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Review of the Reference Rate in Israel: Telbor and *Makam* Markets

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Abstract

The reference rate markets are an important and central feature in capital markets around the world, through which it is possible to increase financing possibilities for the business sector and reduce exposure to the risks of unexpected changes in the interest rate. The Telbor market, a platform for setting reference rates for the short-term nominal interest rate in Israel, has developed markedly in the past decade—but only in the area of interest rate derivatives. These derivatives have matured greatly, even more than the widespread activity in foreign exchange derivatives. Due to the many manipulations of reference rates discovered worldwide—the Libor rates—it is interesting to examine the interest rate markets in Israel and their characteristics. Therefore, the research question dealt with in this study regards the structure of the markets, and its objective is to determine which of the two main interest rate markets in Israel—the Telbor market or the Makam (short-term nominal-interest central bank bills—up to a year) market—is the preferred platform for determining the reference rate. The study also examines the Telbor market in Israel as compared to the Libor market, and discusses as well the basic characteristics that are important for the efficient functioning of the reference rate market, delineating the many benefits in continuing the development of this market.

בחינת שוק ריביות הסמן בישראל שוק התלבור לעומת שוק המק״ם

רועי שטיין

תקציר

שוקי ריביות הסמן הם נדבך חשוב ומרכזי בשוקי ההון בעולם, ובעזרתם ניתן להגדיל את אפשרויות המימון למגזר העסקי ולהקטין את חשיפתו לסיכונים הנובעים משינויים בלתי צפויים בריבית. שוק התלבור, המהווה פלטפורמה לקביעת ריביות סמן לריבית הנומינלית הקצרה בישראל, התפתח רבות בעשור האחרון – אולם רק בתחום הפעילות בחוזים העתידיים על הריבית; זו התגברה מאוד, אף יותר מאשר הפעילות הענפה בנגזרי מט״ח. על רקע המניפולציות הרבות שהתגלו בעולם על ריביות הסמן – ריביות הליבור – מעניין לבחון את שוקי הריביות בישראל ומאפייניהם. על כן, שאלת המחקר הנדונה בעבודה זו עניינה במבנה שווקים והמטרה היא לקבוע איזה שוק, מבין שני שוקי הריבית העיקריים בישראל – שוק התלבור ושוק המק״ם – הוא הפלטפורמה המועדפת לקביעת ריבית הסמן. המאמר בוחן בנוסף את שוק התלבור בישראל תוך השוואה לשוק הליבור – שוק ריביות הסמן של המשקים הגדולים בעולם; כן דן המאמר במאפיינים הבסיסיים החשובים לתפקודו היעיל של שוק ריביות סמן ומתאר את היתרונות הרבים בהמשך פיתוחו של שוק זה.

1. Introduction

The Telbor interest rate is the Israeli version of the Libor interest rate, which serves as the reference rate for various financial assets and products, particularly interest rate derivatives—one of the largest and most liquid financial markets in the advanced economies. The Libor rate is based on the interest rates quoted by the commercial banks for (unsecured) interbank loans. In recent years, particularly since the financial crisis of 2008, interbank loans have almost halted but the Libor rate continued to serve as the reference rate for widespread activity in financial derivatives, particularly for loans and mortgages to households. In the resulting situation, commercial banks that quote interest rates ("contributors") are able to manipulate the rate and improve their profits associated with the Libor rates without actually executing any interbank transactions on these interest rate quotes. Following the discovery and investigation of such manipulations in recent years, financial authorities worldwide initiated comprehensive reforms of the reference rate market, setting codes of conduct for the contributors and defining the transactions that are relevant to these rates. It is important to note that the reference rate market is an integral part of the capital and money markets (see Section 6 for further details); without it, the business sector would be exposed to market risks and financing options would be extremely limited.

Unlike the Libor market, in the Israeli version of the reference rate market there is a commitment to execute transactions in accordance with the quotes used for setting the interest rates. The interest rate quote for each business day obligates the contributors to provide (unsecured) loans or accept deposits within a pre-defined spread, and the longer-term interest rate quotes require the bank to execute transactions in a range of pre-defined interest rate derivatives. Consequently, the Telbor rate has two unique features:

1. The commitment to execute transactions based on the quotes creates a well-defined anchor for setting the Telbor rate so that it reflects the actual interest rate every day.
2. The quoted rate does not include credit and liquidity risks beyond the range of one business day. The reference rates that are determined on the basis of the quotes are therefore as clear as possible of risk and liquidity premiums.

Reference rate markets are an important and central feature of capital markets worldwide. They help increase the financing possibilities for the business sector, not only through loans with daily fixed or floating nominal interest rates, but also with rates that vary over longer periods. The interest on a loan or deposit (or the coupon payment on a floating rate bond) can be indexed to the reference rate, with the option of setting some spread that represents the borrower's risk premium. So for example, the reference rate, which is the prevailing rate in the market on a given date, can be used to determine the interest on a loan or deposit that is set automatically every three months. Another widespread option is to set a credit facility for a customer where the actual interest rate on the loan is the reference rate plus the customer's specific risk premium.

The reference rate is also the basis of the market for interest-rate derivatives, and in particular, futures contracts—which enable companies and the public to reduce and even neutralize interest rate risks. For example, to develop and set up a project, Company X may, at some future date, require a loan. The company's profit will depend, among other things, on the prevailing interest rate on that future date and it therefore has two options: (1) to take a risk and be exposed to the possibility that the interest rate will increase, the project will be put on hold or will continue but make a financial loss; or (2) to hedge the risk through a forward contract on the future interest rate, thus neutralizing the risk and eliminating the exposure to loss if the interest rate rises. The more developed the derivatives market, the more options there are for neutralizing the interest rate risk. These include OIS (Overnight Index Swap) transactions which are widely used in advanced economies and allow cash flows received from a fixed interest rate to be "swapped" for cash flows received from a periodically adjusted floating interest rate, and vice versa. For more information about the principal types of interest rate derivatives, see Appendix 1.

The interest rate derivatives market in Israel has developed considerably in recent years, and it includes growing volumes of FRA (Forward Rate Agreement) and IRS (Interest Rate Swap) transactions in which the settlement of accounts at term is based on the Telbor rate. In addition to the Telbor market, trading in Israel is also conducted on Makam series (short-term nominal-interest central bank bills—up to a year), whose yield to maturity can also be used as market reference rates. The Makam series are issued at a discount (zero-coupon), every month for 12-month periods and are traded on the secondary

market. The yield to maturity of each series is calculated by means of a simple formula, according to the closing prices on each day of trade. A complete yield curve can be calculated from these yields which could serve as a reference rate for interest rates and various financial products. In view of the two possible markets in Israel, and due to the considerable importance of the interest rates market in the economy, this paper will examine the required characteristics for the reference rate market, which will then help us answer the research question: which of the two main interest rate markets—the Telbor or the Makam—is the preferred one for determining reference rates in Israel.

1. I will compare empirically the development of the two main interest rate markets in Israel—the Telbor market and the Makam market—that represent the Bank of Israel rate and the expectations for its development, but have different statistical features.
2. To determine which kind of market is the preferred platform for the effective function of the reference market, we will discuss whether reference rates can used for pricing other financial products, and specifically, what types of premiums are included in the reference rates and whether these premiums are desirable.

As the reference rate is used for a large number of financial assets and products, it should be determined in an efficient market, without, to the extent possible, opportunities for the contributor banks to make profits by manipulating their quotes. For this reason, in 2006 the Bank of Israel established an inter-organizational committee—the Telbor Interest Rate Committee—whose main function is to ensure an orderly reference rate market that is reliable and transparent, providing a stable foundation on which the related markets can function (see Section 2 for an explanation of the Committee's activity).

The format of this paper is as follows: Section 2 describes the Telbor market and presents the scope of activity in the interest rate derivatives market in Israel, comparing it with that of other selected countries. Section 3 compares the Telbor rates with the nominal yields from the Makam market and points to the benefits of the Telbor market as the reference market platform. Section 4 provides a detailed description of the Telbor market and the extensive reform of the global reference rate markets. Section 5 discusses a theoretical framework for the efficient function of reference rate markets. Section 6

presents the implications of the development of the interest rate markets on long-term economic growth and financial stability, and Section 7 concludes.

2. The Telbor market

The Telbor Interest Rate Committee[1] (hereinafter, the Telbor Committee) was formed to support the development and regularization of the Telbor market—to spur the commercial banks that contribute their interest rate quotes to operate reliably and transparently. Thus, the main function of the Telbor Committee is to facilitate an efficient and competitive reference rate market in Israel. The Committee therefore formulated definitions and rules for quotes, drew up a list of contributor banks, established rules for calculating and publicizing the Telbor rates based on the quotes, as well as a commitment to execute transactions based on the quoted interest rates around the time of fixing the Telbor rate. The Telbor rate is based on the interest rate quotes of a number of commercial banks (the "contributors") in the interbank market and is published daily by Thomson-Reuters. The algorithm for fixing the Telbor rate for each term to maturity averages the banks' quotes after excluding outliers. The interest rates quoted are for periods of one business day (overnight), a month, and three, six, nine and twelve months.[2]

In many advanced and developing economies, reference rates serve as the basis for two types of financial products: 1. deposits, loans and floating nominal interest-rate bonds of various maturities; 2. derivative financial assets. In Israel, most financial activity, at the time of the sample, is only in the form of OTC derivative financial assets.

