Ben Zeev and Nathan (2024a,b)). Fund portfolios come from Praedicta, a commercial provider of Israeli mutual-fund data, and, for retirement savings funds, from Gemel-Net, the public database of Israel's Capital Market, Insurance and Savings Authority (Internet Appendix Section IA.1.1). For the 2011 tax change we have holdings by sector from the published holder statistics and security-level yields from public TASE price data. For the other bill markets of Section VI, foreign holdings also come from public sources. Banco de México reports foreign holdings of Mexican Treasury bills (Cetes). The Bank of Japan's flow of funds and the Japanese Ministry of Finance report foreign holdings of Japanese Treasury bills. Bill yields and exchange rates for Mexico and Japan come from LSEG.

We link the two Bank of Israel records to see whether the nonresident buyers of Makam hedge with dollar forwards. The data on foreign transactions identify each nonresident account, and the foreign-exchange data name the counterparties of every forward and FX swap with an Israeli bank or institutional investor. The two records share no identifier, so we map each nonresident account to its parent institution and match parents to foreign-exchange counterparties by name. Institutions with dollar forward positions made 87% of nonresident Makam purchases from June 2020 to August 2022. Nearly all the remaining purchases went through custodian and omnibus accounts, whose beneficial owners neither record reveals. Within an institution, each shekel of net Makam purchases in a week comes with about 0.8 shekels of new forward dollar purchases in the same week ($t = 5.1$, clustered by institution and week, Figure 2, Internet Appendix Section IA.1.2).[4] Of the new forward dollar purchases, 97% by notional are the far legs of FX swaps, in which the institution sells dollars for shekels at the start and buys the dollars back at maturity. The far legs alone give a slope of 0.8 ($t = 6.2$), and outright forwards give 0.04 ($t = 0.8$). The nonresident holders of Makam are therefore mostly the hedged, dollar-funded investors whose funding rate the model uses.

C. TELBOR and the foreign funding rate

The two groups of Makam holders value the bills against different rates, domestic banks against TELBOR and hedged foreign investors against the foreign funding rate. We define the two rates, explain why each serves as its group's benchmark, and describe how we measure them.

[4]Without the institution-weeks in the rightmost bin of Figure 2, the slope is 1.2 ($t = 5.9$).

Let $y_{t,\tau}$ denote the Makam yield at remaining maturity τ and $r^D_{t,\tau}$ TELBOR at the same tenor. TELBOR, which the Bank of Israel publishes daily, is the quoted shekel interbank rate that Bank of Israel regulation ties to the policy path.[5] Our main object of study is TELBOR minus the Makam yield, so we check whether the quoted TELBOR matches executed trades. The Bank of Israel's confidential derivatives trade repository allows the check, which is unavailable for most interbank benchmarks. The 8 spot-starting shekel overnight-index swaps of 30 to 94 days traded from April to October 2022 all lie within 2.2 basis points of TELBOR at the same date and maturity, with a median absolute difference of 0.7 basis points and a median signed difference of +0.3 basis points. TELBOR is a rate at which banks trade, not only a quote.[6]

Each group of holders values Makam against its next-best use of the money, and the two groups' next-best uses differ. A domestic bank that does not hold Makam can deposit its shekels at the Bank of Israel, through either the deposit window or the deposit tenders that the Bank of Israel conducts with banking corporations (Bank of Israel (2016)). The deposit earns about TELBOR. From January 2010 to June 2025, overnight TELBOR was within 1 basis point of the Bank of Israel interest rate on 99% of days (Internet Appendix Figure IA.1). A foreign investor funded in dollars has no such access. It can keep its money in dollar assets, or it can obtain shekels through an FX swap and hold Makam. Measured in hedged shekel terms, the dollar alternative yields the foreign funding rate. The model therefore treats TELBOR as the benchmark of domestic banks and the foreign funding rate as the benchmark of swap-funded foreign investors, with limited arbitrage between the two.

We construct the foreign funding rate independently of Makam prices. Let E_t be the spot exchange rate in shekels per dollar, $Q_{t,\tau}$ the forward exchange rate for the same quotation, and $r^{\$}_{t,\tau}$ a dollar funding rate. In matched simple-rate conventions, the foreign funding rate $r^F_{t,\tau}$, the shekel cost of borrowing dollars and hedging repayment, satisfies

$$1 + \tau r^F_{t,\tau} = \frac{Q_{t,\tau}}{E_t}\left(1 + \tau r^{\$}_{t,\tau}\right). \tag{1}$$

The foreign funding rate is the synthetic shekel rate implied by covered interest parity (Du, Tepper, and Verdelhan (2018)). The hedged spread on Makam, $y_{t,\tau} - r^F_{t,\tau}$, is the deviation

[5] One- and three-month TELBOR are the fixed rates in shekel overnight-index swaps, whose floating leg, overnight TELBOR, moves essentially one-for-one with the rate in the Bank of Israel's deposit auctions. Six-, nine-, and twelve-month TELBOR are the fixed rates in forward-rate agreements on the three-month swap rate.

[6] Because three-month TELBOR is the fixed rate in an overnight-index swap, it carries little bank credit risk, and it shows no premium over the policy rate. From July 2020 to December 2021, when the Bank of Israel interest rate stayed at 0.1%, three-month TELBOR averaged 0.9 basis point below it, while TELBOR minus the Makam yield averaged 8 basis points and the Makam yield was below zero in 25 of 79 weeks. A bank credit premium in TELBOR therefore cannot account for TELBOR minus the Makam yield.

from covered interest parity measured on Makam, the return to an investor that borrows dollars, buys shekels at spot, invests them in Makam, and buys the dollars back forward. Per dollar borrowed, the trade has the following cash flows.

	Today, t	At maturity, $t+\tau$
Borrow dollars	$+1$ USD	$-(1+\tau r^{\$}_{t,\tau})$ USD
Sell the dollars at spot	-1 USD	
	$+E_t$ ILS	
Buy Makam	$-E_t$ ILS	$+E_t(1+\tau y_{t,\tau})$ ILS
Buy the dollars back forward		$+(1+\tau r^{\$}_{t,\tau})$ USD
		$-Q_{t,\tau}(1+\tau r^{\$}_{t,\tau})$ ILS
Net	0	$E_t\,\tau\,(y_{t,\tau}-r^{F}_{t,\tau})$ ILS

The trade nets to zero today. By equation (1), buying the dollars back costs $Q_{t,\tau}(1+\tau r^{\$}_{t,\tau}) = E_t(1+\tau r^{F}_{t,\tau})$ shekels, so the trade pays whenever Makam yields more than the foreign funding rate, including when Makam yields less than TELBOR.

At each tenor and date from 2010 onward, we take spot exchange rates, outright forward points, and the maturity-matched dollar fed funds overnight-index-swap rate from LSEG (formerly Refinitiv), a commercial provider. We add a fixed spread of 26.161 basis points that brings the dollar rate to the level of unsecured bank funding.[7]

We convert all yields and rates to the same annualization and maturity conventions and report TELBOR minus the Makam yield, $r^D - y$, which is positive when Makam yields less than TELBOR. TELBOR minus the Makam yield parallels the spreads between money-market rates and bill yields that measure the convenience of bills (Nagel (2016), d'Avernas and Vandeweyer (2024)).

D. Two episodes of foreign ownership

Foreign investors entered and left Makam twice, a decade apart (Figure 1, Panel A, and Table I). Each time, other holders and the Bank of Israel had to supply the bills that foreign investors bought and take the bills they released. Table II tracks the changes holder by holder. In the first episode the Bank of Israel supplied the bills by issuing more, and banks absorbed most of the bills that foreign investors released after the 2011 tax change (Section III).

[7]The spread is the one that the International Swaps and Derivatives Association (ISDA) set in March 2021 to convert three-month dollar LIBOR into its SOFR-based replacement, so that the dollar rate approximates the unsecured bank funding rate used in studies of covered interest parity (Du, Tepper, and Verdelhan (2018)). The spread sets the level of the foreign funding rate but barely moves its weekly changes.

In the second episode banks supplied the bills first, the Bank of Israel took over in 2022, and mutual funds and long-term institutional investors took the bills when foreign investors left. Between December 2019 and December 2021 Makam outstanding fell, so the ILS 37.1 billion that foreign investors added over those two years had to come from domestic holders, mostly banks. Within the mutual-fund sector, funds that track foreign stock indices added ILS 8.2 billion of Makam from May 2020 to December 2021, while other mutual funds sold ILS 0.7 billion. By January 2021 the five largest banks together held only ILS 0.4 billion of Makam. Banks kept dealing in the bills, buying newly issued bills at tenders and selling outstanding ones, as dealers do in Treasury markets (Anbil et al. (2026)). From December 2021 to September 2022 Makam outstanding rose by ILS 29.4 billion, more than the ILS 19.2 billion that foreign investors added. The Bank of Israel described its larger tenders as a response to demand (Bank of Israel (2023)). From September to December 2022 Makam outstanding rose by a further ILS 65.0 billion, and TELBOR minus the three-month Makam yield fell by 93 basis points. From January 2017 to August 2022, foreign investors' share of government debt with up to one year to maturity rose from 4% to 41%, while their share of longer government bonds rose from 10% to 16% and their share of Israeli equities from 16% to 20% (Internet Appendix Figure IA.3).

In the exit, foreign investors left mainly by letting their bills mature without buying new ones (Internet Appendix Section IA.1.5). Foreign holdings fell by ILS 73.3 billion from the November 2022 peak to the trough in November 2024, but foreign net sales on the exchange came to only ILS 11.8 billion, about a sixth of the decline. Mutual funds and long-term institutional investors took the bills. Within the fund sector, funds that held more cash before the exit raised their Makam weights more.[8]

Foreign investors left in two steps. From September–October 2022 to September 2023 the foreign share of Makam fell from 46% to 12%, while the five-year credit default swap spread on Israel's dollar government debt rose only from 40 to 52 basis points. Foreign investors left the short end of the shekel government market while Israel's sovereign credit spread barely moved. From December 2022 to September 2023 they sold, net, ILS 14.1 billion of nominal government bonds with less than two years to maturity on the exchange and bought ILS 12.1 billion of bonds with more than five years. The second step followed the outbreak of war in October 2023. The credit default swap spread averaged 116 basis points from October to December 2023, and by April–June 2024 foreign investors held 2% of Makam (Internet Appendix Section IA.4.4).

[8]Internet Appendix Sections IA.1.5 and IA.1.6 give the holder-level detail of both episodes.

E. Makam between TELBOR and the foreign funding rate

Panel B of Figure 1 plots two three-month spreads in quarterly averages from 2010, TELBOR minus the Makam yield and TELBOR minus the foreign funding rate. The figure shows that a low foreign funding rate did not by itself pull the Makam yield away from TELBOR. Between 2013 and 2017, when foreign investors held at most 6% of Makam, TELBOR minus the foreign funding rate ranged from −17 to 44 basis points, while TELBOR minus the Makam yield stayed between −3 and 2 basis points. TELBOR minus the Makam yield widened only after foreign ownership rose from 2020 to 2022. Foreign ownership rose when TELBOR minus the foreign funding rate, Israel's deviation from covered interest parity, became larger than the deviations in other currencies. A global bank that funds in dollars can earn such a deviation in many currencies, and its balance sheet goes to the largest. Israeli banks earn the shekel deviation only on a limited scale. They fund dollar positions mainly from their own dollar deposits, and larger positions would weigh on their regulatory capital (Ben Zeev and Nathan (2024b)). From 2018 to 2019, TELBOR minus the foreign funding rate averaged 27 basis points, against 22 in euros and 35 in yen. From July 2020 to December 2021 it averaged 30 basis points while the deviations in euros and yen fell to 0 and 4, and the foreign share of Makam rose from 9% to 28% on average (Internet Appendix Section IA.4.2). The deviation widened as domestic institutions hedged more of their foreign assets. Their dollar hedges rose from USD 32 billion on average from 2018 to 2019 to 65 billion from July 2020 to December 2021 and 81 billion from January to September 2022, while TELBOR minus the foreign funding rate rose from 27 to 30 and 95 basis points (Table I).

TELBOR minus the Makam yield did not return to zero when foreign investors left. It was 30 basis points in 2023 and 24 from January to September 2024 (Table I), when mutual funds and long-term institutional investors held most of Makam (Section I.D). The level of TELBOR minus the Makam yield depends on the demand of all holders, while its sensitivity to the foreign funding rate depends on how much of the market foreign investors hold (Section II).

The clearest evidence that the foreign funding rate entered the price of Makam comes from July 2020 to December 2021, when foreign investors held 28% of Makam on average (Table I). Over those 79 weeks TELBOR stayed positive (Figure 3), so a domestic bank could always earn a positive rate at the Bank of Israel. The foreign funding rate was negative in 75 of the weeks, and the three-month Makam yield, which stayed between the two rates, was negative in 25, reaching −15 basis points in a week when TELBOR stood at 10. A bank would not choose a bill with a negative yield over a positive rate at the same central bank, so a negative Makam yield points to holders whose alternative paid less than TELBOR. Foreign investors were such holders, because their funding rate was negative. Yields computed from

traded bills were negative in 25 weeks as well, so the pattern appears in transaction prices, not only in quoted yields.

II. Foreign ownership and the pricing of Makam

When the foreign funding rate moves and TELBOR does not, how much does the Makam yield move? We call the response foreign-rate pass-through. If each group of holders values Makam against its own substitute (Section I.C), the Makam yield should track the foreign funding rate more closely as the foreign share rises. We estimate pass-through from weekly changes at the three-month maturity, omitting the maturity subscript.[9] We regress the weekly change in the three-month Makam yield on the weekly changes in three-month TELBOR and the three-month foreign funding rate. In week w,

$$\Delta y_w = \alpha + \theta_D \, \Delta r_w^D + \theta_F \, \Delta r_w^F + \varepsilon_w, \tag{2}$$

where Δy_w, Δr_w^D, and Δr_w^F are the weekly changes in the three-month Makam yield, TELBOR, and the foreign funding rate. Foreign-rate pass-through is θ_F, the response of the Makam yield to the foreign funding rate at given TELBOR, and θ_D is the response to TELBOR at a given foreign funding rate. Section IV.B estimates the same response using scheduled hedge maturities as an instrument for the foreign funding rate.