In recent years, the volume of activity in financial derivatives based on the Telbor rate has grown enormously. The number of FRA and IRS transactions has increased greatly, and in recent years, three-month OIS transactions, which in 2010 the Committee

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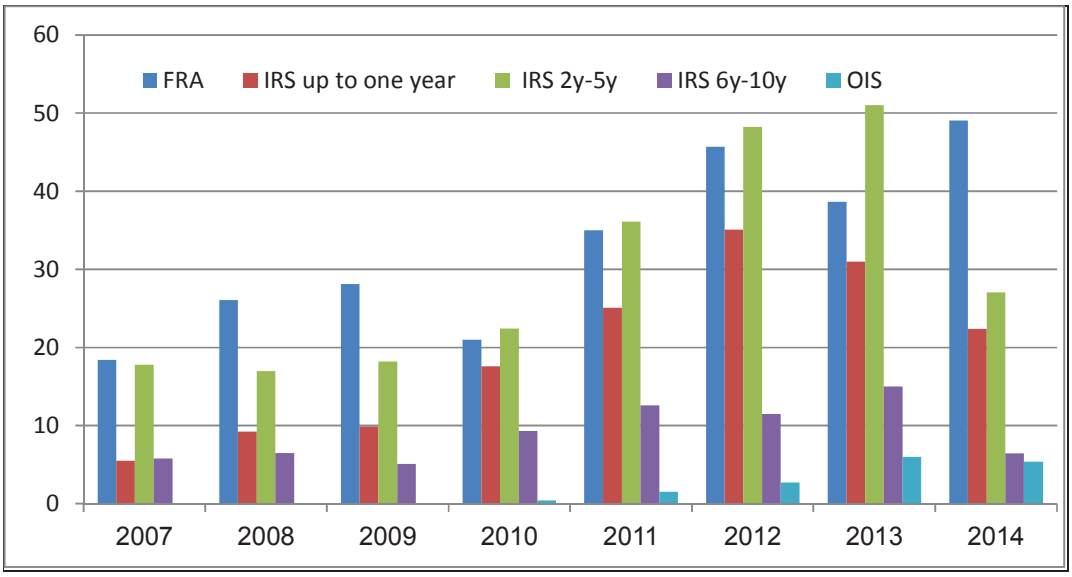
1 The Telbor Committee—a committee to regularize and develop the Telbor rate—is comprised of four representatives: Roy Stein (Chairperson) representing the capital market section in the Bank of Israel's Research Department; Ketty Cohen, representing the dealing room in the Bank of Israel's Market Operations Department; Zahi Elias, Chairman of Forex Israel representing the commercial banks; and Sharon Lavi, director of the Tel Aviv Stock Exchange Maof (Derivatives) Unit.

2 Information about the Telbor market and the activity of the Telbor Committee can be found on the Bank of Israel website at: http://www.boi.org.il/en/Markets/TelborMarket/Pages/Default.aspx

defined as binding transactions, also take place between the banks and their customers, and not only as part of the commitment. (See Appendix 1 for a detailed description of the financial derivatives.) Figure 1 shows the marked increase in the volume of transactions between the contributing banks from 2007 through 2013.[3]

Figure 1: Volume of transactions in financial derivatives* by the contributing banks per quarter, annual average, NIS billion



* See footnote no. 3.

Activity in financial derivatives in Israel, based on information in the banks' financial reports, can be compared with global market activity using the data of the reporting countries in a BIS survey.[4] Although the use of interest rate derivatives in Israel has accelerated notably in recent years, and in 2011 the scope of such transactions exceeded the

[3] At the end of 2012 and during 2013 and 2014, the foreign banks discontinued their activity as contributors to the Telbor market as a result of developments in the global interest rates market, as described in greater detail in Section 4. Two of the four foreign banks accounted for a key share of the total volume of activity. In this context, the contributing banks ceased to report their financial derivatives activity to the Bank of Israel, although they continue to operate in this market. The volumes of activity presented in Figure 1 are therefore biased to the downside mainly in 2014 but also partly in 2013.

[4] See BIS survey from December 2013. http://bis.org/publ/otc_hy1411.pdf . Countries reporting at semiannual frequency: Australia, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, the UK and the US.

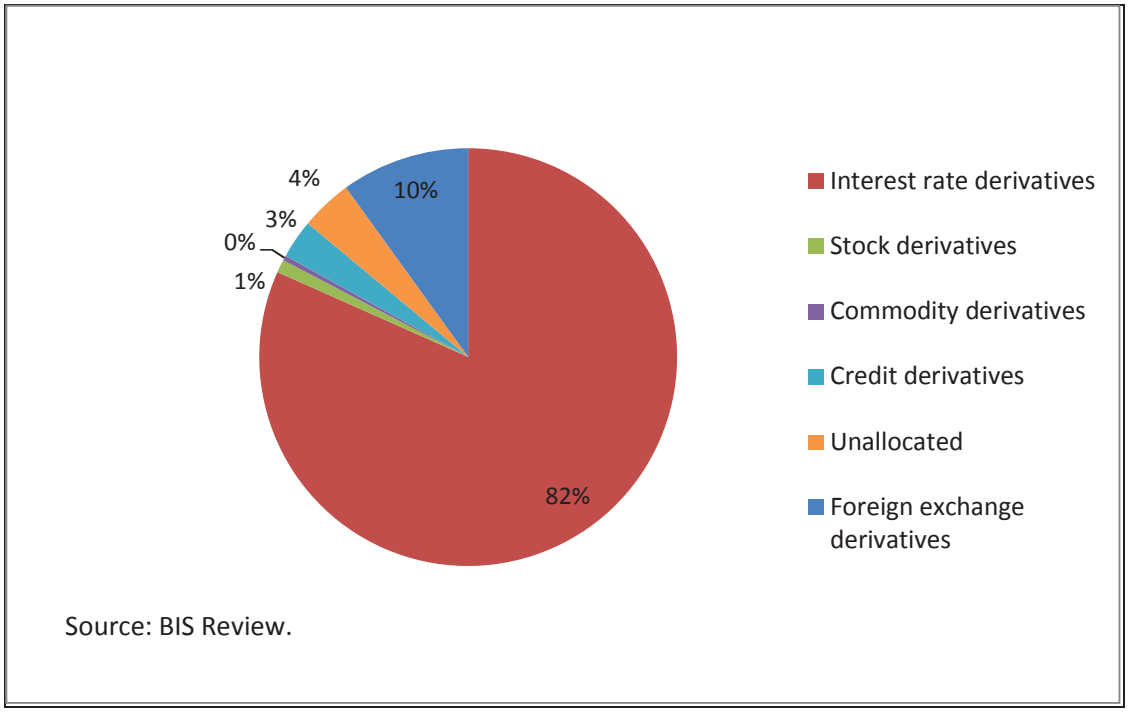
value of the open positions in foreign exchange derivatives, it was still low, as a share of GDP, compared with the rest of the world. According to the reporting countries, in December 2013 the value of open positions in interest rate derivatives was $584 trillion (in terms of underlying asset), which is 14.6 times the aggregate GDP. In Israel, the value of open positions in interest rate derivatives was $286 trillion – essentially equal to GDP. This difference between Israel and the advanced economies underscores the limited use of financial hedges against interest rate risks in Israel as compared with advanced economies. (See Section 6 for a detailed explanation of the global comparison.)

Figures 2 and 3 show the distributions of open positions in OTC derivatives by underlying asset in the reporting countries and Israel, respectively. The key finding from these distributions relates to the overwhelming share of interest rate derivatives in the total value of financial derivatives. The share of interest rate derivatives in Israel has increased markedly in the past few years, reaching 55 percent of all financial derivatives, but is still much lower than the 82 percent in the reporting countries.[5]

Notably, a large number of transactions on a range of interest rate contracts enables companies to protect themselves financially against unexpected changes in the interest rate, thus minimizing their financial risks. An extensive interest rate derivative market also increases the sophistication of the interest rate market so that investors' expectations regarding future interest rates will be more effectively reflected in the rates.

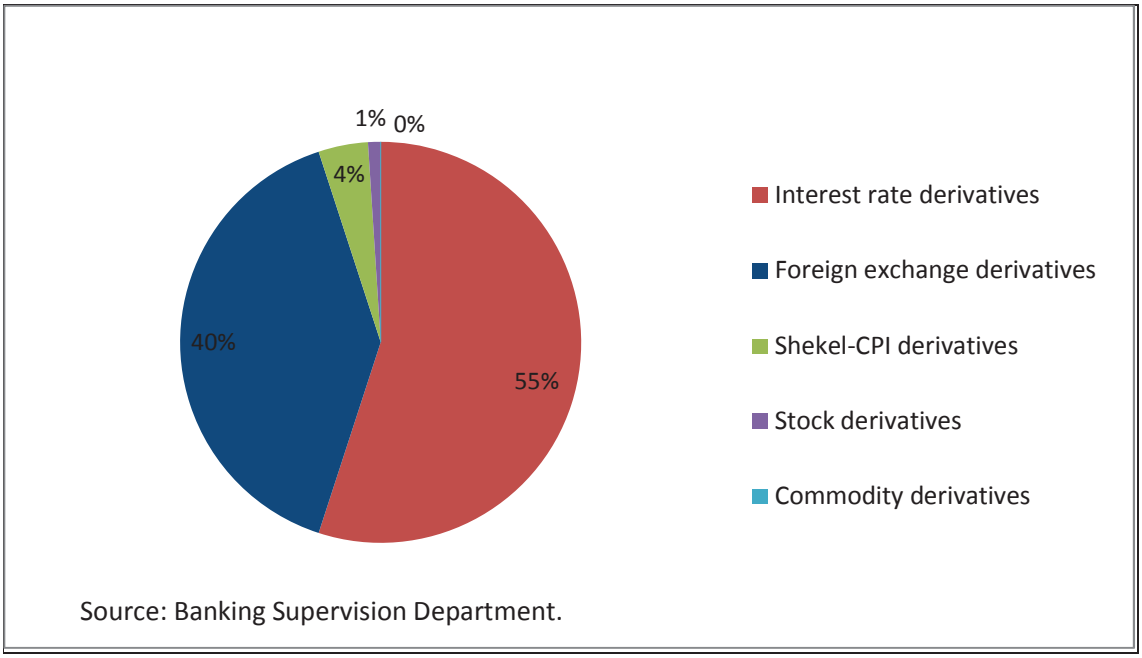
[5] The growth of the interest rate derivatives market relative to the entire derivatives market in Israel (and its counterpart – the decline in the share of the foreign exchange derivatives market) is consistent with the declining impact of the exchange rate on economic activity and prices. Nevertheless, Israel's foreign exchange derivatives market is still relatively large, accounting for 40%, of all derivatives, compared with just 10% in other countries. According to the BIS three-year review, countries that are not among those reporting every six months are generally characterized by a relatively high proportion of foreign exchange derivatives. This is due to the intensive management of the foreign exchange risk in those countries.