Figure 4 tests whether the Makam yield tracks the foreign funding rate more closely as the foreign share rises, in both of Israel's episodes of foreign ownership. Within each episode it groups weeks by the foreign share at the end of the previous month and estimates equation (2) separately in each group, so that each group has its own intercept, coefficient on TELBOR, and pass-through. In both episodes the yield barely tracks the foreign funding rate at low foreign ownership and tracks it closely at high ownership. From 2018 to 2024, pass-through was between -1.3 and 7.1 basis points per 100 basis points in the weeks when foreign investors held less than 30% of Makam. In the weeks when they held more, pass-through was 26.7 ($t = 3.4$). Above 30%, about a quarter of any move in the foreign funding rate passed into the three-month Makam yield at given TELBOR. From 2010 to 2012 the corresponding estimates are -1.8 below 30% and 33.6 ($t = 3.7$) above it (Internet Appendix Table IA.6).

[9] Three-month TELBOR is the fixed rate in a shekel overnight-index swap, so at that maturity TELBOR measures the domestic funding rate directly. TELBOR at six months and longer is built from forward-rate agreements on the three-month rate. The three-month tenor is also the standard benchmark for deviations from covered interest parity (Du, Tepper, and Verdelhan (2018)). Weighted by notional, the median original maturity of the dollar hedges that domestic institutions write or roll over is 96 days.

Estimating equation (2) separately for each period gives the same picture (Internet Appendix Table IA.4). Pass-through was 7 basis points from 2018 to 2019, when the foreign share was 9%. It was 16 ($t = 4.1$) from July 2020 to December 2021, when the foreign share was 28%, and 28 ($t = 2.4$) from January to September 2022, when the foreign share was 46%. From 2020 to 2021 TELBOR barely moved, with a weekly standard deviation of 0.2 basis points, so the estimate for those years comes almost entirely from the foreign funding rate.

The yield can track the foreign funding rate more closely as the foreign share rises for two reasons, one on each side of the market. When the foreign funding rate falls, foreign investors want more Makam, and the yield falls until domestic holders sell them the bills. How far the yield falls depends on how many more bills foreign investors want and on how readily domestic holders part with them. A larger foreign investor base raises the number of bills foreign investors want, because more investors respond to the same change in their funding rate. When banks leave the market, domestic holders part with bills less readily. Banks are the most elastic holders of Makam, because a deposit at the Bank of Israel, which pays about TELBOR, is a close substitute for the bills. While they hold Makam, they sell some of it whenever its yield falls below TELBOR. Once they hold none, they can sell no more, and the remaining holders give up bills less readily. Stein and Wallen (2025) find the same order in U.S. Treasury bills. Money funds sell bills first. Once money funds hold none, less elastic corporate treasurers become the marginal holders and supply shifts move bill yields more.

From 2018 to 2024 the two reasons came together. The growing foreign base bought the bills that banks sold until banks held almost none (Section I.D), so that episode alone cannot separate the two reasons. From 2010 to 2012, however, the yield tracked the foreign funding rate closely while banks still held 18% of Makam on average from January 2010 to June 2011. The banks traded the bills readily. When foreign investors left after the 2011 tax change, banks took ILS 31.7 billion of the bills that foreign investors released (Section III). A larger foreign base therefore makes the yield track the foreign funding rate more closely even when banks stay in the market and trade readily. Section V.A uses the model of Section V to divide the rise between the two reasons.

A. Foreign ownership and foreign-rate pass-through

We now let pass-through vary continuously with foreign ownership, by letting both responses in equation (2) depend on the foreign share. Let s_w denote the foreign share of Makam outstanding at the end of the month before week w, expressed as a fraction and measured as a deviation from its sample mean. We regress the weekly change in the Makam yield on the

weekly changes in TELBOR and the foreign funding rate, on each of these changes multiplied by the foreign share, and on the foreign share itself,

$$\Delta y_w = \alpha + \lambda\, s_w + \Big(\theta_D + \gamma_D\, s_w\Big)\Delta r_w^D + \Big(\theta_F + \gamma_F\, s_w\Big)\Delta r_w^F + \varepsilon_w, \tag{3}$$

so pass-through is $\theta_F + \gamma_F s_w$. We call γ_F the ownership interaction. A positive γ_F means that pass-through rises with foreign ownership. We use the foreign share of all Makam rather than of three-month bills alone. Foreign investors shift their purchases across maturities toward the highest hedged spreads (Section IV.A), so the foreign demand that prices the three-month bill comes from foreign holders of every maturity.

In the baseline, estimated from January 2010 to September 2024, pass-through rises by 7.4 basis points per 100 basis points of the foreign funding rate for each 10 percentage points of foreign ownership ($t = 3.3$, Table III, column 1). At the 2018 to 2019 share of 9%, pass-through is -1 basis point per 100 basis points, essentially zero. At the 2022 share of 46% it is 26 (Table III, Panel B). A null-imposed wild bootstrap clustered by calendar year gives $p = 0.003$ for the ownership interaction. Omitting one calendar year at a time leaves the ownership interaction between 4.6 and 8.0 basis points per 10 percentage points. Excluding March to June 2020 leaves the interaction at 6.9 ($t = 3.0$). Nor is the rise a time trend, since foreign ownership rose and fell in both episodes. A linear time trend interacted with both rate changes leaves the ownership interaction at 7.3 ($t = 3.2$).

Column 3 separates a larger foreign base from banks' exit. Foreign ownership rose while banks sold from 2019 to 2021 (Section I.D), but the two shares did not move in lockstep. The part of the foreign share that a linear regression on the bank share cannot explain has a standard deviation equal to 60% of the foreign share's own. With the lagged bank share and its interactions with both rate changes added, pass-through rises by 9.0 basis points per 10 percentage points of foreign ownership ($t = 2.7$). The interaction of the bank share with the foreign funding rate is 2.9 ($t = 0.9$).[10]

Column 4 rules out shocks that moved all short rates together, such as the 2022 tightening. It compares the Makam yield at four maturities within the same week, with a fixed effect for each week. Pass-through still rises with foreign ownership, by 9.3 basis points per 10 percentage points ($t = 3.9$), from 3 basis points per 100 basis points at the 2018 to 2019 share to 38 at the 2022 share.

[10]The ownership interaction is similar from 2018 onward and with bank holdings measured in shekels. In the regression with week fixed effects (column 4), the control for bank holdings makes the TELBOR interaction more negative, from -15.9 to -22.1. With both week effects and the control for bank holdings, the interactions with the foreign funding rate and TELBOR are 12.1 ($t = 3.9$) and -22.1 ($t = -2.4$).

Rates rose sharply after October 2022, and three-month TELBOR averaged 4.61% in 2023 while foreign investors left (Table I). The closer tracking could therefore reflect the level of rates rather than foreign ownership. With each rate change also interacted with the previous week's TELBOR, foreign-rate pass-through still rises by 7.4 basis points per 10 percentage points of foreign ownership ($t = 3.2$). The interaction of the foreign funding rate with the level of TELBOR is close to zero ($t = 0.2$, Internet Appendix Table IA.8).

The closer tracking at high foreign ownership also survives a control for domestic institutions' dollar hedges, which leaves the ownership interaction at 7.2 ($t = 2.8$), and it does not depend on the vintage of the holder statistics.[11]

III. The 2011 tax change

Israel's first ownership episode ended with a change in tax law. Nonresidents were exempt from Israeli tax on government securities. Between 2009Q3 and 2011Q2 foreign investors raised their share of Makam from 2 to 35%. On January 27, 2011, the government announced that the exemption would end for securities with an original maturity of up to one year, including every Makam bill. The change took effect on July 7, and foreign investors kept buying until then. Government bonds issued at longer maturities kept the exemption even after their remaining maturity fell into the Makam range. The tax rule therefore separates securities of similar remaining maturity by their original maturity, which was fixed at issuance.[12]

The episode adds two pieces of evidence. The yield again tracked the foreign funding rate more closely as foreign ownership rose (Section III.A). The tax change also gives a causal test of whether who holds Makam affects its price, separate from how the holders fund their bills. The tax change removed Makam's foreign holders for reasons unrelated to the price of the bills, so the response of the price shows whether the identity of the holders matters (Section III.B). The co-movement of yields and funding rates in Section II cannot answer that question.

[11] Internet Appendix Sections IA.1.3, IA.2.1, and IA.2.3 and Table IA.7 report the checks and the regression at one, six, nine, and twelve months.

[12] In January 2011 the Bank of Israel also imposed a 10% reserve requirement on banks' foreign-exchange swap and forward transactions with nonresidents, and required nonresidents to report large daily transactions in Makam and short-term government bonds (Bank of Israel (2013)). Neither measure separates securities by original maturity, as the tax change did. The reserve requirement falls on the currency hedge whatever shekel security the hedge finances, and the reporting requirement carries no charge. Yields on affected securities did not rise relative to yields on exempt bonds in 2011Q1, when the reserve requirement took effect (Figure 5, Panel B).

Foreign holdings of Makam fell from ILS 42.6 billion in June 2011 to ILS 2.6 billion in June 2012 (Figure 5, Panel A). Banks added ILS 31.7 billion and nonbank domestic holders ILS 14.5 billion, while Makam outstanding rose by ILS 6.2 billion.

A. Foreign-rate pass-through over the episode

Foreign holdings ran off over months, so we estimate the ownership regression (3) on monthly data, over the 29 monthly changes of January 2010 to June 2012. Foreign-rate pass-through rises with foreign ownership by 6.8 basis points per 10 percentage points ($t = 2.3$), close to 7.8 in the weekly sample from 2018 onward (Table III, columns 2 and 5). The weekly estimates of Figure 4, Panel B, show the same rise over the episode. The relation between foreign ownership and foreign-rate pass-through from 2010 to 2012 matches the relation from 2018 onward, in a different decade and over an ownership episode that a change in tax law ended. Because foreign entry from 2010 to 2011 coincided with monetary tightening, one might suspect that the closer tracking reflected the level of rates. The level of rates and foreign ownership separated in the second half of 2011, however. Foreign holdings of Makam fell by ILS 27.8 billion in those months while three-month TELBOR averaged 2.94%, its highest level in the episode (Tables I and II, Panel B). The ownership episode therefore did not simply follow the rate cycle.

B. Yields on affected and exempt securities

The tax change left government bonds of similar remaining maturity, issued by the same government, exempt. If the price of a bill did not depend on who held it, the yield of Makam relative to the exempt bonds would not have changed as foreign investors left Makam. The funding channel instead predicts that Makam yields rose relative to exempt yields. The bills moved from foreign investors, who valued them against the foreign funding rate, to banks, who valued them against TELBOR. From 2010 to 2011 TELBOR exceeded the foreign funding rate by 105 to 150 basis points. A tax clientele, in which foreign investors require a higher pre-tax yield, predicts the same direction (Litzenberger and Rolfo (1984), Green and Ødegaard (1997)). Under either explanation, a rise in Makam yields relative to exempt yields shows that who holds Makam affects its price. We compare affected and exempt securities. Calendar-month effects absorb movements common to both groups. We regress the yield of each security in each month on an indicator for affected securities after implementation,

$$y_{it} = \alpha_i + \alpha_t + \mu_t \tau_{it} + \gamma \, Affected_i \times Post_t + \varepsilon_{it}. \tag{4}$$

Here $Affected_i$ indicates affected Makam, $Post_t$ the implementation period, τ_{it} remaining maturity, α_i security effects, α_t calendar-month effects, and μ_t the maturity slope in month t.[13] The sample covers July 2009 to June 2012 and remaining maturities of one to twenty-four months, with 47 affected securities and 7 exempt bonds.

Affected yields rose by 12.8 basis points relative to exempt yields after implementation (Table IV). The rise is of the same order as TELBOR minus the Makam yield itself, which averaged 18 basis points from January 2010 to June 2011 and 14 from July to December 2011 (Table I). With standard errors clustered by security and month, the t-statistic is 3.78. A restricted wild-cluster bootstrap by security, suited to the small number of exempt bonds, gives $p = 0.015$. The increase is positive and significant with a quadratic maturity curve that differs by month (Table IV). It remains positive with a common maturity slope, when each exempt bond is left out in turn, and in maturity windows of 1–12, 1–18, and 3–24 months, where it lies between 7.5 and 13.9 basis points (Internet Appendix Table IA.9).

Quarter by quarter, the affected-minus-exempt yield moves opposite to foreign holdings. Panel B of Figure 5 replaces the post-implementation indicator in equation (4) with quarterly interactions on the same panel, relative to 2011Q2, the last quarter before implementation. As foreign investors entered, affected-minus-exempt yields fell. After implementation, as foreign holdings ran off, affected-minus-exempt yields rose. Across the twelve quarters, the coefficients and quarterly foreign holdings of Makam have a correlation of -0.92. From 2010Q2 through 2011Q1 the quarterly coefficients lie between -6.5 and 1.3 basis points. The affected-minus-exempt yield does move before the tax change, but it moves downward, as foreign investors entered. The rise after implementation therefore does not continue an earlier trend.

The affected-minus-exempt yield rises by 6.5 basis points between the announcement quarter and 2011Q2. If the rise reflects anticipation of the July implementation, comparisons with 2011Q2 understate the repricing. The 12.8-basis-point estimate is essentially unchanged when the sample starts in April or July 2010 (Table IV, column (4)), so the 2009 observations do not drive it.