Figure 2: Distribution of the value of open OTC positions in reporting countries in terms of underlying asset, December 2013



Source: BIS Review.

Figure 3: Distribution of the value of open OTC positions in OTC derivatives in Israel in terms of underlying asset, December 2013



Source: Banking Supervision Department.

3. The Telbor rate vis-à-vis the yields to maturity on Makam

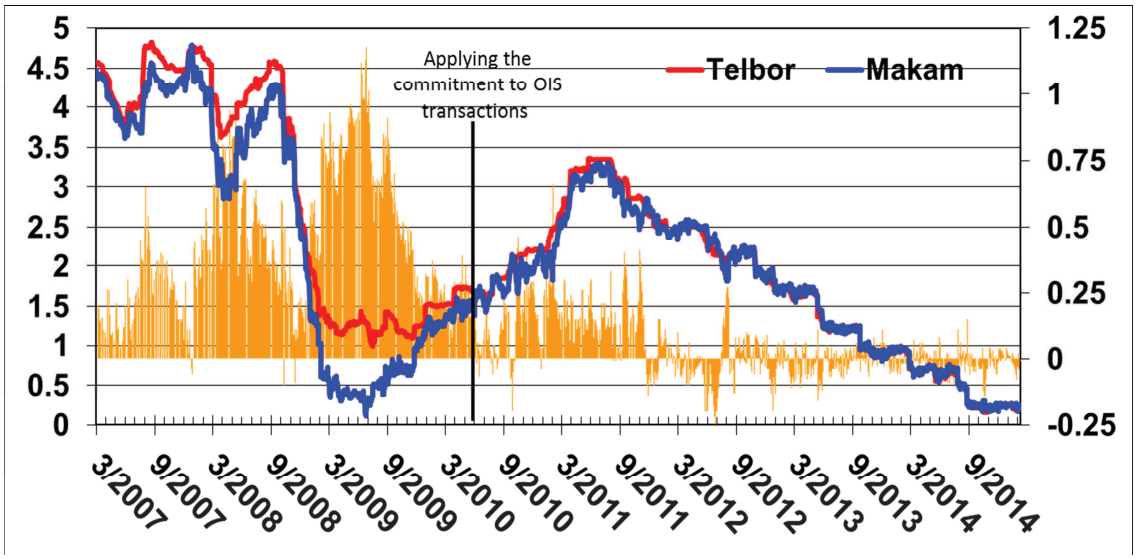
This section discusses the development of the Telbor rate over time compared with the yield to maturity on Makam series with maturities as near as possible to those of the main reference rates—3 months and 12 months.[6] The discussion will focus on the sample period after the middle of 2010, during which the Telbor Committee obligated the contributor banks to execute three-month OIS transactions based on their quotes if requested by another contributor bank. This commitment created a clear, well-defined anchor for the Telbor rates for periods of longer than one business day. An empirical comparison of the two interest rate markets permits the consideration of each market's unique features—rates in the Telbor market, which are based on the interest rate quotes of the contributing banks, and the Makam market, which comprises 12 series of zero-coupon unindexed bills. The Bank of Israel issues this instrument to the public by auction, with a term to maturity of up to a year, as one of the instruments for managing its monetary policy. Makam yields for the different maturities are affected mainly by Bank of Israel's key rate and the public's expectations of its development. The comparison between these two markets is interesting because they both represent the central bank's interest rate and expectations for its development, but have very distinct characteristics. To answer the research question discussed in this paper—which one is the preferred market for determining the reference rate for other financial instruments and products—the statistical characteristics of both types of interest rates must be examined empirically and we must determine which characteristics are more appropriate for this purpose. The interest rate chosen as the preferred reference rate must reflect the actual interest rate every business day, yet at the same time must develop with relatively low volatility over time and with serial correlation as close as possible to zero. These characteristics will be examined in this section with respect to two key reference maturities—three months and twelve months.

3.1 Three-month maturities

[6] In this paper, we calculated two types of indices for Makam yields for the reference rate terms: 1. Yield to maturity of the series closest to three months (the series is replaced once a month). 2. Calculation of the yield from the yield curve estimated using the Nelson-Siegel method by the Bank of Israel. See Stein (2007).

A comparison of the three-month Telbor rate and the yield to maturity on the Makam series with the maturity closest to three months shows the differences between the periods—before and after applying the commitment to OIS transactions (Figure 4).

Figure 4: Three-month Telbor rate and Makam yield and the difference between them



Although the Telbor rate and Makam yield are similar and the differences between them are small and inconsistent,[7] nevertheless, their development is different. Several statistical indicators were examined in this paper, including the standard deviation of the daily changes, correlation of levels and changes, serial correlation (also known as autocorrelation) and causality. Table 1 indicates that the standard deviation of daily changes in the Makam yield is significantly higher than that in the Telbor rate.[8] The high standard deviation in the Makam series, which is typical of various tradable assets, makes it difficult to act as stable reference rates. Moreover, the negative autocorrelation of the daily

[7] Excluding the period around 2011, which was strongly impacted by the entry and exit of foreign investors in the Makam market. This point will be expanded upon when discussing the 12-month interest rates and yields.

[8] Stock exchange trading in Makam series is carried out on price, using only the two digits after the decimal point. Small price fluctuations have a greater effect on yield volatility when the term to maturity is shorter. This causality could possibly increase the standard deviation of the daily changes in the Makam yields.

changes in the yield obtained from the Makam series also impedes the use of the Makam as a reference rate.

Table 1: Statistical indices* for the three-month Telbor rate and Makam yield

daily changes, 1/2013—2/2015, in percent

	Makam yield	Telbor rate
Standard Deviation (SD)	3.8	2.1
Autocorrelation (a degree of consistency)	-20.2	-0.8
Correlation between levels	99.7	
Correlation between changes	25.4	

* The Telbor rate is fixed on business days in Israel at approximately 12:00, whereas the Makam yield is calculated according to closing prices at the end of daily trading on the Tel Aviv Stock Exchange.

A review of the statistical significance of the autocorrelation in an estimation equation, presented in Appendix 2, indicates that the negative autocorrelation in the Makam yield is statistically significant and is even of second order.[9] In contrast, autocorrelation of the changes in the Telbor rate is positive and close to zero.

Due to the considerable difference found between the statistical indicators that describe the development of the Makam yield and the Telbor rate over time, I examined the relationship between these two variables to determine the leading one—responding quicker and more efficiently to changes in the financial markets. This examination, presented in Appendix 3, may also point to the interest rate that is appropriate to serve as the reference rate. The examination revealed that the Telbor rate is a statistically significant leading indicator of the Makam yield, but the Makam yield is not a statistically significant leading indicator of the Telbor rate. In summary, the empirical findings obtained so far show that the Telbor market is more stable, develops over time without a negative autocorrelation,

[9] Typical reasons for negative autocorrelation in daily changes in the prices of financial assets: 1. Effect of the spread of supply and demand – particularly when the prices of assets do not change significantly. (French and Roll, 1986). 2. Pricing errors during trading, and particularly the effect of seasonality with a weekly and/or monthly frequency (French, 1980 and Ariel, 1987).

and serves as a leading indicator of Makam yields. We can therefore conclude that the three-month Telbor rate is more informative, and more effectively reflects the prevailing interest rate in the economy on any business day.[10]

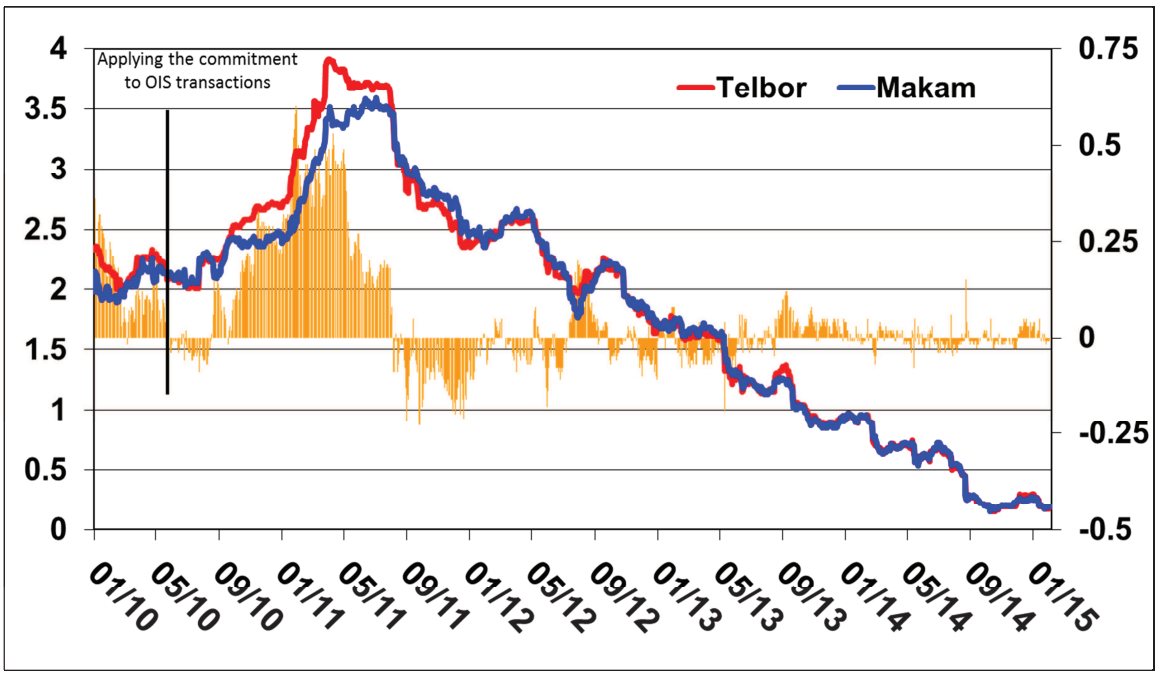
3.2 Twelve-month maturities

The comparison, in Figure 5, between the 12-month Telbor rate and the yield to maturity on the Makam series with maturity closest to a year indicates that the differences between the two are relatively large around 2011, and are even consistent. Toward the end of 2010 and in the first half of 2011, foreign investors greatly increased their holdings of Makam series, reaching extremely large holdings. After restrictions were imposed on their holdings and after the renewed financial crisis late in 2011, the foreign investors redeemed a large percentage of their holdings so that by the end of 2011 their holdings of Makam series were reduced significantly. The prices of the Makam were therefore biased in these periods and as a result the yields to maturity calculated from them are biased. It is important to note that the ability of market participants to trade at their desired prices at any given moment is strongly impacted by the trading depth in Makam series. Trading in the Makam series lacks sufficient depth to withstand the changing pressures of supply and demand, and this limitation is a significant factor when choosing the interest rate most appropriate to serve as the reference rate.[11]

[10] Although the Makam does not appear to be the preferred option for use as the reference rate, this does not reflect on its role as an underlying asset for use in monetary policy.