IV. Foreign demand and its price effects

Section III shows that who holds Makam affects its price. We now show that the foreign funding rate itself moves the price. From 2017 through August 2022 we observe foreign

[13] Remaining maturity is a security's redemption date minus calendar time, so a maturity term common to all months is nearly absorbed by the security and month effects. The month-specific slope lets the shape of the yield curve change from month to month.

investors' transactions and the currency hedges of the domestic institutions on the other side of the swap market. The dates on which those hedges mature move the foreign funding rate for reasons unrelated to Makam. The calendar of hedge maturities is the paper's causal test of the funding channel (Section IV.B). We first show that foreign demand responds to the two rates as the channel requires (Section IV.A) and end with the year-end pause in foreign buying (Section IV.C).

A. What foreign investors respond to

Foreign holdings respond to the two rates as the funding channel requires. They rise with the Makam yield and fall with the foreign funding rate, and foreign purchases tilt toward the maturities with the highest hedged spread (Tables V and VI).

A foreign investor's return on Makam is the hedged spread, the Makam yield minus the foreign funding rate. Investors may respond differently to the two rates, however, and a regression on the spread alone would force equal responses. We therefore regress the monthly change in foreign holdings on the previous month's three-month Makam yield and three-month foreign funding rate as separate regressors, together with the previous month's foreign holdings and domestic institutions' dollar hedges,

$$\Delta F_t = \alpha_{p(t)} + \beta_y \, y_{t-1} + \beta_F \, r^F_{t-1} + \rho \, F_{t-1} + \beta_H \, H_{t-1} + \varepsilon_t, \tag{5}$$

where F_t is foreign holdings of Makam at the end of month t, and the rates are measured at the end of the previous month, before the change in holdings.[14] The hedge stock H_{t-1} is the dollars that domestic institutions have sold forward and not yet delivered. The hedge stock controls for the other side of the foreign position. The intercept $\alpha_{p(t)}$ differs across 2018 to 2019, June 2020 to December 2021, and January to August 2022.

Foreign holdings respond to both rates, in opposite directions (Table V). A 100-basis-point rise in the Makam yield goes with foreign holdings ILS 5.7 billion higher in the following month ($t = 4.1$). A 100-basis-point rise in the foreign funding rate goes with holdings ILS 8.6 billion lower ($t = -5.6$).[15] The other two coefficients describe how positions adjust. Foreign

[14]The rates enter in levels because the foreign demand curve (7) relates the level of foreign holdings to the level of the rates. With the lagged level F_{t-1} in equation (5), holdings move each month only part of the way toward the level that the rates imply, as foreign investors build positions through tenders and the rollover of maturing bills. The bounds test of Pesaran, Shin, and Smith (2001), which is valid whether each series is stationary or has a unit root, finds a stable relation among the levels of foreign holdings, the two rates and the hedge stock ($F = 12.6$, against a 1% critical value of 5.61).

[15]The rates are persistent, and persistent regressors can bias coefficients and t-statistics in a predictive regression (Stambaugh (1999)). A bootstrap that simulates the rates from a vector autoregression and keeps the correlation between their innovations and the regression error, with 4999 replications, puts the bias at

holdings close about 45% of the gap to the level the rates imply each month ($\rho = -0.45$). Each USD billion of domestic dollar hedges goes with foreign holdings ILS 0.39 billion higher in the following month (β_H, $t = 8.5$), as those hedges are the other side of the swaps through which foreign investors fund their bills. Adding lagged TELBOR leaves the foreign-funding coefficient at −8.4 billion per 100 basis points ($t = -5.8$, Internet Appendix Table IA.10). A second regression, of the monthly change in foreign holdings on the same month's changes in TELBOR and the foreign funding rate, extends the evidence to the full 2010 to 2024 sample. Holding TELBOR fixed, a 100-basis-point rise in the foreign funding rate goes with foreign holdings ILS 4.8 billion lower in the same month ($t = -4.2$). The fall in holdings is the quantity side of foreign-rate pass-through. As foreign investors release bills, the Makam yield must rise until domestic holders and the Bank of Israel take the released bills.

Foreign investors also choose maturities by the hedged spread (Table VI). For each investor group g, we regress the share of the group's purchases that falls in each maturity bucket on the bucket's hedged spread in the previous month, with month and bucket effects,

$$q_{mt} = \alpha_t + \alpha_m + \beta_g \left(y - r^F\right)_{m,t-1} + \varepsilon_{mt}$$

over 55 months from 2018 to 2022, where q_{mt} is the share of the group's secondary-market purchases in month t that falls in maturity bucket m, $\left(y - r^F\right)_{m,t-1}$ is the bucket's hedged spread in the previous month, and α_t and α_m are month and bucket effects. The regression leaves out tenders because at a tender the Bank of Israel chooses which maturities are on offer, whereas the secondary market offers every outstanding maturity. Tenders made up 43% of gross foreign purchases from July 2020 to December 2021. A bucket whose hedged spread is one basis point higher receives 1.55 percentage points more of foreign purchases ($t = 4.2$). Banks show a similar slope ($t = 3.2$), consistent with banks buying the maturities they then sell to foreign investors (Section I.D). Mutual funds, pension funds and insurers, and ETFs and market makers show no such slope. On the exchange, where all of these groups trade, the foreign slope exceeds theirs (t between 2.1 and 2.4).[16]

B. Scheduled hedge maturities

Scheduled hedge maturities give the paper's causal test that the foreign funding rate moves the Makam yield. Domestic institutions hedge their foreign assets by selling dollars forward,

−0.4 and −0.1. The bias-corrected coefficients are 6.1 (95% interval [0.9, 10.9]) and −8.5 ([−11.9, −4.8]), and the bootstrap p-values under the null of no response are 0.003 and below 0.001. The augmented regression of Amihud, Hurvich, and Wang (2009) gives t-statistics of 3.1 and −4.8.

[16] Internet Appendix Table IA.10 reports the benchmark-controlled predictive regression, the same-venue comparison, and the rollover of maturing hedges, and Table IA.2 reports purchases by venue.

on contracts that come due on dates fixed months in advance. When the contracts come due, the institutions renew most of them, 84% of the maturing notional in the week of maturity or the week before. Each renewal is a new forward sale of dollars. The added supply of forward dollars lowers the foreign funding rate (Ben Zeev and Nathan (2024b)), so the calendar of scheduled maturities moves the foreign funding rate for reasons unrelated to Makam. If the foreign funding rate did not enter the Makam yield, the calendar would have no reason to move the yield. The lower funding rate should in turn bring foreign purchases of Makam and a lower Makam yield. One shock gives two estimates. The first is foreign-rate pass-through, the response of the Makam yield to the foreign funding rate. The second is the price impact of foreign purchases, the response of the Makam yield to each shekel of Makam that foreign investors acquire. Both estimates start from the same response of the yield to the calendar. Foreign-rate pass-through divides that response by the calendar's effect on the foreign funding rate, and the price impact divides it by the calendar's effect on foreign acquisitions. The calendar's effect on the foreign funding rate and its effect on foreign acquisitions are the two first stages.

The instrument is the calendar Z_w, the dollar notional of institutional forward contracts, including FX-swap far legs, scheduled to mature in week w and written at least 97 days before the start of that week. Every contract in the calendar was written before week $w-3$, so the calendar contains no hedge decision made during the weeks over which we measure prices and purchases. We first regress the foreign funding rate, or foreign acquisitions of Makam, on the calendar and controls. We then regress the change in the Makam yield on the part of the foreign funding rate, or of foreign acquisitions, that the calendar predicts,

$$\begin{aligned} X_w &= \pi Z_w + \Gamma' C_w + v_w, \\ \Delta y_w &= \beta \hat{X}_w + \Gamma_y' C_w + \varepsilon_w, \end{aligned} \tag{6}$$

where Δ denotes the change from week $w-3$ to week w, and X_w is one of two variables measured over the same three weeks, $w-2$ to w. The first is the change in the foreign funding rate, Δr_w^F. The second is foreign acquisitions of Makam, tender and secondary purchases minus secondary sales summed over the three weeks. The first line of equation (6) is the first stage. The controls C_w include an indicator for 2022, the maturities scheduled fourteen weeks ahead (which include the hedges written during the three-week window), holdings before that window, and recent changes in rates. Internet Appendix Section IA.4.5 lists every control. The usual t-test can mislead when the first stage is weak. When the first-stage F statistic is below 10, we therefore also report Anderson–Rubin confidence sets, which remain valid

however weak the instrument (Anderson and Rubin (1949)). We compute them from a test robust to heteroskedasticity and autocorrelation with 8 Newey–West lags.

Scheduled maturities lower the foreign funding rate. Over the 114 weeks of 2020 to 2022, each USD billion of scheduled maturities lowers the three-month foreign funding rate by 10.4 basis points (Table VII, column 1, with first-stage $F = 15.8$ in column 3).[17] The Makam yield follows. Using the calendar as an instrument, a 100-basis-point fall in the foreign funding rate lowers the three-month Makam yield by 21 basis points at given TELBOR (column 3). The estimate is close to the foreign-rate pass-through of 24 basis points estimated without the instrument over the same weeks, so over those weeks the co-movement measured in Section II is close to the effect of the funding rate itself.[18] None of 43 calendars shifted by 5 to 26 weeks in either direction moves the three- or six-month Makam yield as much as the actual calendar does, and maturities scheduled two to four weeks later do not predict the yield (Internet Appendix Table IA.14).

The same shock moves foreign holdings. Each USD billion of scheduled maturities raises foreign acquisitions of Makam by ILS 0.91 billion (column 4, first-stage $F = 15.5$).[19] Using the calendar as an instrument for foreign acquisitions gives the price impact of foreign purchases. An additional ILS billion of foreign acquisitions lowers the three-month Makam yield by 2.44 basis points at given TELBOR (column 6), and the six-month yield by 3.16. With one price impact for both maturities, an additional ILS billion of foreign acquisitions lowers the Makam yield by 2.80 basis points ($t = 5.0$), with an Anderson–Rubin 95% set of [1.81, 4.41]. The model of Section V uses the pooled estimate.[20]

The estimates rest on two conditions. Scheduled maturities must reach the Makam yield only through the foreign funding rate and foreign purchases, and they must not shift domestic demand or issuance directly. Long-term institutional investors do sell Makam in weeks of heavy maturities. Their sales, however, are about as large as foreign investors' purchases on the exchange. Some maturing hedges leave an institution owing shekels and others leave it receiving shekels. If the maturities moved domestic demand directly, through the cash the

[17] The calendar's first stage is absent from 2023 to 2024 ($F = 0.2$) and too weak from 2010 to 2011 once the timing of rate decisions is controlled ($F \leq 3.5$), so the calendar identifies pass-through only from 2020 to 2022.

[18] At six months the estimate is 34 basis points ($t = 3.5$).

[19] At a monthly frequency, foreign net purchases rise by ILS 0.92 billion per standard deviation of the hedges scheduled to mature in a month ($t = 2.97$), and the relation also appears in exchange records alone ($t = 3.41$). Within the month, foreign tender purchases come in the week before the hedges mature ($t = 2.4$) and secondary-market purchases in the week they mature ($t = 2.1$).

[20] The pooled estimate stacks the three- and six-month regressions of column 6, each with its own controls, and the Anderson–Rubin set inverts the test that the common reduced-form coefficient is zero (Internet Appendix Section IA.4.5). With the hedge stock and TELBOR minus the foreign funding rate as additional controls, the point estimates keep their sign, and the six-month price impact is 3.41 basis points, with an Anderson–Rubin set of [2.12, 5.54] (Internet Appendix Table IA.15).

maturing hedges settle, the two groups of institutions would sell different amounts of Makam. Institutions' sales of Makam do not depend on which of the two groups an institution belongs to. The sales are therefore domestic holders supplying the bills that foreign investors buy, a movement along the domestic supply curve. Net issuance does not respond.[21]

C. The year-end pause

The year-end gives a check on the price impact from scheduled hedge maturities. Global banks shrink their balance sheets at year-end (Du, Tepper, and Verdelhan (2018)), and the largest foreign buyers of Makam are international banking groups. If foreign demand moves the price, the Makam yield should rise when foreign investors pause their buying. We compare the weeks ending between December 11 and the end of December, about three weeks, with the same weeks of the other quarter-ends, and for the yield we condition on TELBOR and the foreign funding rate (Internet Appendix Figure IA.4 and Table IA.18).

Foreign buying pauses at year-end. Foreign net purchases are tender and secondary-market purchases minus secondary-market sales. Over the three weeks, foreign net purchases fall by ILS 2.4 billion ($t = -9.3$). Part of the fall comes from the absence of tenders after early December. Foreign net secondary-market purchases, which exclude tenders, still fall by ILS 1.0 billion ($t = -4.0$). Neither measure falls at the other quarter-ends. The Makam yield rises. The three-month yield rises by 8.6 basis points over the three weeks ($t = 3.2$), and by 7.4 basis points ($t = 3.8$) over the 2017 to 2021 year-ends of the purchase sample, so the rise does not depend on 2022 and 2023.[22]

Two facts tie the rise in the yield to the pause in foreign buying. First, the pause in tenders reduces the supply of bills, which on its own would lower the Makam yield, so the rise in the yield does not come from supply. Second, at the other quarter-ends foreign buying does not fall and the yield does not rise. The year-end response confirms the direction and the order of magnitude of the price impact estimated from scheduled hedge maturities. Section V.A nonetheless uses the price impact estimated from scheduled hedge maturities, not from the year-end. Part of the year-end fall in foreign purchases is tender purchases that disappear together with the bills the tenders would have supplied, so the year-end fall does not measure the bills that domestic holders had to absorb.

[21] Per USD billion of scheduled maturities, long-term institutional investors sell ILS 0.29 billion of Makam on the exchange ($t = 3.4$), and foreign investors buy ILS 0.31 billion there ($t = 2.3$). The difference in sales between institutions that owe and receive shekels on the maturing hedges has $t = -0.04$, and the response of net issuance has $t = -0.5$.

[22] The rise survives ownership-dependent TELBOR and foreign-rate pass-through as in Table III, exclusion of December 2022 (the one year with a tender inside the window), longer Newey–West windows, and omission of each December in turn. Across the 7 year-end episodes, dropping one December at a time leaves the three-week rise in the Makam yield between 6.9 and 9.9 basis points.

V. Funding rates and the Makam yield

Sections II–IV leave three facts for a model to explain. When foreign investors own more Makam, the Makam yield moves more closely with the foreign funding rate at given TELBOR (Section II). Foreign purchases move the yield (Sections III and IV). Yet from 2018 to 2019 a hedged dollar-funded investor could earn about 28 basis points on Makam while the Makam yield stayed at TELBOR (Table I). Had the investor with the cheapest funding set the price, the Makam yield would have fallen toward the foreign funding rate.

The model below explains all three. It is a demand system in the sense of Koijen and Yogo (2019), with one change. Each group of holders values Makam against its own observed substitute rather than a single outside asset. Domestic banks compare Makam with deposits at the Bank of Israel, whose rate TELBOR tracks. Foreign investors compare Makam with a synthetic shekel position that earns the foreign funding rate. Neither group will hold unlimited amounts. Because foreign demand is finite, foreign investors stop buying while the hedged spread is still positive. When foreign investors are a small part of the market, domestic holders set the yield close to TELBOR. As the foreign investor base grows, foreign demand responds more strongly to the foreign funding rate, and the Makam yield moves more with the foreign funding rate and less with TELBOR.

As in Vayanos and Vila (2021), investors with finite demand elasticities jointly determine the yield. As in Stein and Wallen (2025), the capacity of holders and the issuer to absorb shifts in supply and demand governs how far prices move. Section V.A estimates the model and measures the funding channel in basis points and in shekels.

The model has two groups of holders, foreign and domestic, and an issuer. We describe each in turn and then clear the market. Consider Makam at a fixed maturity. Let y be the Makam yield, r^D TELBOR, and r^F the foreign funding rate. TELBOR minus the Makam yield is then $r^D - y$, which is positive when Makam yields less than TELBOR. Foreign holdings are F, domestic holdings D, and Makam outstanding S, all in shekels, and rates are in basis points.

Foreign investors. Foreign investors hold more Makam when it yields more and less when their funding costs more. Foreign holdings are

$$F = a\,y - b\,r^F + u, \qquad a, b > 0. \tag{7}$$

The slope a is the rise in foreign holdings per basis point of Makam yield, and b is the fall per basis point of the foreign funding rate. Both slopes grow with the foreign investor base, because a larger base responds to the same change in rates with larger purchases. The term

u collects everything else that shifts foreign demand. We do not impose $a = b$, the restriction that foreign demand depends only on the hedged spread $y - r^F$.

Why do foreign investors not keep buying until the Makam yield falls to their funding rate? The global banks that could trade the hedged spread away pay a regulatory cost on every position they add to their balance sheets, and so take only limited positions (Du, Tepper, and Verdelhan (2018)). The key assumption of the model is therefore that foreign demand is finite, so that a given hedged spread draws a given amount of foreign holdings and no more. The same balance sheet can also earn deviations from covered interest parity in other currencies. When those deviations shrink, Makam becomes the better use, and the slopes a and b rise (Section I.E).

Domestic investors. Domestic investors sell Makam as it yields less relative to TELBOR, and each can sell only what it holds. Domestic investor j holds

$$D_j = \max\{0,\ \bar{D}_j - \delta_j(r^D - y)\}, \qquad \delta_j \geq 0. \tag{8}$$

The level $\bar{D}_j$ is investor j's holding when Makam yields the same as TELBOR, and δ_j is how much investor j sells per basis point of $r^D - y$. Once its holding is gone, the investor supplies no further bills. The bound reflects that Makam has no centralized securities-lending facility (Tel Aviv Stock Exchange (2026)). Summing over the investors that still hold Makam gives domestic holdings $D = \bar{D} - \delta(r^D - y)$, where $\bar{D}$ and δ are the sums of $\bar{D}_j$ and δ_j over those investors.

Supply. Makam outstanding is

$$S = \bar{S} + \phi\,(r^D - y), \qquad \phi \geq 0. \tag{9}$$

The term $\bar{S}$ is issuance set independently of the yield, and ϕ is how much the Bank of Israel expands issuance per basis point of $r^D - y$.

Market clearing. Foreign and domestic holdings equal Makam outstanding, $F + D = S$. Domestic holders and the issuer together supply

$$B = \delta + \phi$$

additional bills per basis point of $r^D - y$, and we call B the domestic supply slope. In the data, δ comes mainly from banks, for which a deposit at the Bank of Israel is a close substitute for

the bills, and from mutual funds and long-term institutional investors, and ϕ is the Bank of Israel's issuance at its tenders. The linear forms keep the algebra visible and are stronger than the results need. With nonlinear demand and supply, the slopes become local derivatives and the results below carry over. What matters is that each group values Makam against its own rate and that neither will hold unlimited amounts. Market clearing gives

$$y = \frac{B\, r^D + b\, r^F + \bar{S} - \bar{D} - u}{a + B}. \tag{10}$$

The Makam yield is pulled toward two rates. Domestic holders pull it toward TELBOR, foreign investors pull it toward their funding rate, and each side pulls in proportion to how strongly its holdings respond. No single group of holders sets the yield. A foreign investor buys Makam until the hedged spread no longer covers the cost of adding the position to its balance sheet. A domestic holder keeps a bill as long as the bill is worth at least as much to it as a deposit at the Bank of Israel. Holders that value the bills highly, such as funds that must hold shekel collateral, keep them even when the Makam yield is well below TELBOR.[23] Both conditions hold at the same yield. The two groups need not value the bills equally, because they fund at different rates, and limited arbitrage keeps TELBOR and the foreign funding rate apart. In equation (10), TELBOR's weight is the domestic supply slope B, and the foreign funding rate's weight is the foreign slope b, both relative to $a + B$, the total response of holdings and supply to the Makam yield. When $a = b$ the weights sum to one, and the yield is a weighted average of the two rates. The level terms $\bar{S} - \bar{D} - u$ shift the Makam yield. When the foreign investor base is small, b is small relative to B, so the yield follows TELBOR and foreign investors stop buying before the hedged spread closes. The small foreign base of 2018 to 2019 explains why a hedged spread of about 28 basis points could persist while the Makam yield stayed at TELBOR.

TELBOR minus the Makam yield. Subtracting the equilibrium yield from TELBOR gives

$$r^D - y = \frac{b}{a + B}(r^D - r^F) + \frac{a - b}{a + B}\, r^D - \frac{\bar{S} - \bar{D} - u}{a + B}. \tag{11}$$

Equation (11) follows from writing TELBOR over the denominator of equation (10) and adding and subtracting $b\, r^D$ in the numerator. The first term is the foreign funding rate's weight in the Makam yield times the gap between TELBOR and the foreign funding rate. The first term is positive whenever foreign investors fund more cheaply than domestic banks. The second term vanishes when $a = b$, that is, when foreign demand depends only on the

[23] Internet Appendix Section IA.1.7 documents the portfolios of these funds.

hedged spread. The third term collects the level terms in demand and supply. A change in holders can therefore change TELBOR minus the Makam yield without changing the bill's promised repayment or its safety and liquidity characteristics.

Funding-rate exposure and price impact. Equation (10) separates funding-rate exposure from price impact. A change in the foreign funding rate moves the Makam yield by

$$\frac{\partial y}{\partial r^F} = \frac{b}{a+B}, \tag{12}$$

which we call funding-rate exposure. A shift up in foreign demand, a rise in u, moves the Makam yield by

$$\frac{\partial y}{\partial u} = -\frac{1}{a+B}. \tag{13}$$

Foreign holdings rise by less than u, because the lower yield reduces the rest of foreign demand. Whatever raises foreign holdings, the additional bills come from domestic holders and the issuer. Market clearing gives $F = \bar{S} - \bar{D} + B(r^D - y)$. At given TELBOR, any change in foreign demand or in the foreign funding rate that raises foreign holdings by dF therefore lowers the Makam yield by

$$-\frac{dy}{dF} = \frac{1}{B}, \tag{14}$$

which we call price impact, the change in the Makam yield per shekel that foreign investors acquire. Funding-rate exposure and the response to a shift in foreign demand share the denominator $a + B$, so both depend on the size of the foreign investor base. Only exposure also has a foreign slope, b, in its numerator. Price impact contains neither foreign slope, so the estimate from scheduled hedge maturities in Section IV.B applies at any foreign share, as long as the same domestic holders remain.

PROPOSITION 1: *Suppose the foreign investor base grows, raising the foreign slopes a and b in the same proportion, while the same domestic investors keep positive holdings, so that the domestic supply slope $B > 0$ does not change. Hold the two rates and the level terms fixed.*

(i) Funding-rate exposure $b/(a+B)$ rises, and TELBOR exposure $B/(a+B)$ falls.

(ii) If foreign and domestic holdings are positive and $ay - br^F > 0$, the foreign share of Makam outstanding, F/S, rises.

(iii) The response of the yield to a shift in foreign demand, $1/(a+B)$, falls, and price impact $1/B$ does not change.

(iv) At a given foreign investor base, a fall in B raises funding-rate exposure, the response to a shift in foreign demand, and price impact.

The point of the proposition is that the foreign funding rate matters for the Makam yield in proportion to how much of the market's response to rates comes from foreign investors. The proof is in Internet Appendix Section IA.5.1. Parts (i) and (ii) match the evidence of Section II. In that section, pass-through measures how the Makam yield moves together with each rate. A larger foreign investor base comes with higher foreign-rate pass-through and lower pass-through from TELBOR (Figure 4 and Table III). Section V.A separates pass-through from exposure. By part (iii), price impact, $1/B$, does not depend on the foreign investor base, and scheduled hedge maturities measure it from 2020 to 2022 (Section IV.B). Part (iv) describes bank exit (Section I.D). When a domestic holder's holding reaches zero, the holder drops out of δ, the domestic supply slope falls, and funding-rate exposure and price impact rise together. In 2011 banks still held Makam and absorbed most of the bills foreign investors released, so the domestic supply slope was larger and price impact smaller (Section III).

A. The size of the funding channel

We now turn the estimates into the paper's headline number. From January to September 2022, TELBOR minus the Makam yield averaged 51 basis points, and the headline number is the part of that spread that the funding rate of foreign holders accounts for. Getting there takes three steps. The estimate from scheduled hedge maturities in Section IV.B gives price impact, the change in the yield per shekel that foreign investors acquire. Estimating the model with price impact fixed at that value recovers funding-rate exposure, the weight of the foreign funding rate in the Makam yield, at each foreign share. Exposure times the gap between TELBOR and the foreign funding rate gives the funding term, the part of the spread that equation (11) attributes to the foreign funding rate. We average the funding term from January to September 2022, when the gap was 95 basis points. Along the way, the estimates show how much of the rise in exposure comes from foreign demand and how much from the domestic side.

Exposure is not the same as the pass-through of Section II. Funding-rate exposure, equation (12), asks how much the Makam yield moves when the foreign funding rate moves for its own reasons, at given TELBOR. Pass-through is the co-movement of the Makam yield and the foreign funding rate in the data. The foreign funding rate does not move only for its own reasons. Foreign investors who buy Makam also buy dollars forward, and those purchases raise the foreign funding rate. Domestic institutions that renew their currency hedges supply forward dollars and lower the foreign funding rate (Ben Zeev and Nathan (2024b)). The shocks that move the funding rate can also come with shifts in domestic demand for Makam.

The yield and the funding rate can then move together in the data even if the funding rate itself had no effect on the yield. Co-movement equals exposure only when funding shocks alone move the funding rate.[24]

The estimation answers two questions. How large is exposure at low and at high foreign ownership, and does its rise come from foreign demand or from the domestic supply slope? We fit foreign demand and the domestic supply slope to 89 months of data, January 2017–May 2024, with foreign holdings at market value and three-month rates. The fit estimates the foreign-demand slopes and the domestic supply slope $B(s)$, each linear in the previous month's foreign share s. We take the shocks to be Student-t, which fit the monthly data far better than normal shocks, with a log likelihood higher by 71. Table VIII also reports normal shocks. In the model, the domestic supply slope changes with the foreign share because domestic holders leave the market as the share rises (Proposition 1, part (iv)), and the linear form in s captures their exit. We evaluate the model at two foreign shares, 5.9%, the average of 2017 to 2018, the first two years of the estimation sample, and 26.4%, close to the average of 28% from July 2020 to December 2021. Three restrictions separate foreign demand from the domestic side.

The first restriction fixes the level of the domestic supply slope. Price impact in the model is $1/B$, the change in the yield per shekel that foreign investors acquire. The estimate of Section IV.B, 2.80 basis points per ILS billion, therefore sets $B(s)$ at the higher ownership state, whose share is close to the July 2020 to December 2021 average. We assume that each shekel foreign investors acquire comes from one shekel of domestic holdings.[25]

The second restriction ties the domestic supply slope to two features of the data. We require the same slope $B(s)$ to govern both how much domestic holders sell when TELBOR minus the Makam yield widens and how closely the Makam yield follows TELBOR. The foreign-demand slopes then account for the rest of the yield's response to the two rates.

The third restriction identifies the foreign-demand slopes. Coupons on government bonds held by domestic funds hand the funds cash on dates fixed when the bonds were issued. The payments can shift domestic demand and the funding rate. We assume the payments do not shift foreign demand directly, so the yield changes that the payments cause trace out the foreign demand curve.

[24]With a funding equation $r^F = \bar{r}^F + \kappa F + v$, $\kappa \geq 0$, where $\bar{r}^F$ collects the observed determinants of funding and v is a funding-market shock, weekly co-movement combines the response to foreign-demand shocks with the response to funding shocks. Internet Appendix Section IA.5.2 derives the equilibrium responses.

[25]The matched responses imply 0.95 shekels of displacement per shekel of acquisitions. The one-for-one mapping holds valuation and the issuer's response fixed and keeps the units reported in the transaction data. The estimate pools the three- and six-month yields, whose separate estimates are 2.44 and 3.16.