[11] The SDs of the daily changes in the 12-month Makam yields and 12-month Telbor rates and of the other statistical indices reviewed in this paper are extremely similar: there are no statistically significant differences between them.

Figure 5: The 12-month Telbor rate and Makam yields and the difference between them



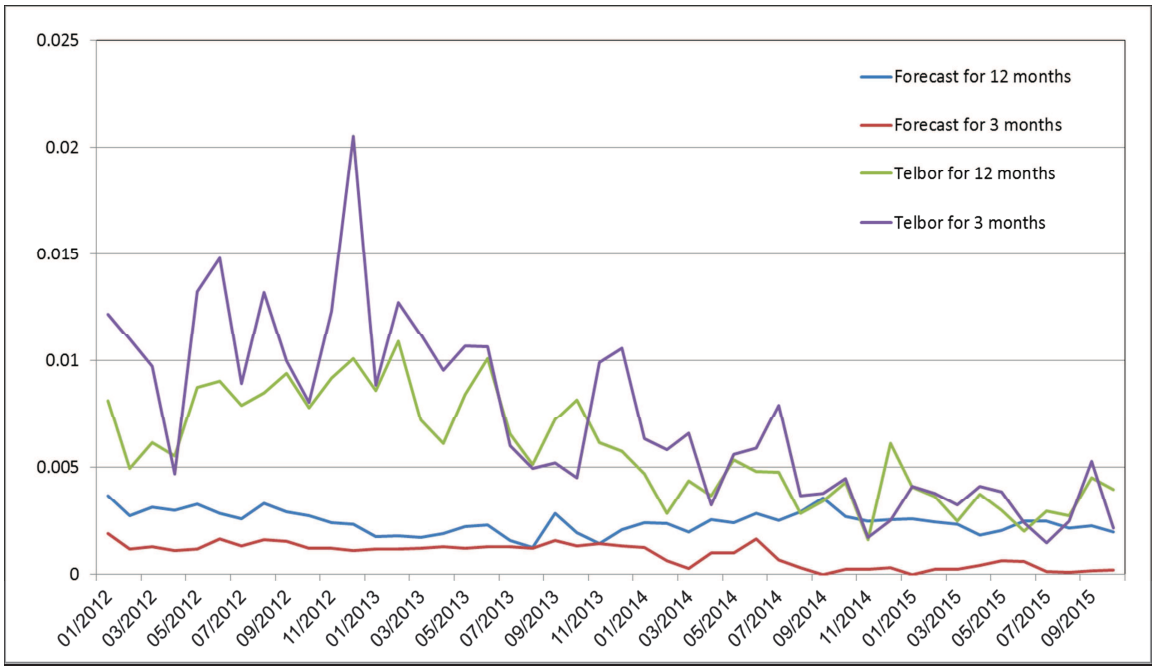
In addition to these empirical findings, it is important to recall that the Makam series traded in the secondary market have a fixed maturity date so that throughout the trading period the term to maturity shortens. This creates a significant problem in setting the reference rate on an ongoing basis for fixed maturities.

The withdrawal of the foreign banks from the list of contributing banks greatly reduced the number of banks contributing interest rate quotes and raises concern that the statistical indicators examined in this paper do not reflect the situation at the end of the estimation period, when the foreign banks were no longer part of the contributors list. Therefore it is important to examine whether the diversification of the contributors' quotes, which are used to fix the Telbor rate—a diversification calculated as the standard deviation of the differences between each of the quotes and the Telbor rate—reflects the degree of uncertainty among these banks with respect to the changes in the expected interest rate.[12] The degree of the diversification of the interest rate quotes and of the forecasters'

[12] The spread between the maximum and minimum quotes as an indicator of the spread of the quotes was also examined, and the results obtained were similar.

projections for the monetary interest rate can be explained by estimating the prevailing level of uncertainty in the market. The level of uncertainty in the market is stated by the intraday standard deviation of the change in the yield in all the Makam series.[13]

Figure 6: Standard deviation of the diversification of the forecasters' projection of interest rates and Telbor rate quotes for durations of 3 and 12 months, monthly averages 1/2012-10/2015



An examination of the diversification of contributor banks' quotes (Figure 6) shows that although the extent of the diversification declined somewhat in 2014, it is still high relative to the diversification of forecasters' projections.[14] To check whether the level of distribution in the quotes does in fact reflect the degree of uncertainty regarding interest rate expectations, I examined, in the estimation equation presented in Appendix 4, the extent of the impact of the intraday standard deviation in the Makam series – as an estimate of uncertainty regarding the interest rate expectations – on the diversification of Telbor rate quotes and forecasters' projections. The results of the estimation equation show that the

[13] See Gamrasni (2011). The intraday standard deviation for the Makam market is calculated on a regular basis by the Bank of Israel.

[14] This is despite the fact that the expectations inherent in the Telbor rates contain a probability for all possible states, whereas the forecasters' projections only possible frequent states.

degree of uncertainty regarding the interest rate expectations significantly affects the diversification in Telbor rate quotes for both reference maturities—three months and one year—whereas it does not affect, to a statistically significant level, the degree of the diversification of forecasters' projections for these maturities. In addition, the diversification of the forecasters' projections points to statistically significant autocorrelation, whereas the autocorrelation in the Telbor rates' diversification is not statistically significant at all. It can therefore be concluded that the reduction in the number of contributing banks does not affect the quality of the reference rate, which is determined according to their quotes.

4. The Libor rate

The interest rate quotations used for setting the Libor rates reflect the interest rates that the quoting bank is willing to charge on an unsecured interbank loan (and not the interest on loans actually provided). In the financial world, the spread between the Libor rate and the dollar OIS rate for the same term to maturity serves as a measure for the resilience of the banking system, since it reflects the banks' view of the credit risk inherent in providing loans to other banks.[15]

Reference rates – recent global developments:

- Following the onset of the financial crisis at the end of 2008, the underlying asset, namely – unsecured short-term (up to a year) interbank loans, diminished to the extent that their use was almost entirely discontinued. In contrast, underlying asset derivatives, namely – loans and mortgages with floating interest rates, futures contracts and a wide range of structured products did not diminish, and they became a significant component in the considerations of the banks contributing their quotes

[15] As the Libor rate reflects the interest on an unsecured loan (the physical transfer of money when a transaction is executed), it includes a credit risk premium relating to the banking system, in contrast with an OIS transaction in which there is no physical transfer of money when a transaction is executed and it therefore does not include a credit risk premium. In contrast, there can be no such spread in Israel's Telbor market since the commitment in respect of the Telbor rate for one and three months is executing an OIS transaction at the interest rate quoted for these durations.

for the purpose of setting the Libor rate. This led to numerous incentives for manipulation by the contributing banks when fixing the Libor rates.

- In 2012, following investigations by the authorities in several countries into the banks' manipulation of the interbank interest rates, heavy fines were imposed on those banks that were found guilty of such misconduct. The reports that followed raised concern that the reference rate market—the financial market with the largest volume of activity in the world—was on the verge of collapse.
- The discovery and investigation of manipulations in the Libor market in recent years led financial authorities worldwide to initiate a comprehensive reform of the reference rate market, in which rules of conduct were drawn up for the contributing banks and transactions relevant to those interest rates were defined. It should be emphasized that the authorities preferred comprehensive reforms to shutting down this market, given that it is an important pillar of financial activity which supports real activity in the economy.
- Britain's Chancellor of the Exchequer appointed Martin Wheatley[16] of the Financial Services Authority (FSA) to conduct an independent review of the Libor market, which was under the oversight of the British Bank Association (BBA). Wheatley's final report was published in September 2012, and it included the following recommendations:[17]

    1. Regulation of the Libor market and strengthening of the sanctions regime for non-compliance with the rules (with a definition of the rules of conduct).
    2. Reestablishment of an institution to administer and oversee Libor (which would replace the BBA) to work in full cooperation with the relevant regulatory entities.
    3. The immediate adoption of a number of structural changes in the process of fixing the reference rates, e.g., the phased removal of reference rates for

[16] The Chancellor of the Exchequer commissioner Martin Wheatley, Managing Director of the FSA and Chief Executive-designate of the Financial Conduct Authority, to undertake a review of the structure and governance of LIBOR and the corresponding criminal sanctions regime.

[17] The full report can be found at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/191762/wheatley_review_libor_finalreport_280912.pdf

currencies and maturities for which there is insufficient data/transactions, the monitoring of transactions executed and a review of the interest rates inherent in them relative to the banks' quotes, publication of the contributing banks' interest rate quotes with a lag of three months, encouraging additional commercial banks to participate in the process by contributing their quotes, and improved contingency plans to be applied automatically when the contributing banks fail to provide quoted rates.

4. The discussion of potential alternatives to setting the reference rates so as to provide a better correlation between the risk premium inherent in the reference rates and the risk premiums inherent in the financial products linked to them. One of the recommended alternatives is the OIS curve, the interest rate curve closest to the risk-free interest rates curve.