The feedback from foreign holdings to the foreign funding rate is the rise in that rate per shekel of foreign holdings. The reference specification sets the feedback to zero, as a benchmark for the specifications that estimate the feedback. It also lets shocks to funding and shocks to domestic demand be correlated.

In the reference specification with Student-t shocks, a 100-basis-point rise in the foreign funding rate raises the Makam yield by 14.1 basis points at 26.4% foreign ownership and by 3.2 basis points at 5.9% (Table VIII, Panel A). Normal shocks give 13.4 basis points at higher ownership and 3.4 at lower ownership. The numbers depend on price impact. At the upper end of its 95% Anderson–Rubin set, 4.41 basis points per ILS billion, exposure at the higher state is 20.2 basis points with Student-t shocks. Although zero price impact lies outside the set, the zero case shows why the first restriction is needed. With zero price impact, exposure is zero at both states, yet the co-movement the model implies is still 7.4 and 11.2 basis points. Co-movement alone therefore cannot reveal exposure.

Most of the rise in exposure comes from the foreign-demand slopes, which grow with the foreign investor base (Table VIII, Panel D). Switching the foreign-demand slopes from their low- to their high-ownership values accounts for 61–86% of the rise with Student-t shocks and 92–97% with normal shocks. The domestic supply slope accounts for the rest. Each range spans the two orders in which the two sets of slopes can be switched. Panel C reports co-movement, the model's counterpart of the pass-through regression of Section II. The co-movement the model implies rises by about as much as exposure across the two ownership states. With feedback fixed at zero, a model in which exposure changes with the foreign share fits the data better than a model with constant exposure, under both shock distributions. Internet Appendix Section IA.5.3 gives the full specification, the comparison of fit, and specifications with feedback from foreign holdings to the foreign funding rate.

The estimated model also measures the funding term, the amount by which the Makam yield would rise if foreign investors could fund at TELBOR. The funding term equals funding-rate exposure times the gap between TELBOR and the foreign funding rate, the first term of equation (11). The remaining terms of that equation make up the rest of the spread. A lower foreign funding rate widens TELBOR minus the Makam yield at given TELBOR, by more when exposure is higher, without a change in the bill's promised repayment. We evaluate exposure each day at the previous month's foreign share, with the estimated slopes, which are linear in the share. The estimation sample, January 2017–May 2024, includes the 2022 shares, so the linear relation is evaluated within the range of the data. Figure 6 plots the funding term against the spread, month by month. From January to September 2022, when TELBOR exceeded the foreign funding rate by 95 basis points on average, the funding term is 34 basis points, out of a mean spread of 51. With normal shocks it is 21.

With Student-t shocks, the funding term from July 2020 to December 2021 is 5 basis points out of a spread of 8. From 2018 to 2019, when foreign ownership was low, the funding term and the spread were both close to zero. TELBOR then exceeded the foreign funding rate by 27 basis points, so the small foreign base, not the absence of a gap, kept the funding term near zero. The 2022 funding term rises with the price impact imposed on the model. Over the 95% Anderson–Rubin set of price impact it runs from 27 to 44 basis points (Internet Appendix Section IA.5.3).

Holding exposure at its 2017 to 2018 level, with the same rates, gives the counterfactual Makam yield. Over the whole of 2022, the three-month Makam yield would have been higher on average by 38 basis points with Student-t shocks and 22 with normal shocks. The Bank of Israel would have paid ILS 0.6 billion more interest on Makam with Student-t shocks and ILS 0.3 billion with normal shocks, on an average of ILS 145 billion outstanding. The counterfactual differs from the funding term in two ways. It lowers exposure to its 2017 to 2018 value instead of closing the gap between the two rates, and it covers all of 2022, including October to December, when TELBOR exceeded the foreign funding rate by 179 basis points.[26]

VI. Evidence beyond Israel

If the funding channel is general, bill yields should also track the foreign funding rate more closely as foreign ownership rises in other markets where hedged, dollar-funded investors hold a large share. We test this prediction in Mexico and Japan.

A. Mexican government bills

The test requires only that a country publish foreign holdings of a short-term sovereign bill at least monthly and have a domestic benchmark rate and a dollar forward market. Mexico meets the requirements and offers three comparisons with Israel.[27] First, Banco de México publishes daily nonresident holdings of Cetes, the government's discount bills, dating back to 1994, so foreign ownership is measured for the bill itself rather than for government debt as a whole. Second, foreign ownership of Cetes rose and fell on a timetable unrelated to Israel's. The foreign share rose from 4% from 2008 to 2009 to 59% from 2013 to 2014 and fell

[26] In terms of the weekly variance of the spread, the foreign funding rate accounts for 0% of the spread's movements from 2018 to 2019 and 17% from January to September 2022, where each rate is credited with its own variance contribution and half of the covariance between the two rates.

[27] Banco de México staff describe foreign investors combining government-security holdings with dollar forwards to hedge currency exposure, and the Bank's monitoring of holdings alongside forward positions (Alfaro (2002)).

back by 2021. Third, Cetes have a different issuer, the Mexican Treasury rather than the central bank. We estimate regression (3) on weekly changes in the three-month Cetes yield. The domestic benchmark is the 91-day TIIE, the interbank equilibrium rate that Banco de México computes from banks' quotes. We build the three-month foreign funding rate from the same dollar rate as for Israel and from peso forward points. We interact the changes in both rates with the foreign share of Cetes outstanding at the end of the previous month.

Mexico reproduces the central finding (Table IX and Figure 7, Panel A). When weeks are grouped by the foreign share as in Figure 4, foreign-rate pass-through rises from 3.1 basis points at foreign shares below 10% to 22.9 ($t = 5.5$) when foreign investors held more than 50% of Cetes. As the foreign share of Cetes rose from 4% from 2008 to 2009 to 59% from 2013 to 2014 and fell back, the Cetes yield became more sensitive to the foreign funding rate. Foreign-rate pass-through rises by 2.9 basis points per 10 percentage points of foreign ownership ($t = 3.2$), against 7.4 in Israel. The foreign share counts every nonresident holder, including investors who do not fund in hedged dollars. A smaller Mexican response fits a foreign base in which fewer holders fund in hedged dollars. Without the 2008 to 2009 crisis months the interaction is 2.2 ($t = 2.2$). It stays positive with winsorized changes in the foreign funding rate, and omitting one year at a time leaves it between 1.6 and 3.3 (Internet Appendix Section IA.6).

As in Israel, the bill yield lay between the foreign funding rate and the domestic benchmark, and foreign holdings followed the hedged spread. From 2011 to 2014, as foreign investors built their position, the three-month foreign funding rate averaged 3.46%, below the 91-day TIIE at 4.37%, and the Cetes yield, at 3.92%, lay between the two. The Cetes yield exceeded the foreign funding rate on 80 to 100% of trading days in each year of 2010 to 2015, as foreign ownership built up and peaked. In each year of 2017 to 2023, while foreign holdings fell, the Cetes yield exceeded the foreign funding rate on at most 21% of trading days.

B. Japanese Treasury bills

Japan tests the relation in a large market. The Bank of Japan's flow of funds records nonresidents' holdings of Japanese Treasury discount bills (Bank of Japan (2026)), and their share of the bills rose from 19% at the end of 2010 to 73% at the end of 2018 and stood at 56% at the end of 2024. We estimate regression (3) on 711 weekly changes in the three-month bill yield from 2010 to 2024. The domestic benchmark is the three-month yen overnight-index-swap rate, and the yen foreign funding rate is built from the dollar rate and yen forward points as for Israel and Mexico. We interact the change in each rate with the foreign share of the bills at the end of the previous quarter. Foreign-rate pass-through rises by

2.3 basis points per 10 percentage points of foreign ownership ($t = 3.0$, Table IX). Grouping weeks by the foreign share gives the same rising pattern as in Israel and Mexico (Figure 7, Panel B). A 100-basis-point rise in the foreign funding rate goes with a change in the bill yield of -2 basis points at the 2010 share and 10 at the 2019 share. Measured from auction to auction, with rates at the close before each auction, pass-through rises by 2.0 basis points per 10 percentage points ($t = 5.0$). The rise in tracking with foreign ownership does not rest on any single year. Leaving out one year at a time, it ranges from 1.7 to 4.1 basis points per 10 percentage points, and leaving out 2020, the year in which the foreign funding rate moved most, gives 4.1 with a t-statistic of 3.1.

Japan also lets us measure how much of the bills' convenience yield is a funding cost. For each year, the funding component is the tracking estimated at that year's foreign share times the gap between the yen overnight-index-swap rate and the foreign funding rate. Co-movement can differ from funding-rate exposure (Section V.A). In the Israeli model at the estimated price impact, co-movement at the higher ownership state is 12.8 basis points per 100 against exposure of 14.1 with Student-t shocks, and 8.7 against 13.4 with normal shocks, so at that price impact the calculation understates exposure. Applied to Israel in 2022, the same calculation gives 25 basis points, below the model's 34, as expected when co-movement understates exposure. From 2016 to 2024, when foreign investors held more than 45% of Japanese bills, the funding component averaged 2 basis points, 17% of the 12-basis-point average gap between the yen overnight-index-swap rate and the bill yield. In 2019, when the foreign share peaked at 71%, it was 3 of 9 basis points.

The Bank of Japan attributes movements in bill yields to dollar-funded investors who hold Japanese bills financed through foreign-exchange swaps (Bank of Japan (2018, 2017, 2025)), the same position that foreign holders of Makam take.

VII. Implications

A. Monetary implementation

The central bank's own bill yielded less than zero while its policy rate was positive. From July 2020 to December 2021, as the foreign funding rate turned negative, the three-month Makam yield fell below zero while TELBOR remained positive (Figure 3). The Makam yield fell below zero even as Makam outstanding rose by ILS 22.0 billion. In the estimated model, with exposure held at its 2017 to 2018 level, the weekly yield would have been negative in 11 to 12 of the 79 weeks rather than 25. A policy rate pins the funding cost of institutions with access to the domestic money market, but a safe asset held by other investors can yield a

different rate. When the policy rate is near zero, even a small difference can take the bill yield below zero. The response of the Makam yield to TELBOR is also lower when foreign ownership is higher (Table III, column 4).

An investor-based account of a short-rate disconnect (Lenel, Piazzesi, and Schneider (2019)) makes monetary implementation depend on who finances and holds safe assets. Anbil et al. (2026) show that money market funds' supply of repo financing can constrain the Federal Reserve's balance-sheet reduction even when banks' reserve demand does not bind. Access to reserve remuneration and reverse-repurchase facilities shapes domestic money-market pricing (Duffie and Krishnamurthy (2016)). Our evidence adds a cross-border channel, through which the central bank's own bill follows the funding rate of foreign holders.

B. Local-currency borrowing and foreign funding

An issuer that borrows in its own currency can still be exposed to foreign funding conditions through its investors, because the cost of financing a hedged position enters the bill's yield. How exposed the issuer is depends on the balance between the two sides of the market. Funding-rate exposure is high when funding-sensitive foreign demand is large relative to the domestic supply slope. A market with deep domestic demand can therefore have little exposure even with substantial foreign ownership. For the same reason, when banks leave, other domestic investors or additional issuance can restore the supply slope and offset the effect of the banks' exit.

The issuer controls one part of the domestic supply slope. The Bank of Israel described its larger tenders of 2022 as a response to demand (Section I.D). Issuance that rises with demand, and so with TELBOR minus the Makam yield, is a rise in ϕ in the model rather than in $\bar{S}$. A higher ϕ lowers funding-rate exposure and price impact. From September to December 2022, as Makam outstanding rose by ILS 65.0 billion, TELBOR minus the Makam yield fell by 93 basis points.

The distinction between funding and convenience also matters for welfare. When foreign funding conditions widen the spread between interbank rates and bill yields, the issuer pays less interest although the bills provide no more safety or liquidity than before. The saving comes from the funding cost of its foreign holders.

VIII. Conclusion

Investors can value the same safe bill against substitutes with different funding rates. As the investor base changes, the bill's yield can come to follow a different mix of those rates. The

Makam yield followed the foreign funding rate more closely whenever foreign investors held more of the bills, and Mexican and Japanese Treasury bills show the same relation. In the estimated model, the funding cost of foreign investors accounts for 34 of the 51 basis points by which Makam yielded less than TELBOR from January to September 2022, depending on the distribution of shocks.

The standard measure of a safe asset's convenience yield, the spread between money-market rates and the asset's yield, therefore records part of the funding cost of the asset's holders alongside their demand for safety and liquidity. A bill that promises repayment in domestic currency can become exposed to foreign funding conditions without a change in that repayment. Even the central bank's own bill can move with the foreign funding rate at given TELBOR. The same funding component can appear wherever hedged, dollar-funded investors hold a large share of a local bill market, as nonresidents do in Japanese Treasury bills. In those markets, a convenience yield measured from the spread between money-market rates and bill yields can contain a funding cost that grows with the foreign share.

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Table I: The Makam market by period

This table reports the size of the Makam market, its holders, dollar hedges, and three-month rates by period. Entries are means over the weeks of each period, with holdings and hedges at the end of the month before each week and rates as weekly means of daily data. Long-term institutions are retirement savings funds, pension funds, and insurance companies, and other domestic holders are the remainder of Makam outstanding. The foreign funding rate, r^F, is the shekel cost of borrowing dollars at the dollar overnight-index-swap rate plus a fixed spread of 26.161 basis points and hedging repayment at the three-month forward rate. The fixed spread is the one ISDA set to replace three-month dollar LIBOR, and it brings the dollar rate to the level of unsecured bank funding (Section I.C, footnote 7). The hedged spread is the Makam yield minus the foreign funding rate. Sources: Bank of Israel and LSEG.

Panel A. 2018–2024

	2018–2019	Jan–Jun 2020	Jul 2020–Dec 2021	Jan–Sep 2022	Oct–Dec 2022	2023	Jan–Sep 2024
Market size							
Makam outstanding (ILS bn)	107	111	96	128	164	282	261
Foreign holdings (ILS bn)	9	17	27	58	74	41	8
Dollar hedges (USD bn)	32	43	65	81	75	65	55
Holders (% of Makam outstanding)							
Foreign investors	9	16	28	46	45	15	3
Banks	36	23	5	4	5	22	15
Mutual funds	24	27	37	27	21	30	48
Long-term institutions	26	32	30	23	27	27	30
Other domestic	5	2	1	0	1	5	4
Three-month rates							
TELBOR (%)	0.18	0.14	0.09	1.02	3.40	4.61	4.46
TELBOR − r^F (bp)	27	71	30	95	179	85	57
TELBOR − Makam yield (bp)	−1	1	8	51	81	30	24
Hedged spread (bp)	28	70	22	44	98	55	33

Panel B. 2010–2013

	Jan 2010–Jun 2011	Jul–Dec 2011	Jan–Jun 2012	Jul 2012–Dec 2013
Market size				
Makam outstanding (ILS bn)	118	121	124	122
Foreign holdings (ILS bn)	28	31	9	1
Dollar hedges (USD bn)	8	11	9	11
Holders (% of Makam outstanding)				
Foreign investors	22	25	7	1
Banks	18	13	27	38
Mutual funds	21	24	29	29
Long-term institutions	18	14	15	15
Other domestic	20	23	23	17
Three-month rates				
TELBOR (%)	2.11	2.94	2.41	1.55
TELBOR − r^F (bp)	105	150	63	11
TELBOR − Makam yield (bp)	18	14	−2	1
Hedged spread (bp)	87	137	65	9

Table II: Changes in Makam holdings by holder

This table reports changes in Makam holdings by holder between the ends of the two months in each row, together with the change in Makam outstanding and in TELBOR minus the three-month Makam yield. Holdings are Bank of Israel holder statistics at market value, and the five holder columns sum to the change in Makam outstanding up to rounding. Long-term institutions are retirement savings funds, pension funds, and insurance companies, and other domestic holders, mainly households and firms, are the remainder of Makam outstanding. The spread is the mean of the last seven days of each month. Source: Bank of Israel.

	Change in holdings (ILS bn)					Change in	Change in
	Foreign	Banks	Mutual funds	Long-term institutions	Other domestic	Makam outstanding (ILS bn)	TELBOR − Makam yield (bp)
Panel A. 2018–2024							
Dec 2017–Dec 2019	+9.3	−7.7	+18.5	+11.0	−3.1	+28.0	+1
Dec 2019–Dec 2021	+37.1	−32.0	+1.7	−11.9	+0.1	−4.9	+11
Dec 2021–Sep 2022	+19.2	+7.3	−8.3	+11.0	+0.2	+29.4	+115
Sep 2022–Dec 2022	+0.9	+10.2	+22.6	+25.5	+5.8	+65.0	−93
Dec 2022–Sep 2024	−64.1	−8.7	+70.0	+24.0	+0.3	+21.5	0
Panel B. 2010–2013							
Dec 2009–Jun 2011	+38.3	−7.8	+3.8	−1.5	+5.2	+37.9	−15
Jun 2011–Dec 2011	−27.8	+19.7	+5.6	−1.9	+3.6	−0.8	−7
Dec 2011–Jun 2012	−12.2	+12.1	+5.0	+1.9	+0.3	+7.0	−20
Jun 2012–Dec 2013	−2.5	+6.6	−0.6	+3.5	−11.1	−4.1	+15

Table III: Foreign-rate pass-through at low and high foreign ownership

This table estimates equation (3). The dependent variable is the weekly change in the three-month Makam yield, and the monthly change in column 5. The coefficients θ_F and θ_D are the responses to the foreign funding rate and to TELBOR at the mean foreign share, in basis points per 100 basis points, and γ_F and γ_D are their changes per 10 percentage points of foreign ownership. Column 3 adds the lagged bank share of Makam and its interactions with both rate changes. Column 4 stacks the yields at four maturities, each with TELBOR and the foreign funding rate at the same maturity. Panel B evaluates pass-through at the 2018–19 and January–September 2022 mean foreign shares, and in column 3 also at each period's mean bank share. Newey–West t-statistics with 4 lags in parentheses (Driscoll–Kraay in column 4, 2 lags in column 5). Sources: Bank of Israel and LSEG. *, **, and *** denote significance at the 10, 5, and 1% levels, based on the t-statistics shown.

Dependent variable: change in the three-month Makam yield, Δy_w					
	(1) 2010–24	(2) 2018–24	(3) 2010–24	(4) 2010–24	(5) 2010–12, monthly
Panel A. Coefficients of equation (3)					
θ_F, foreign funding rate	2	6^{**}	3	7^{**}	-2
	(0.7)	(2.2)	(1.2)	(2.0)	(-0.8)
θ_D, TELBOR	71^{***}	66^{***}	72^{***}	62^{***}	78^{***}
	(10.8)	(4.9)	(10.9)	(6.7)	(8.4)
γ_F, foreign funding rate × foreign share	7.4^{***}	7.8^{***}	9.0^{***}	9.3^{***}	6.8^{**}
	(3.3)	(2.9)	(2.7)	(3.9)	(2.3)
γ_D, TELBOR × foreign share	-8.1	-4.1	-1.1	-15.9^{***}	10.1
	(-1.5)	(-0.4)	(-0.1)	(-2.9)	(1.3)
Panel B. Pass-through, $\theta_F + \gamma_F s_w$					
At the 2018–19 share (9%)	-1	-2	2	3	
At the January–September 2022 share (46%)	26	27	26	38	
Bank-share controls	No	No	Yes	No	No
Four maturities	No	No	No	Yes	No
Week fixed effects	No	No	No	Yes	No
Weeks (months in column 5)	747	346	747	620	29

Table IV: Yields on affected and exempt securities after the 2011 reform

This table reports the change in Makam yields after nonresidents' tax exemption ended on 7 July 2011, relative to exempt government bonds of similar remaining maturity. Each column estimates equation (4) on monthly security yields through June 2012, with remaining maturities of one to twenty-four months. The coefficient γ is the change in the yield of affected Makam relative to exempt government bonds after implementation. Columns vary the maturity curve and the sample start, and column (5) reports the range over the 7 regressions that each leave out one exempt bond. t-statistics clustered by security and month in parentheses, wild-cluster bootstrap p-values by security. Source: Bank of Israel. *, **, and *** denote significance at the 10, 5, and 1% levels, based on the t-statistics shown.

Dependent variable: yield of security i in month t, y_{it}					
	(1)	(2)	(3)	(4)	(5)
γ, affected × post (bp)	12.8^{***}	10.9^{***}	22.3^{***}	12.6^{***}	10.7 to 16.6^{***}
	(3.8)	(4.9)	(4.1)	(3.6)	(3.8 to 4.7)
Bootstrap p-value	0.015	0.019	0.002	0.015	
Security and month effects	Yes	Yes	Yes	Yes	Yes
Maturity curve	Linear, by month	Quadratic, by month	Linear, common	Linear, by month	Linear, by month
Sample start	Jul 2009	Jul 2009	Jul 2009	Jul 2010	Jul 2009
Exempt bonds	All	All	All	All	One left out
Securities affected / exempt	47 / 7	47 / 7	47 / 7	35 / 6	47 / 6
Security-months	515	515	515	353	491–512

Table V: Foreign demand for Makam

This table estimates equation (5), regressing the monthly change in foreign Makam holdings, in ILS billion, on the previous month's three-month Makam yield, foreign funding rate, foreign holdings, and domestic institutions' dollar hedges, with a separate intercept in each period, 2018–2022. Newey–West t-statistics with 3 lags in parentheses. Sources: Bank of Israel and LSEG. *, **, and *** denote significance at the 10, 5, and 1% levels, based on the t-statistics shown.

Dependent variable	Change in foreign holdings, ΔF_t
Makam yield$_{t-1}$, β_y (per 100 bp)	5.7^{***}
	(4.1)
Foreign funding rate$_{t-1}$, β_F (per 100 bp)	-8.6^{***}
	(-5.6)
Foreign holdings$_{t-1}$, ρ (ILS bn)	-0.45^{***}
	(-6.1)
Domestic dollar hedges$_{t-1}$, β_H (USD bn)	0.39^{***}
	(8.5)
Period intercepts	Yes
Months	50

Table VI: Maturity choice by investor group

This table regresses each investor group's share of its Makam purchases in a remaining-maturity bucket on the bucket's hedged spread in the previous month, with month and bucket fixed effects, February 2018–August 2022. The hedged spread of a bucket is the Makam yield minus the foreign funding rate, both at the midpoint of the bucket's maturity range, and it is what a foreign investor earns on the bill after funding in dollars and hedging the currency. TASE investor classes differ from the Bank of Israel holder sectors. t-statistics clustered by month in parentheses. Sources: Bank of Israel, TASE, and LSEG. *, **, and *** denote significance at the 10, 5, and 1% levels, based on the t-statistics shown.

Dependent variable: share of the group's purchases in the maturity bucket (pp)					
	(1) Foreign investors	(2) Banks	(3) Mutual funds	(4) Pension and insurance	(5) ETFs and market makers
Hedged spread$_{t-1}$, β_g (bp)	1.55^{***}	1.14^{***}	-0.12	-0.04	-0.29
	(4.2)	(3.2)	(-0.7)	(-0.3)	(-1.4)
Month and bucket fixed effects	Yes	Yes	Yes	Yes	Yes
Months	55	55	55	55	55

Table VII: Scheduled hedge maturities and the Makam yield

This table estimates equation (6) over the weeks ending June 2020–August 2022. The instrument is the USD notional of domestic institutions' dollar-sale forwards scheduled to mature in week w and written at least 97 days earlier. Columns (1)–(3) use the calendar as an instrument for the change in the foreign funding rate, Δr^F_w, and columns (4)–(6) for foreign acquisitions of Makam, tender and secondary purchases minus secondary sales in ILS billion. The outcome Δy_w is the change in the Makam yield in basis points, at the maturity of the panel. Columns (2) and (5) estimate the same regression by least squares. Anderson–Rubin 95% sets, valid however weak the instrument, are in brackets. Rates and yields change from week $w-3$ to week w, and acquisitions are summed over weeks $w-2$ to w. Every column controls for the change in TELBOR at the panel's maturity and for the other controls of equation (6): an indicator for 2022, the calendar fourteen weeks ahead, holdings before the window, and recent changes in rates. Newey–West t-statistics with 8 lags in parentheses. Sources: Bank of Israel and LSEG. *, **, and *** denote significance at the 10, 5, and 1% levels, based on the t-statistics shown. Stars are omitted on instrumental-variable estimates whose first-stage F is below 10, for which the Anderson–Rubin set is the relevant inference.

Dependent variable	(1) Δr^F_w	(2) Δy_w	(3) Δy_w	(4) Foreign acquisitions	(5) Δy_w	(6) Δy_w
	First stage	OLS	IV	First stage	OLS	IV
Panel A. Three-month maturity						
Scheduled maturities (USD bn)	-10.4^{***}			0.91^{***}		
	(-4.0)			(3.9)		
Foreign funding rate (per 100 bp)		24^{***}	21^{***}			
		(6.0)	(3.5)			
Foreign acquisitions (ILS bn)					-2.29^{***}	-2.44^{***}
					(-6.5)	(-3.7)
First-stage F			15.8			15.5
Anderson–Rubin 95% set						$[-4.21, -1.21]$
Panel B. Six-month maturity						
Scheduled maturities (USD bn)	-8.4^{***}			0.91^{***}		
	(-3.7)			(3.8)		
Foreign funding rate (per 100 bp)		10^{***}	34^{***}			
		(4.0)	(3.5)			
Foreign acquisitions (ILS bn)					-1.44^{***}	-3.16^{***}
					(-6.2)	(-4.6)
First-stage F			13.4			14.5
Anderson–Rubin 95% set						$[-5.16, -1.90]$
Change in TELBOR	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Weeks	114	114	114	114	114	114

Table VIII: Funding-rate exposure in the estimated model

This table reports funding-rate exposure, the funding term, and co-movement in the estimated model. The model is estimated on 89 months, January 2017–May 2024, with feedback from foreign holdings to the funding rate set to zero. Student-t shocks are the reference specification. Rows fix price impact at the higher state, in basis points per ILS billion of foreign acquisitions, at the hedge-maturity estimate and at the upper end of its 95% Anderson–Rubin set. The last row of Panel A uses the January to September 2022 mean share, inside the estimation sample. Panel B reports the funding term, funding-rate exposure times TELBOR minus the foreign funding rate, averaged over January to September 2022. Panel D switches the foreign-demand slopes and the domestic supply slope between the two states in each order.

	Student-t shocks		Normal shocks	
	Lower state, 5.9%	Higher state, 26.4%	Lower state, 5.9%	Higher state, 26.4%
Panel A. Funding-rate exposure (bp per 100 bp)				
Price impact 2.80 (estimate)	3.2	14.1	3.4	13.4
Price impact 4.41 (upper end)	6.9	20.2	4.7	20.6
Price impact 2.80, 2022 share (46%)	35.1		22.2	
Panel B. Funding term, January to September 2022 (bp)				
Price impact 2.80 (estimate)	34		21	
Price impact 4.41 (upper end)	44		31	
Panel C. Co-movement the model implies (bp per 100 bp)				
Price impact 2.80 (estimate)	2.2	12.8	−1.5	8.7
Price impact 4.41 (upper end)	1.3	12.7	−6.1	11.0
Panel D. Share of the rise in exposure from the lower to the higher state (%)				
	Foreign demand	Domestic supply	Foreign demand	Domestic supply
Foreign-demand slopes switched first	61	39	92	8
Domestic supply slope switched first	86	14	97	3

Table IX: Foreign ownership and foreign-rate pass-through across markets

This table estimates equation (3) on weekly three-month bill yields in three markets, interacting the changes in the domestic benchmark and the foreign funding rate with the lagged foreign share. The benchmarks are three-month TELBOR, the 91-day TIIE (the Mexican interbank equilibrium rate, computed by Banco de México), and the three-month yen overnight-index-swap rate. Interactions are in basis points per 100-basis-point rate change and per 10 percentage points of foreign ownership. Newey–West t-statistics with 4 lags. Sources: Bank of Israel, LSEG, and Internet Appendix Section IA.6. *, **, and *** denote significance at the 10, 5, and 1% levels, based on the t-statistics shown.