- The reforms are implemented by regulators in different countries and also by global regulating entities such as the International Organization of Securities Commissions (IOSCO) and the Financial Stability Board (FSB). In July 2013, IOSCO published a document of principles for financial benchmarks (which, *inter alia*, addresses the reference rates) which sets required standards in several areas.[18] The IOSCO document requires the entities responsible for the reference rates to examine their compliance with the principles included in the publication and to publicize their results within 12 months of the publication of the document of principles. (For a list of the IOSCO principles, see Appendix 5.) Furthermore, in July 2014, the FSB published a document on the necessary reforms in the reference rate markets.[19]
- The different reports compiled on the reference rate markets highlighted two key problems:

    1. The quoted interest rates (used for setting the reference rates) reflect the interest rates on unsecured interbank loans, loans that feature the specific credit and liquidity risks of each of the quoting banks. In contrast, these reference rates are mostly used for pricing financial derivatives and secured mortgages—financial

[18] The full report can be found at: https://www.iosco.org/library/pubdocs/pdf/IOSCOPD415.pdf
[19] The full report can be found at: http://www.financialstabilityboard.org/wp-content/uploads/r_140722.pdf?page_moved=1

products in which the credit risks are typically much lower. This creates a structural inconsistency in the financial products.

2. The interest rate is based exclusively on quotes for the interbank interest rate on loans that would be provided to other banks on the list of contributor banks, and not on the basis of loans actually provided. The contributor banks were therefore able to manipulate the interest rate and improve profits on their off-balance sheet position, which is tied to the Libor rates, without executing transactions with real money (loans and deposits) on these rates.

- The FSB undertook responsibility for the functioning of the market. To this end, the FSB established the OSSG (Official Sector Steering Group) which is made up of representatives of several regulatory entities and central banks.
- As part of the enhanced supervision and monitoring of derivative transactions worldwide, and based on recent reforms (Basel III, Dodd-Frank and EMIR) it was decided that banks executing derivative transactions must allocate capital for the transactions, unless the transactions are settled through a qualified central clearing house. It should be emphasized that since the allocation of capital increases the cost of the transaction, this decision might reduce the worthwhileness of executing transactions in many countries, including Israel, in which there is no central clearing mechanism for transactions executed in the banking system.

In conclusion, the discovery and investigation of manipulations in the Libor market in recent years led financial authorities worldwide to reform the reference rates market so that the characteristics of the global new reference rates market now approach those of the Telbor market.[20] In addition, these authorities recommended that regulators should develop a new reference rate market, which is more aligned with the pricing of derivatives and other financial products, including the development of additional reference interest rates.

[20] In this context we mention the recommendation to reinforce the connection between quotes and transactions, the recommendation to develop a reference rate market based on OIS rates – which is reasonably clear of risk premiums, and the recommendation to create a new entity to administer the reference rates while enhancing cooperation with the regulators.

5. Discussion of the risk premiums inherent in the reference rates

The Libor rate, which reflects the offered interest rate to be collected on (unsecured) interbank loans, includes the specific credit and liquidity risk premiums for each of the quoting banks. However, it is also used as a benchmark for many interest rate derivatives that do not contain such premiums, and even for loans and mortgages provided to the public that also do not include those risk premiums, particularly secured loans. This creates a structural inconsistency in the financial products. In contrast, the Telbor rate reflects the quotes of the contributing banks that are obligated to execute transactions based on their quotes: with a maturity of one business day – loans and deposits; for longer maturities – transactions in various categories of interest rate derivatives.[21] The Telbor rates therefore give little expression to credit risks and liquidity premiums, and thus reflect interest rates that are as close as possible to risk free rates.[22] The Telbor rate is therefore well suited to serve as the reference rate both for the pricing of interest rate derivatives and for pricing loans and bonds, with the addition of premiums that correspond with the credit and liquidity risks of the issuing entity or loan applicant.

The premium added to the risk-free interest rate is generally broken down into three components:

1. Credit risk premium—this depends on the estimated insolvency risk of the borrower or bond issuer and the estimated recovery rate in such a case. When the loan is backed by financial collaterals, the premium will be close to zero, as there is a high probability of realizing the collateral at a low cost if the borrower becomes insolvent. There is no credit risk in the derivative financial assets, particularly after legislation of the Transactions in Financial Assets Law, 5766–2006 in 2006.[23]

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[21] Interest rate contracts do not include a credit-risk premium and liquidity premium and are considered contracts that indicate the closest interest rate to the expected risk-free rate.

[22] The minimum risk premiums are the result of the obligation to provide the interbank loans for one business day on the interest rate quoted for one business day.

[23] This law provides both parties to financial derivatives transactions with legal certainty. The law ensures the proper function of the financial market in Israel and facilitates activity in the international financial arena within the framework of generally accepted transactions in derivative financial instruments.

2. Liquidity risk premium—this depends on the ability to repay the loan immediately at no cost. Clearly, if the loan is not tradable (such as a bank loan), the premium will be higher, and the more liquid (high tradability in the secondary market) the asset, the smaller the risk premium would be.
3. Time premium—this depends on the loan maturity. Even if there is no need to exercise the loan for liquidity purposes, its maturity date directly affects the degree of uncertainty, and accordingly the size of the premium. This premium therefore increases as the period to maturity increases.

Theoretically, the interest rate on different loans should vary from one customer to another depending on the specific risks inherent in each of the loans. The bank will therefore set the interest on the loan in line with the risk-free rate (which should change over the maturities determined in the loan conditions and in line with market conditions) and the specific risk premium (which should remain fixed over time, unless the customer's risk characteristics change). The interest paid to the bank on loans provided in this theoretical example is therefore aligned with the borrower's risks, but is not necessarily the same as the cost of the credit for the bank. This difference, which creates a balance sheet exposure for the bank, will increase the cost of raising the credit for the bank. But it is important to emphasize that in this case, borrowers are not exposed to the risks of the banking system, which could materialize rapidly. In another example, where the interest on different loans is set according to an interest rate that also includes the risk premium of the contributing banks, such as Libor, the bank is not exposed to the risk spreads, and in practice passes its risks on to the customers. Thus, the interest on a loan which is set on the basis of Libor rates might change in line with changes in the risks of the banking system, unrelated to the borrower's risk. This is not the case with the Telbor rate, which is determined on a more efficient platform and does not expose borrowers to the risks of the banking system.

5.1 The desired characteristics of the reference rates

Regulators in advanced economies are struggling to develop a method for creating stable and reliable reference rates. These rates play a key role in the economy and its ability to withstand severe crises and fluctuations in the prices of financial assets. The ability to price financial assets on the basis of "credible" reference rates (those that correctly reflect the

price of money at any given moment) is extremely important for the function of companies operating in the economy, and mainly the possibility for non-financial companies to create financial hedges. (See Section 6 for further discussion.)

Table 2: Desired characteristics for reference rates[24]

General characteristics	Definition	Important for:
Reliability	Proper governance and administration to safeguard against manipulations or errors	Function and wholeness of the market
Robustness	Clear rules for reference rate production, including a backup plan during times of instability	Availability and usability during times of instability
Frequency	Rates calculated on a daily basis	Pricing of new contracts and mark-to-market valuation
Ready availability	Publication on designated sites	Authentication for contracts
Representation	Rate drawn from a representative sample of observations	Correct pricing basis

Table 2 provides a concise summary of the desired reference rate characteristics—those that reduce the probability of financial crises. The purpose of the characteristics is, first and foremost, to enhance the reliability and stability of the reference rates. Furthermore, these rates must be available on a daily basis for fixed maturities, transparent to all entities and well defined so that market participants understand exactly what they represent. Notably, these characteristics, which relate to the technical aspect of calculation and publication, enhance reliability and stability over time, but there is not enough discussion of whether the reference rates contain risk premiums and which assets should be based on the rates, as explained above in Section 5.

6. The relationship between the financial system and economic growth and its stability

The relationship between the capital markets and economic growth has been extensively studied in the literature and it has always been found to be strong and positive.[25] The

[24] According to the report prepared for BIS –
"Towards better reference rate practices: a central bank perspective", March 2013, BIS.

financial system, which serves primarily as an intermediary between the supply of and demand for capital, mobilizes the public's savings and channels them towards investments and manufacturing activity, playing a crucial role in business development, the creation of jobs, and ultimately in economic growth. Levine (1997) studied in detail the relationships between economic growth, monetary policy and the capital markets and presented the key characteristics of a developed capital market, all of which improve the efficiency of savings and investments in the economy and thus enhance long-term growth. The academic literature on the subject goes back many years, initially focusing mainly on the banking system. Bagehot (1873) and Hicks (1969) argued that the industrialization of England was sparked by the development and sophistication of the banking system which eased the movement of capital. Schumpeter (1912) argued that the efficient function of banks spurs technology and innovation by identifying those entrepreneurs with the greatest capacity for improving products and production methods.

Numerous papers in the past few decades have examined both the empirical and causal relationships between the capital market and the financial system in general and economic growth. All the empirical papers found a strong, positive relationship consistent with theory and in most cases it was found that the development of the capital market affects future growth rates. Some of the empirical papers found a reverse causality, namely that market development is explained by economic growth, based on the argument that economic developments create demand for distinct financial arrangements.[26] Hassan, Sanchez and Yu (2001) examined this question in several low-income and middle-income countries. They examined per capita GDP in each of the countries with respect to a number of different estimates that represent development of the market and found a positive correlation between the growth of per capita GDP and the development of the capital market in developing countries, in most of which there is a two-way causality. Their findings led them to conclude that a developed, well-functioning capital market is critical to achieving sustained growth in developing economies.

Levine (2005) presented five theoretical causes of a strong relationship between the capital and money markets and economic activity. He noted that financial systems:

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[25] See for example: Goldsmith (1969), McKinnon (1973), Shaw (1973).
[26] Robinson (1952).

1. Produce information ex ante about possible investments and allocate capital.
2. Monitor investments and exert corporate governance after providing finance.
3. Facilitate the trading, diversification and management of risk.
4. Mobilize and pool savings.
5. Ease the exchange of goods and services.

Each of these key functions affects savings and investment in the economy, and consequently also economic growth. In this paper, we will pay particular attention to the third function—the diversification and management of risk through derivative financial assets.