	Israel Makam	Mexico Cetes	Japan T-bills
Interactions with the foreign share, bp per 10 pp of ownership			
Foreign funding rate	7.4^{***}	2.9^{***}	2.3^{***}
	(3.3)	(3.2)	(3.0)
Domestic benchmark	−8.1	−1.7	9.2
	(−1.5)	(−0.5)	(0.9)
Benchmark rate	TELBOR	TIIE	Yen OIS
Sample	2010–24	2008–23	2010–24
Weeks	747	824	711

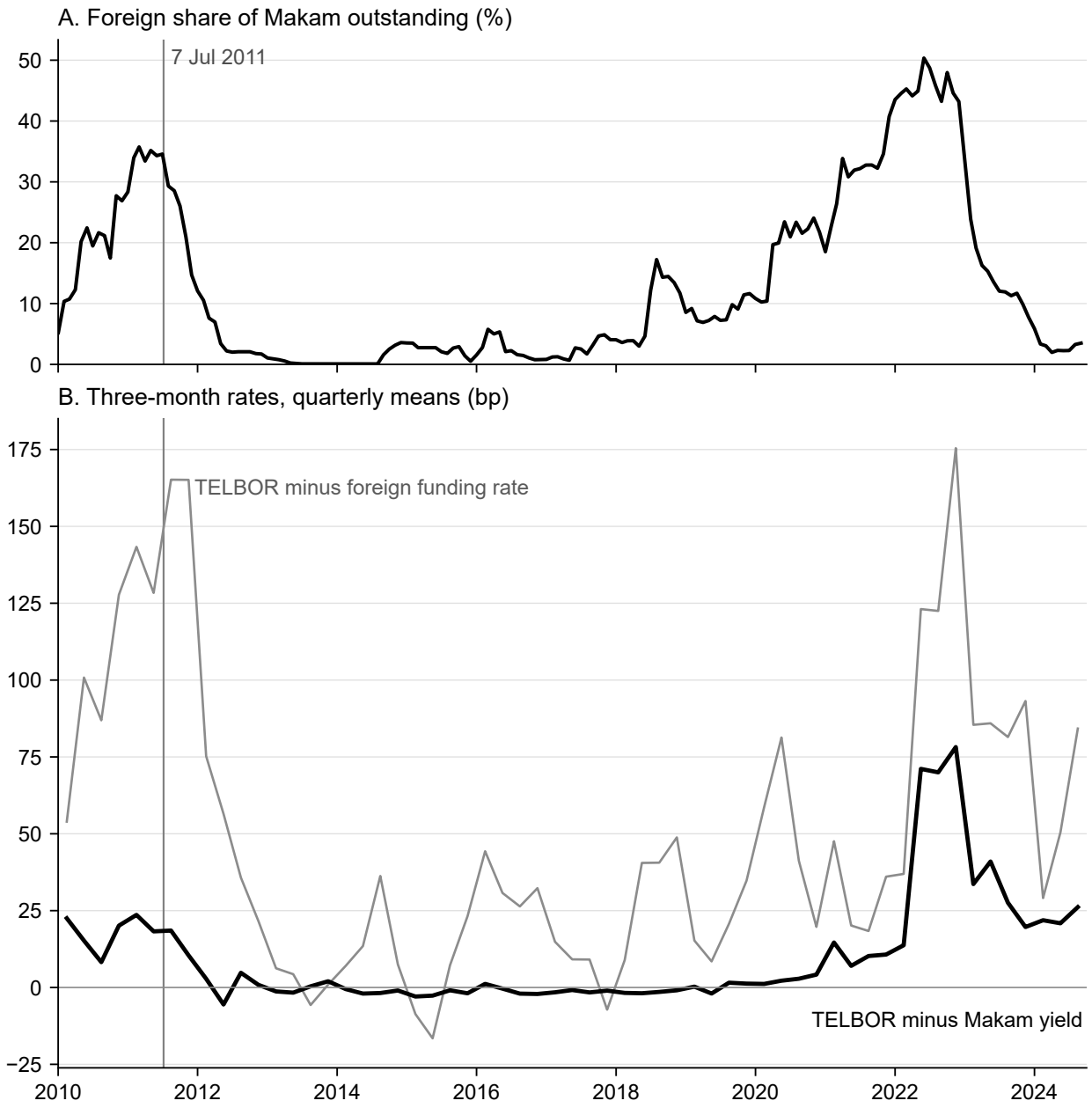


Figure 1: **Foreign ownership and three-month rates, January 2010 to September 2024.** This figure plots the foreign share of Makam and two three-month spreads. Panel A shows the monthly foreign share of Makam outstanding at market value. Panel B shows quarterly means of daily TELBOR minus the Makam yield (black) and TELBOR minus the foreign funding rate (gray). The foreign funding rate is the shekel cost of borrowing dollars at the dollar overnight-index-swap rate plus a fixed spread of 26.161 basis points and buying them back forward. The fixed spread is the one ISDA set to replace three-month dollar LIBOR, and it brings the dollar rate to the level of unsecured bank funding (Section I.C, footnote 7). The vertical line marks 7 July 2011, when nonresidents' tax exemption on Makam ended. The data come from the Bank of Israel and LSEG.

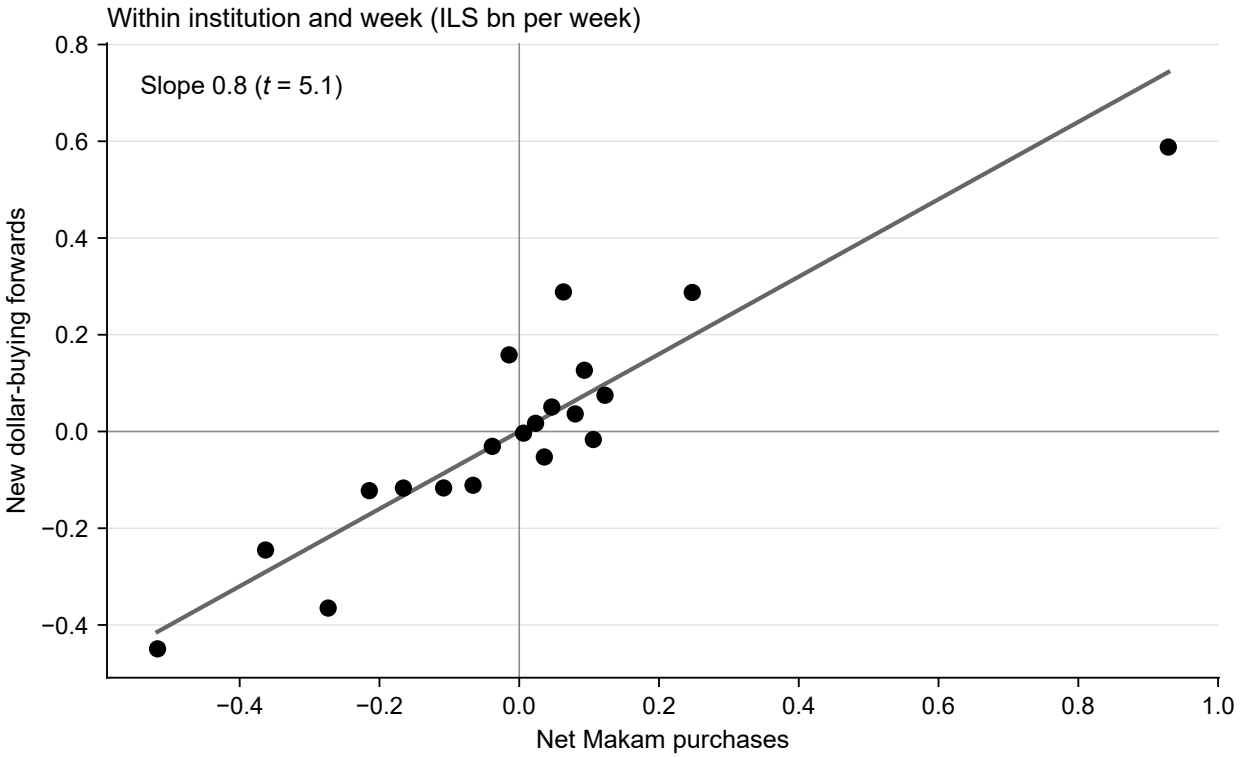


Figure 2: **Foreign Makam purchases and the same institutions' dollar forwards, June 2020 to August 2022.** This figure plots the new dollar-buying forwards of nonresident institutions against their net Makam purchases, matched across the Bank of Israel's records. Institution-weeks, net of institution and week means, are grouped into 20 equal-count bins of net purchases, and each bin pools at least 5 institutions. The data come from the Bank of Israel.

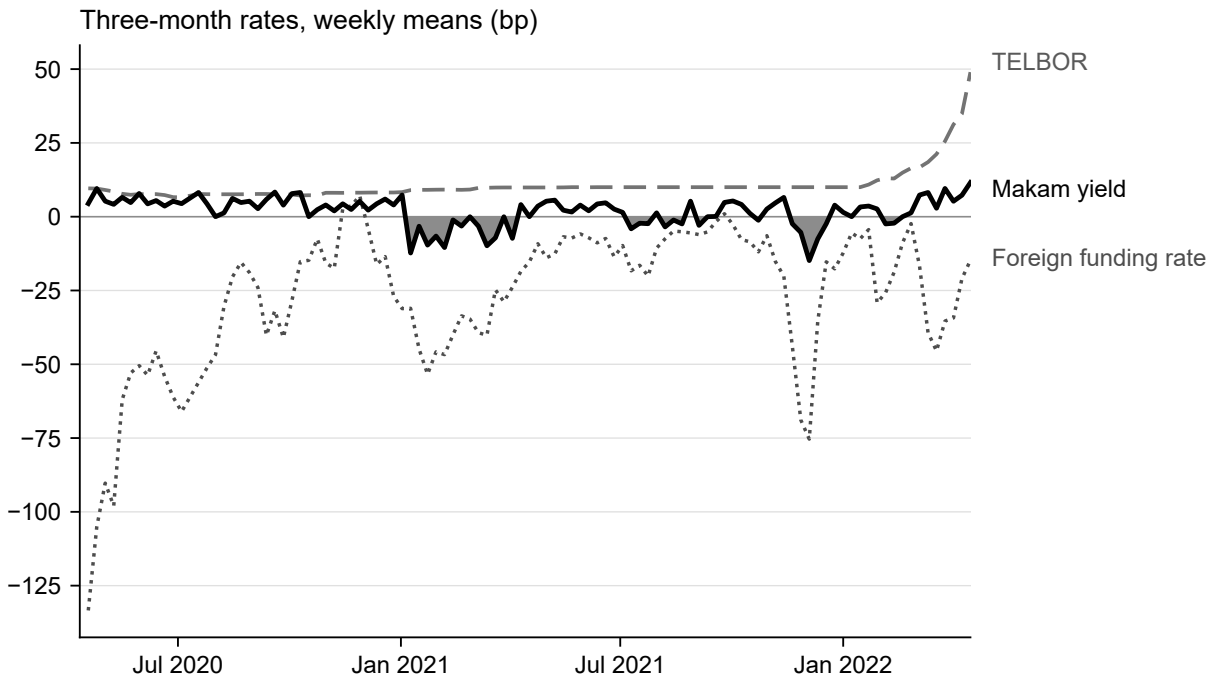


Figure 3: **Three-month rates in the zero-rate period, April 2020 to April 2022.** The Bank of Israel rate stood at its lowest level throughout. This figure plots weekly means of daily three-month TELBOR (dashed), the three-month foreign funding rate (dotted), and the Bank of Israel three-month Makam yield (solid), in basis points. Gray shading marks the weeks in which the Makam yield is below zero. The data come from the Bank of Israel and LSEG.