In countries without a well-developed derivatives market, the economy is more exposed to fluctuations in the prices of products and assets, resulting in a higher level of risk for firms. High risk levels in real (non-financial) activity increase the cost of financing for ongoing activity and investments in the economy, leading to lower long-term growth rates. The empirical literature discussing the extent of the use of derivatives, particularly in view of the global financial crises, has expanded considerably in recent years. (In this context, we note the collapse of LTCM and the last financial crisis which began in 2008.) Bartram, Brown and Conrad (2011) examined the effect of the use of derivatives on credit risk and company value based on a large sample of non-financial firms from 47 countries. Their findings support the argument that the use of derivatives reduces a firm's risk premium and increases its value. They also reported that non-financial firms that used derivatives significantly increased their value and accounting profit during the recession (2001–02), apparently as a result of hedging activity by means of derivative financial assets. Their paper corresponds with the findings of numerous other papers published after the LTCM crisis. For example, Bartram, Brown and Fehle (2009) argued that the use of derivatives by non-financial companies increases their value and improves their stability.[27] Guay (1999) clearly demonstrated the added value generated by the use of derivatives by non-financial companies to hedge risks: a 5 percent decline in the volatility of changes in

[27] Also based on the conclusions of Graham and Rogers (2002) and Allayannis and Weston (2001).

share prices, a 22 percent decline in exposure to interest rate risk and an 11 percent decline in exposure to currency risk.

Nevertheless, the use of derivatives could obscure financial risks. In economies with an over-developed derivatives market, the risk level for non-financial companies might be relatively low but the risk level for financial companies could be high and generate frequent financial crises, thus adversely affecting the risk level in the economy as a whole. Stulz (2004) examined the extent to which derivatives are used by both financial and non-financial companies and he argued that the risk level inherent in the derivatives market can be easily measured and managed at firm level. However, he emphasized that the derivatives market can create a systemic risk, particularly when the financial institutions operating in the derivatives market are too big for the size of the market. Rajan (2005) summarized the issue by arguing that financial instruments, including derivatives, enable individual companies to spread their risks, and have also created faster and cheaper access to financing for firms and households, but the risk appetite and relative size of the financial intermediaries could increase the fluctuations in real activity. He added that even if the financial intermediaries are left with relatively low levels of exposure to risk, their collective behavior could create conditions for turmoil in the capital and money markets, which in turn will affect activity throughout the economy. Chernenko and Faulkender (2011) presented both sides of the use of IRS derivatives—financial hedges and speculation. They argue that non-financial companies use interest rate derivatives for a variety of reasons, but they all facilitate either limiting the risk or reducing the financing costs. Nevertheless, non-financial companies also execute transactions in interest rate derivatives for speculative purposes, and it is sometimes difficult to determine what their real objectives are in such activity.

The question facing regulators and policy makers is therefore: to what extent are financial assets in general and derivative assets in particular used to provide non-financial companies with cheap, effective financing for their operations? Has the use of such assets become so widespread that it could trigger a financial crisis and pose a threat to real activity in the economy? In view of the financial crises that have plagued the developed world in the past few years, the question increasingly being asked is to what extent should the capital market develop? To answer these questions, many researchers have begun to

collection information about the use of derivative instruments by both financial and non-financial companies. It is generally assumed that non-financial companies use derivatives mainly for hedging purposes, whereas the use of derivatives by financial companies could create systemic risks for the entire economy as a result of exposure to risk, even if the risk facing each company is, in itself, not large.

We can use the World Economic Forum's financial development index to assess the development of Israel's capital market, and accordingly to gauge the importance of further development. This index provides a score and rank for each of the 62 countries covered in the study,[28] and its purpose is to shed light on one of the drivers of economic growth in the relevant countries. It allows comparisons with other countries, paving the way for decision making on the necessary measures for developing the capital market. According to the 2012 report, Israel was ranked in twenty-fourth place, below, for example, China, Austria and Kuwait. Of particular interest are the components of two (of eight) categories used for calculating this index. The first is non-banking financial services, in which Israel's ranking was particularly low – thirty six – mainly due to the absence of a securitization market. The second is the financial markets in which Israel is ranked twentieth – not particularly low, mainly due to the relatively favorable state of the stock markets and foreign-exchange derivatives (although no data was available for interest rate derivatives). In this context, it is also important to note that a Repo market, which in developed economies is critical to the effective function of the money markets, bond markets and derivatives, does not yet exist in Israel.

In this paper, I drew an international comparison based on three key indicators[29] which represent the relative size of the local equities, domestic bond and derivatives markets (presented in Appendix 6). These three indicators also help us to estimate the

[28] See: The Financial Development Report (2012) by the World Economic Forum USA , which can be found at: http://www3.weforum.org/docs/WEF_FinancialDevelopmentReport_2012.pdf

[29] There are numerous and diverse indicators for measuring the level of development of the capital market and they can be divided into four categories: 1. Market depth – the size of the financial institutions and scope of the capital and money markets; 2. Access to the market – the degree of access by individuals (households and companies) to financial services; 3. Efficiency of the financial intermediaries and capital market – ease of access to sources of financing and the allocation of resources; 4. Stability – stability of the financial institutions and capital market (see Cihak et al., 2012).

development of Israel's capital market compared with other countries. Accordingly, it was concluded that the equities market is relatively well developed, although this is not the case regarding the domestic bond market, and particularly the interest rate derivatives market.

The differences in the level of financial development, as reflected both in the international indicators and those calculated here, indicate that further development of Israel's capital market, and particularly the reference rate market, would contribute to the economy's long-term economic activity by diversifying the sources of credit and by reducing the interest rate risks.

7. Conclusion

The Telbor market, which is a platform for setting reference rates for the short-term nominal interest rate in Israel, has developed markedly in the past decade—but only in the area of short-term interest rate derivatives. Although at present, the Telbor rate is still only used as the reference rate for financial derivatives, other financial products such as loans and bonds could develop based on reference rates thus diversifying the sources of financing in the economy. If the use of additional financial products based on the reference rate expands, the derivatives market will continue to develop, helping to reduce the interest rate risks in the economy and to lower the costs of financing. Against this background, this study examined the market structure of the two interest rate markets representing the Bank of Israel rate and the expectations for its development. As noted, the paper examined the required characteristics for a reference rate market and this formed the basis for answering the research question: which of the markets is the preferred platform for the reference rate market in Israel. The paper also examined whether other financial products can be priced using the reference rates, and specifically – what types of premiums are included in the reference rates and whether these premiums are desirable. The conclusion emerging from the range of empirical tests conducted in this study is that the Telbor rate is more informative, more effectively reflects the prevailing interest rate in the economy on any business day, and is the preferred platform for determining the reference rates in Israel. It is important to note as well that contrary to reference rates in other parts of the world—i.e.,

the Libor rate—the Telbor rate is as clear as possible of risk and liquidity premiums and it is suitable for use as a reference rate for various financial products.

The relationship between sustainable economic growth and the development of the capital market has been studied extensively and it has been proven theoretically and empirically that the development of the capital market facilitates long-term economic growth. It is important to emphasize that despite the financial crises that affected many countries in recent years and despite the discovery of manipulations of the global Libor market, regulators worldwide who introduced structural reforms of the reference rates market, and the derivatives market in particular did not recommend reducing activity in these markets. Unlike the Libor rate, the Israeli version of the reference rate market includes a commitment to execute transactions on interest rate derivatives based on the quotes that are used to fix the interest rate. This commitment creates a well-defined anchor for setting Telbor rates that are as clear as possible of risk and liquidity premiums. The Telbor rate is therefore determined in a market structure that is better suited to serve as a reference for other financial products and assets, and thus does not expose other investors—particularly borrowers whose loans are linked to the reference rates—to the risks of the banking system.

The regularization and development of the Telbor market must continue if it is to further contribute to Israel's economic activity, and particularly to enable the business sector to diversify its credit options, and reduce and limit the inherent interest rate risk. At the same time, Israel's regulators must closely monitor activity in this market, particularly in view of the manipulations that were discovered in the Libor market.

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Appendix 1

Characteristics of interest rate contracts transacted in Israel

Interest rate derivatives provide protection against interest rate fluctuations that frequently affect credit portfolios and deposits. A broad, deep interest rate derivatives market makes it possible to reduce uncertainty regarding the possibility of financial losses, and provides a mechanism for hedging against unexpected changes in the economic environment. Following are some of the most common interest rate futures contracts transacted in the banks' dealing rooms:

F.R.A. – Forward Rate Agreement – a forward rate agreement between two parties who undertake to pay / receive the difference between a fixed, pre-defined interest rate (known as the FRA rate) and a floating rate (which is based on the Telbor rate), to be set on a specified date for a defined period and amount. The transaction is for one interest period. No swap of the principal is entailed in FRA transactions and the principal is therefore notional. On the settlement date, one party will pay the interest set when the transaction takes place (the fixed interest),[30] and the other party will pay the floating interest, to be set in line with the Telbor rate on the settlement date. These transactions are quoted in an AxB format, where A represents the number of months until the loan commences, and B represents the number of months to settlement of the loan. The most common quotes are 1x4, 1x7, 3x6, 6x9, and 6x12.

The purpose of FRA contracts is to determine interest rates in advance, and they are suited to covering interest rate risks. The buyer / seller of the contract hedges against an increase / decrease in the interest rate above / below the agreed interest rate.

Where the FRA is purchased for the purpose of covering interest rate risks in any initial transaction, then all the profit or loss is offset against the profit or loss of the initial transaction, in respect of which the contract is bought or sold.

I.R.S. – Interest Rate Swap – an agreement between two parties who agree in advance to swap different types of future interest rate cash flows – fixed interest versus floating, which is set according to the Telbor rate, based on pre-defined rules and on a particular (notional)

[30] As part of the commitment to execute transactions determined by the Telbor Rate Committee, the fixed interest is defined on the basis of quotes from the contributing bank.

principal amount. Only the interest rate payments are swapped but there is no swap of the principal at either the agreement stage or on the settlement date. An I.R.S. allows the interest conditions of a loan or deposit to be changed during a defined period – the fixed interest can be replaced with floating interest and vice versa.

IRS transactions are suitable for customers who wish to exchange interest rate bases so that they are better suited to the company's assets or liabilities, in order to reduce exposure to interest rate changes or for investors who wish to speculate on the future direction of the interest rate.

Swaption (**Swap Option**) – an option on an IRS transaction – an option to swap interest rate bases so that they will be better suited to the company's assets / liabilities while retaining the right to benefit from interest rate changes in the market (unlike IRS). The company pays a premium to the bank for the purchase of a Swaption.

Swaptions grant the customer the right to purchase a swap transaction on interest rates (IRS) at a fixed rate for a future period. The customer buys the right to swap the interest rate cash flows if the interest rate reaches a certain level (which is defined in advance). This allows for hedging against an increase / decrease in the interest rate during the option period while retaining the right to benefit if the interest rate increases / decreases.

O.I.S. – Overnight Index Swap – a cash flow swap contract between two parties who agree in advance to swap the cash flows from different types of interest payments – fixed rate versus the average of overnight rates for the same period – based on pre-defined rules and on a certain notional principal. In OIS transactions, only the interest rate payments are swapped but there is no swap of the principal at either the agreement stage or on the settlement date. In OIS instruments, the interest rate conditions of a loan or deposit can be changed during a defined period.

Appendix 2

Statistical tests of autocorrelation on daily changes in the interest rate

Estimation period: middle of 2010 to February 2015. The estimate was made separately for each term to maturity – 3 months and 6 months.

$$D(mkm_t) = \alpha + \beta_0 D(Telbor_t) + \beta_1 D(mkm_{t-1}) + \beta_2 D(mkm_{t-2}) + \varepsilon_t$$

$$D(Telbor_t) = \alpha + \beta_0 D(mkm_t) + \beta_1 D(Telbor_{t-1}) + \beta_2 D(Telbor_{t-2}) + \varepsilon_t$$

Table A.2

	mkm3	Telbor3	mkm12	Telbor12
α	-0.0014	-0.0012	-0.0012	-0.001
	(-1.07)	(-1.9)	(-1.77)	(-1.5)
β_0	0.46	0.09	0.378	0.375
	(8.02)	(6.9)	(14.5)	(13.3)
β_1	-0.19	0.055	-0.068	0.064
	(-6.9)	(1.98)	(-2.52)	(2.36)
β_2	-0.15	0.03	0.034	0.027
	(-5.35)	(0.3)	(1.3)	(1.02)
R^2	0.087	0.044	0.148	0.148
.D.W	2.04	2.05	2.18	2.18

Key findings

Makam series: In the three-month term to maturity, the negative autocorrelation is significant on the last two days of trading, and in the 12-month term to maturity, the negative autocorrelation is significant but weaker – on the last day of trade only. The negative autocorrelation confirms that the market has seasonal biases and systemic trading errors.[31]

Telbor rates: the autocorrelation is positive, but relatively low, both in the three and 12-month terms to maturity. A low, positive autocorrelation confirms that the market is deep and liquid without seasonal bias and systemic trading errors.

[31] It is possible that the systemic trading errors are attributable to the trading platform in the stock exchange, where trading on the price is possible using two digits after the decimal point only. Small price fluctuations have a greater effect on yield volatility when the term to maturity is shorter.

Appendix 3

Causality tests – mid-2010 to February 2015

A. For interest rates and yields on a three-month term to maturity:

Table A.3.a

Pairwise Granger Causality Tests
Date: 07/15/15 Time: 13:48
Sample: 768 2040
Lags: 8

Null Hypothesis:	Obs	F-Statistic	Prob.
D(MKM) does not Granger Cause D(TELBOR)	1243	1.51449	0.1474
D(TELBOR) does not Granger Cause D(MKM)		3.97195	0.0001

Conclusion: We can dismiss the assumption that the change in the three-month Telbor rate does not affect the change in Makam yields for the same term to maturity. In contrast, we cannot dismiss the assumption that the change in three-month Makam yields does not explain the change in the Telbor rate for the same term to maturity.

B. For the interest rates and yields on a twelve-month term to maturity:

Table A.3.b

Pairwise Granger Causality Tests
Date: 10/07/15 Time: 12:58
Sample: 768 2040
Lags: 8

Null Hypothesis:	Obs	F-Statistic	Prob.
D(MKM12) does not Granger Cause D(TELBOR12)	1243	7.68552	4.E-10
D(TELBOR12) does not Granger Cause D(MKM12)		11.6286	5.E-16

Key findings:

We cannot dismiss the assumption that the change in the 12-month Telbor rate does not affect the change in Makam yields for the same term to maturity, and we also cannot dismiss the assumption that the change in 12-month Makam yields does not explain the change in the Telbor rate for the same term to maturity.

Appendix 4

Estimation of dispersion of Telbor interest rate quotes and forecasters' projections for reference rate terms using the uncertainty index for the future interest rate reflected in secondary market trading of Makam series

Table A.4

Results of estimation equations

Dependent Variable: LOG(0.001+STD_FORCAST3)				
Method: Least Squares				
Date: 11/04/15 Time: 15:30				
Sample (adjusted): 2012M02 2015M10				
Included observations: 45 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(VOLATIL)	0.29	0.19	1.58	0.12
LOG(RIBITB)	0.08	0.04	1.75	0.09
LOG(0.001+STD_FORCAST3(-1))	0.47	0.14	3.37	0.00
C	-0.53	2.01	-0.27	0.79
R-squared	0.77	Mean dependent var		-6.31
Adjusted R-squared	0.76	S.D. dependent var		0.31
S.E. of regression	0.15	Akaike info criterion		-0.87
Sum squared resid	0.92	Schwarz criterion		-0.71
Log likelihood	23.6	Hannan-Quinn criter.		-0.81
F-statistic	47.0	Durbin-Watson stat		1.72
Prob(F-statistic)	0			

Dependent Variable: LOG(STD_TELBOR3)				
Method: Least Squares				
Date: 11/04/15 Time: 15:25				
Sample (adjusted): 2012M02 2015M10				
Included observations: 45 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(VOLATIL)	1.09	0.43	2.54	0.02
LOG(RIBITB)	0.26	0.09	3.01	0.00
LOG(STD_TELBOR3(-1))	0.09	0.14	0.66	0.52
C	5.80	4.01	1.45	0.16
R-squared	0.72	Mean dependent var		-5.12
Adjusted R-squared	0.70	S.D. dependent var		0.62
S.E. of regression	0.34	Akaike info criterion		0.78
Sum squared resid	4.79	Schwarz criterion		0.94
Log likelihood	-13.5	Hannan-Quinn criter.		0.84
F-statistic	34.9	Durbin-Watson stat		1.95
Prob(F-statistic)	0			

Dependent Variable: LOG(STD_FORCAST12)				
Method: Least Squares				
Date: 11/04/15 Time: 15:29				
Sample (adjusted): 2012M02 2015M10				
Included observations: 45 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(VOLATIL)	0.06	0.24	0.25	0.80
LOG(RIBITB)	0.00	0.04	-0.02	0.99
LOG(STD_FORCAST12(-1))	0.52	0.13	4.07	0.00
C	-2.35	2.33	-1.01	0.32
R-squared	0.30	Mean dependent var		-6.05
Adjusted R-squared	0.24	S.D. dependent var		0.22
S.E. of regression	0.19	Akaike info criterion		-0.38
Sum squared resid	1.51	Schwarz criterion		-0.22
Log likelihood	12.5	Hannan-Quinn criter.		-0.32
F-statistic	5.73	Durbin-Watson stat		2.02
Prob(F-statistic)	0			

Dependent Variable: LOG(STD_TELBOR12)				
Method: Least Squares				
Date: 11/04/15 Time: 15:29				
Sample (adjusted): 2012M02 2015M10				
Included observations: 45 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(VOLATIL)	1.27	0.36	3.57	0.00
LOG(RIBITB)	0.17	0.06	2.68	0.01
LOG(STD_TELBOR12(-1))	-0.05	0.15	-0.32	0.75
C	6.68	3.17	2.11	0.04
R-squared	0.70	Mean dependent var		-5.25
Adjusted R-squared	0.68	S.D. dependent var		0.47
S.E. of regression	0.27	Akaike info criterion		0.27
Sum squared resid	2.90	Schwarz criterion		0.44
Log likelihood	-2.18	Hannan-Quinn criter.		0.33
F-statistic	31.9	Durbin-Watson stat		2.18
Prob(F-statistic)	0			

STD_FORECAST3/12—the monthly average of standard deviations, which measures the dispersion of forecasters' projections of the interest rate for 3-month and 12-month terms

STD_TELBOR3/12— the monthly average of standard deviations, which measures the dispersion of Telbor interest rate quotes for reference 3-month and 12-month terms

RIBITB—Bank of Israel interest rate (key rate).

VOLATIL—the monthly average of standard deviation of changes in Makam series prices during the trading day (uncertainty index for the future interest rate).

Main findings:

The standard deviation measures the extent of dispersion of forecasters' projections for the interest rate, is not impacted to a statistically significant extent by the intraday standard deviation of Makam series, and it has a statistically significant serial correlation. In contrast, the standard deviation that measures the extent of dispersion of Telbor interest rate quotes is impacted fully by the intraday standard deviation of changes in the prices of Makam series from the level of the Bank of Israel interest rate and does not have an autocorrelation. Thus, it may be concluded that the contributor banks' quotes are informative and include up to date information.

Appendix 5

Principles for the process of setting the reference rate

IOSCO set 19 principles, divided into 4 main groups:

Governance: A benchmark, or reference rate, should have appropriate governance arrangements in place to protect the integrity of the benchmark and to address conflicts of interests.