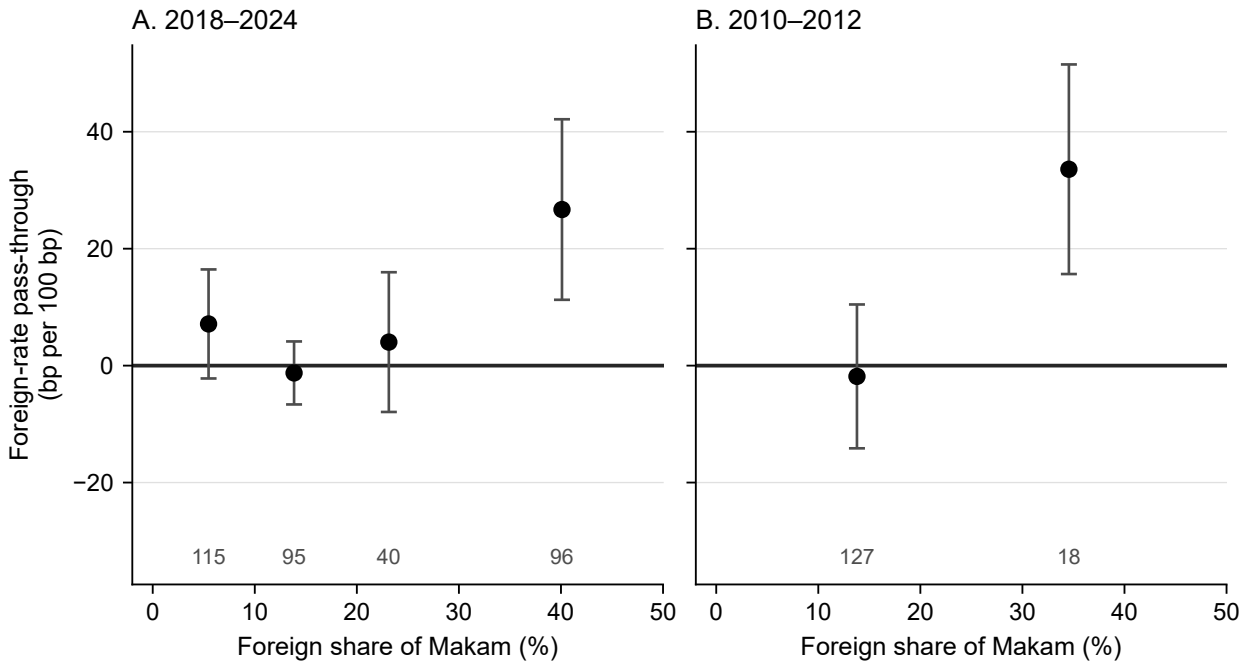


Figure 4: **Foreign-rate pass-through by foreign share of Makam, 2010 to 2024.** This figure plots foreign-rate pass-through for groups of weeks sorted by the previous month's foreign share of Makam. In each group, equation (2) regresses the weekly change in the three-month Makam yield on the weekly changes in TELBOR and the foreign funding rate. Dots are the coefficients on the foreign funding rate per 100 basis points, at each group's mean share, with 95% Newey–West intervals (4 lags). The number just above the horizontal axis under each dot is the number of weeks in that group. Panel A covers 2018–2024 in 10-point groups up to 30% and one group above, and Panel B 2010–2012 below and above 30%, two groups because the shorter episode has fewer weeks. The data come from the Bank of Israel and LSEG.

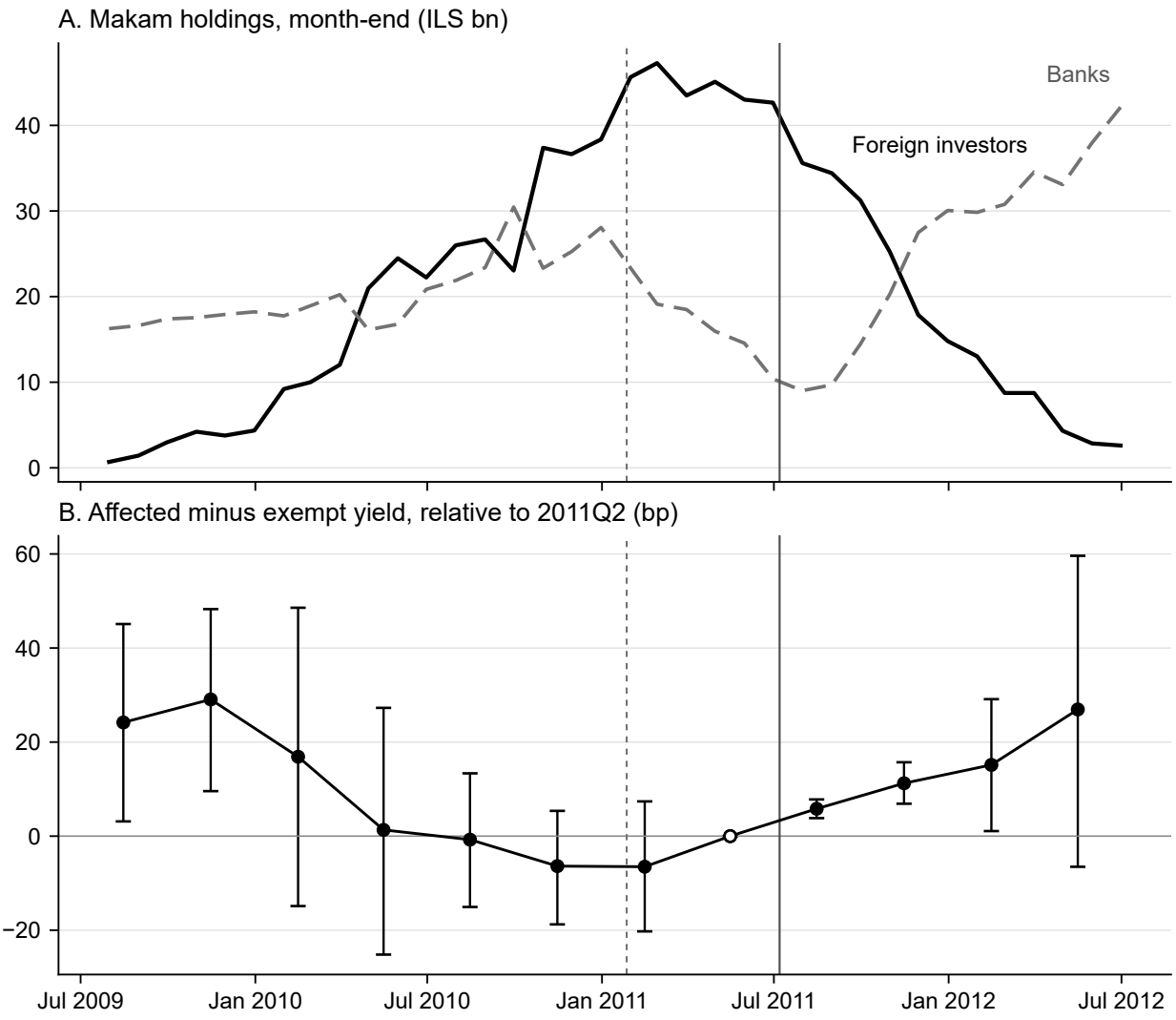


Figure 5: **Makam holdings and relative yields around the 2011 tax reform, 2009Q3 to 2012Q2.** This figure plots holdings and relative yields around the reform that ended nonresidents' tax exemption on Makam on 7 July 2011, announced on 27 January 2011. Panel A shows month-end Makam holdings of foreign investors and banks. Panel B shows quarterly yields of affected Makam minus exempt government bonds, from the regression of Section III.B, relative to 2011Q2 (open circle), with 95% wild-cluster bootstrap intervals. The dashed and solid lines mark the announcement and the entry into force. The data come from the Bank of Israel.

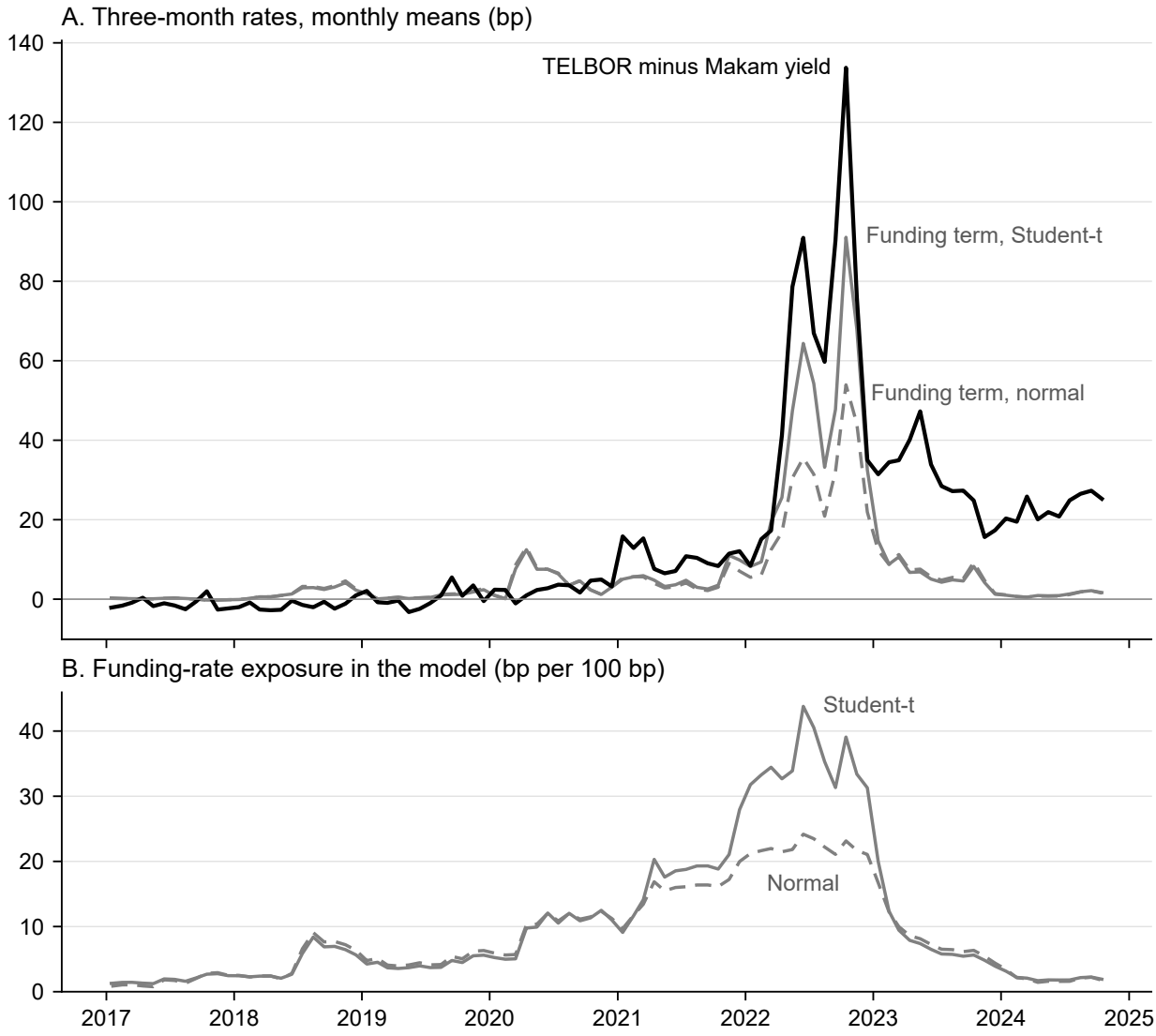


Figure 6: **TELBOR minus the Makam yield and the model's funding term, January 2017 to October 2024.** This figure compares the spread with the funding term. Panel A shows the spread (black) and funding term, the first term of equation (11) at the lagged foreign share. Panel B shows funding-rate exposure, the foreign funding rate's weight in the Makam yield. Solid gray lines use Student-t shocks, the reference specification, and dashed gray lines normal shocks. Their level comes from the hedge-maturity estimate of the price impact of foreign purchases. The data come from the Bank of Israel and LSEG.

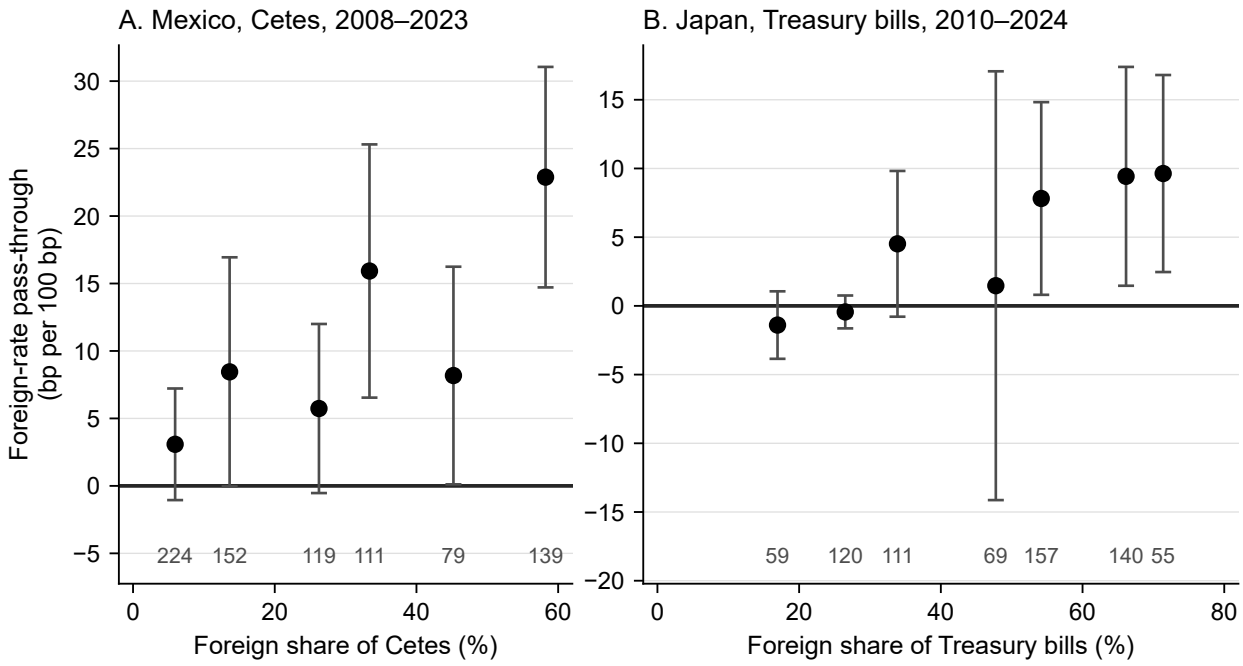


Figure 7: **Foreign-rate pass-through by foreign share in Mexico and Japan.** This figure plots foreign-rate pass-through for groups of weeks sorted by the foreign share of the bills, in 10-point groups. Panel A covers Mexican Cetes, 2008–2023, with the previous month's share and the 91-day TIIE, the Mexican interbank equilibrium rate computed by Banco de México, as the domestic benchmark. Panel B covers Japanese Treasury bills, 2010–2024, with the previous quarter's share and the three-month yen overnight-index-swap rate. In each group the weekly change in the three-month bill yield is regressed on the weekly changes in the domestic benchmark and the foreign funding rate. Dots are the coefficients on the foreign funding rate per 100 basis points, with 95% Newey–West intervals (4 lags). The number just above the horizontal axis under each dot is the number of weeks in that group. The data come from Banco de México, the Bank of Japan, and LSEG.