1. Overall Responsibility of the Administration—The administrator should retain primary responsibility for all aspects of the benchmark determination process.
2. Oversight of Third Parties
    a. Supervised banks quotes per code of conduct
    b. Supervised service providers per operational rules
3. Conflicts of Interest for Administrators
4. Control Framework for Administrators
5. Internal Oversight

Quality of the Benchmark

6. Benchmark Design
7. Data Sufficiency
8. Hierarchy of Data Inputs
9. Transparency of Benchmark Determinations
10. Periodic Review

Quality of the Methodology

11. Content of the Methodology
12. Changes of the Methodology
13. Transition
14. Submitter Code of Conduct
15. Internal Controls over Data Collection

Accountability

16. Complaints Procedures
17. Audits
18. Audit Trail
19. Cooperation with Regulatory Authorities

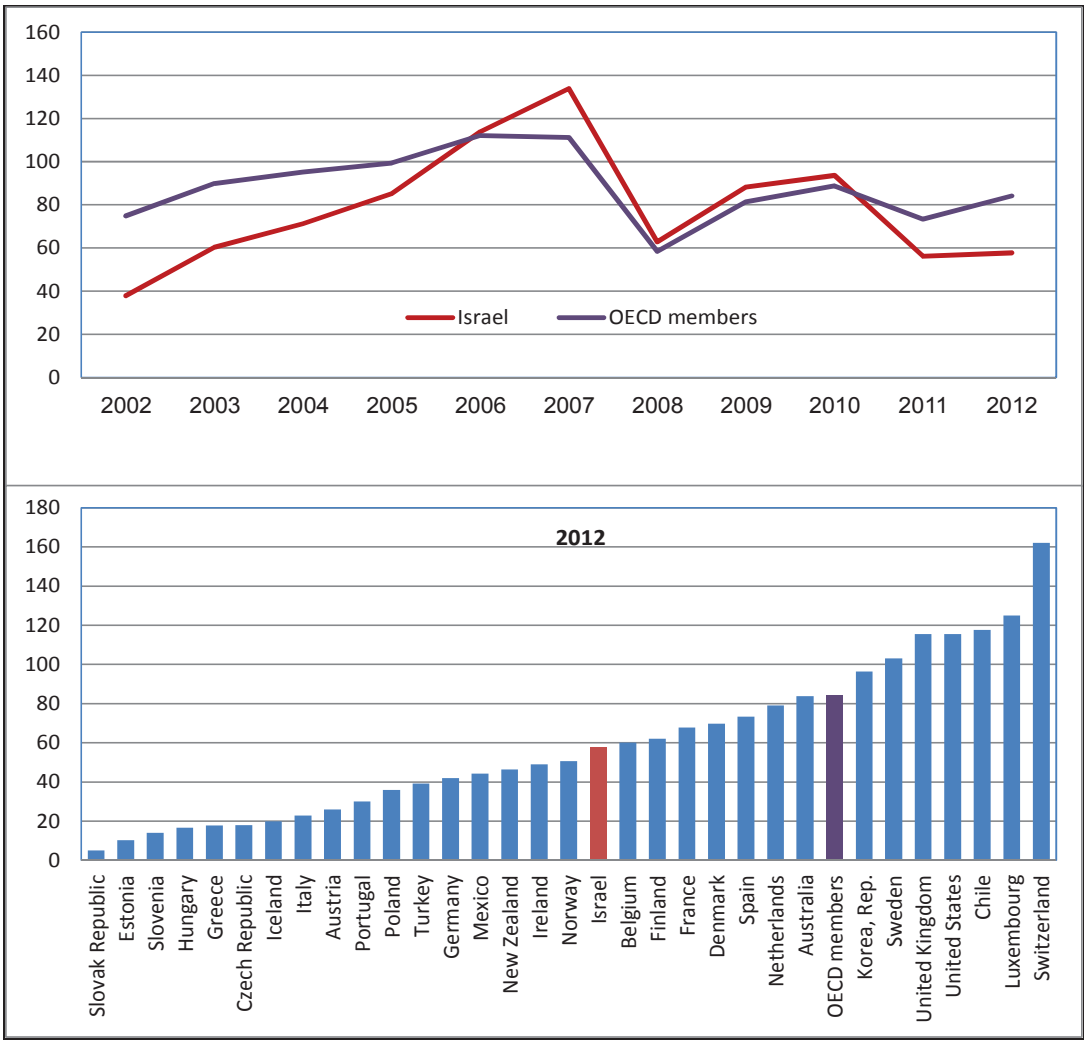
Appendix 6

Three main indices of the level of development of Israel's capital market, international comparison.

1. Equities market

Figure A.6.a

Equity market value, as percent of GDP[32]



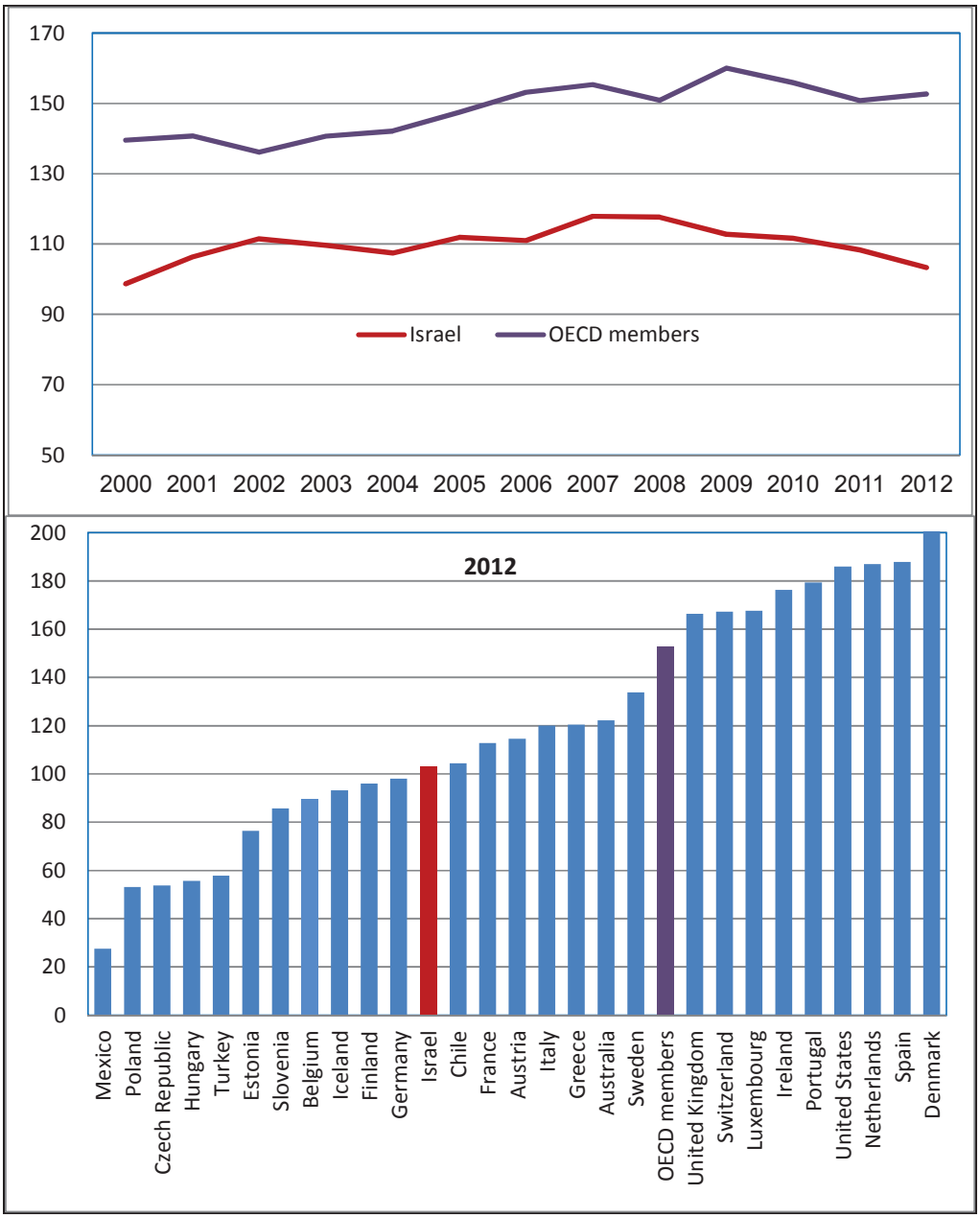
[32] Data are from the World Bank database at: http://data.worldbank.org/indicator/CM.MKT.LCAP.GD.ZS/countries .

The figures indicate a marked improvement in this indicator in Israel, beginning in 2003, apparently as a result of the numerous reforms that were carried out in Israel's economy at that time. (See Chapter 4 of the 2005 Bank of Israel Annual Report.) The crisis that began in 2008 reduced the scope of the equity market relative to GDP in many countries, including Israel, and it appears that in Israel, the indicator has not yet returned to its pre-crisis level. It can also be seen that since 2011m there was a relative deterioration in this index in Israel, and in 2012 a relatively large spread opened up between Israel and the OECD average. Compared with the US and the UK, the spread appears particularly wide, and there is still considerable room for improvement in the Israeli market.

2. Private sector domestic debt

Figure A.6.b

Private sector domestic debt, as a percent of GDP[33]



[33] Data for all countries except Israel are from the World Bank database at: http://data.worldbank.org/indicator/CM.MKT.LCAP.GD.ZS/countries . The data for Israel are from Bank of Israel calculations.

The figures indicate that in Israel in recent years, this index has not improved compared with OECD countries, despite the increase in nonbank credit that began in 2005. It is important to note that when comparing banking sector domestic debt to the private sector as a share of GDP, the differences in an international comparison are small and not consistent over the course of the sample period. It can therefore be concluded that the differences in the scope of domestic debt derive from the lack of development of nonbank domestic debt in Israel.

3. Derivatives market

Based on data published in the BIS semiannual survey[34] and on data from the Banking Supervision Department on banks in Israel, an international comparison of the scope of the derivatives market can be conducted. The survey data indicate that as of the end of 2013, for the reporting countries, the value of open positions in derivatives was $710 trillion (in underlying asset terms), which is 17 times the aggregate GDP. In contrast, in Israel, the value of open positions at that time was about $490 billion, only 1.7 times GDP. An additional figure that is interesting to compare is the fair value, defined as the estimated total value of the derivatives if they were sold at market prices on that day. At the end of 2013, this figure was $18.6 trillion, about 47 percent of aggregate GDP of the reporting countries. In Israel, in contrast, the figure was $22.5 billion, only 8 percent of GDP.

The particularly low scope of use of directives derives mainly from interest rate derivatives and less so from foreign exchange derivatives (and others). The value of open positions in interest rate derivatives was about $584 trillion (in underlying asset terms) in December 2013, about 14.6 times aggregate GDP. In Israel, the value of open positions in interest rate derivatives was about $286 billion, about the same as GDP.

[34] Bank for International Settlements – Statistical release, OTC derivatives statistics at end June-2013 (November 2013). The BIS survey includes the 13 countries with the most developed derivatives market. These countries account for 96 percent of the total value of open positions worldwide.