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A DEEP MARKET IN ISRAELI CORPORATE BONDS: MACRO AND MICROECONOMIC ANALYSIS IN LIGHT OF THE ACCOUNTING STANDARDS*

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Abstract

This article examines the question of whether a “deep market” for tradable corporate bonds exists in Israel, as defined in the international accounting standard (IAS-19) dealing with discounting long-term post-retirement obligations. The analysis was carried out with regard to two aspects of the term “deep market”: the macroeconomic aspect, which relates to the financial system's ability to provide liquidity (lines of credit) to the nonfinancial sector, and the microeconomic aspect, which relates to the size of liquidity premium in the Israeli corporate bond market. An out-of-sample examination of Israel, based on the macroeconomic analysis, indicates a probability of over 95 percent that Israel belongs to the group of countries with deep markets. The microeconomic analysis was carried out based on corporate-bond daily trading data from the beginning of 2004 to the beginning of 2014, categorized by CPI-indexation sector and rating. The assessment results suggest that the liquidity premium for CPI-indexed corporate bonds rated AA- and above is similar to the premium measured for investment-grade corporate bonds in the US.

It is worth stressing that the analysis shown in this paper did not include the coronavirus episode. It might be that the dynamics governing the markets during and after the coronavirus episode are different, implying rules that are not part of the present research. Analyzing the data during the coronavirus episode is an interesting direction for future research.

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The views expressed in this article are the sole responsibility of the authors and do not reflect those of the Bank of Israel.

A. INTRODUCTION

Starting on January 1, 2008, reporting entities in Israel have been required to meet International Accounting Standard 29 (IAS-29), according to which financial statements must be prepared in accordance with international financial reporting standards. Among other things, Israeli entities are required to implement International Accounting Standard 19 (IAS-19), which is concerned with the recognition and measurement of post-retirement employee benefit obligations. The standard distinguishes between defined contribution plans, in which the entity pays fixed contributions and employee rights (e.g., retirement benefits) vary depending on the financial accumulation in one's account, and defined benefit plans that create an obligation on the entity to provide agreed-upon benefits to current and past employees and effectively places actuarial and investment risk on the entity.

The accounting treatment of defined benefit plans can be complicated, as actuarial assumptions are required to measure the obligation and the expense of creating it. These actuarial assumptions will be based on the best possible estimates of the variables, which will determine the final cost of granting the benefits post-retirement, where one of the meaningful actuarial assumptions is the determination of the discount rates used in discounting the obligation cash flow anticipated for the benefit post-employment.[1] In paragraphs 83-86, the standard guides the manner in which the discounting rate should be determined in defined benefit plans. In general, the standard specifies that, in countries where there is a "deep market" for "high-quality corporate bonds" (HQCB), the discount rate should be determined by reference to market yields at the end of the reporting period on "high quality corporate bonds" (and not based on a discount rate that reflects the entity-specific credit risk), and in countries where there is not a deep market in such bonds, the obligations should be discounted at the market interest rate for government bonds at the end of the reporting period.[2]

IAS-19 does not provide an explicit definition for the existence of a deep market, but it does state that the asset's degree of liquidity is a relevant indicator of market depth (paragraphs 136, 83). Numerous academic studies, such as those by Demsetz (1968), Pagano (1989), and others, have shown that an asset's degree of liquidity is positively related to its volume of trade, meaning that trading volume is also related to market depth. However, deep markets and liquidity have both broad and narrow interpretations: According to the broad interpretation, primarily used by macroeconomists, liquidity and market depth are related to the amount of liquid assets available to the public and to the financial institutions. Per the narrow definition, liquidity and market depth refer to the price of liquidity in a stock, bond, or derivatives market; accordingly, this is a measure that is informative on the micro level.

[1] Paragraph 76 of IAS-19.

[2] The international accounting firm Deloitte sets forth its position on how to define "quality" in its guide to implementing the International Financial Reporting Standard (IFRS) (iGAAP 2014, Paragraph 7.2.5, pp. 1199-1202). They note that, although the standard doesn't provide practical guidelines for measuring "quality," in practice there is a general tendency to regard bonds as being of "high quality" if they have been assigned one of the state's two highest credit ratings.

We find importance in a joint examination of both dimensions, given their interdependency. For example, during a panic period, if the bond markets are not liquid in the narrow sense—that is, the cost of executing transactions has increased—then liquidity in the broad sense can ease the liquidity shortage in the markets through the extension of credit lines to financial institutions, which will expand lines of credit to securities traders. In fact, the Fed's monetary accommodation policy following the October 1987 stock market crash, and after the fall of Lehman Brothers in September 2008, attests to the relationship between the two aspects of liquidity. In this study, therefore, we will ask whether Israel can be classified as a country with deep market conditions—in both the broad macroeconomic sense, and in the narrow microeconomic sense—in the corporate bond market.

The past decade has seen major changes in Israel's corporate bond market, which have promoted a substantial increase in the market's activity volume. The pension reform that got underway in 2003 saw a halt in the share of special government bonds issued for the "old" defined benefit pension funds by the Finance Ministry; at the same time, the share of these bonds in the "new" pension funds was reduced. The reform also eased the investment regulations for the provident and pension funds, causing a shift of funding sources towards the public capital market. In 2005, the Bachar Reform, which fundamentally changed the landscape of the Israeli capital market, went into effect. The new legislation's most notable outcome was that management of provident and mutual funds was taken away from the banks, while the consulting and marketing sphere was separated from savings management. As a result of the reform, the supply of nonbank credit increased significantly, while the credit provided by the banks to the business sector was reduced by half, with competition developing between them and other entities, contributing to market efficiency. In 2005, new investment regulations for nonbank financial institutions (provident funds, pension funds, and insurance companies) went into effect. This was in accordance with the Bachar Committee's conclusions, which highlighted distortion in the development of the tradable bond market (and in the allocation of credit sources in the economy), stemming from asymmetry in the method of valuating nontradable assets (adjusted cost basis) versus tradable assets (fair market value).[3] The Committee's recommendations called for fair market value as a basis for valuation, in order to lower the incentive to invest in the nontradable market and deepen the tradable bond market (Bank of Israel, 2004). In 2006 a comprehensive reform went into effect in the bond market that aimed to make a market for government bonds (the "Market Makers" reform), in order to reduce concentration in the domestic bond market, bolster competition, and reduce capital-raising costs for the Israeli government (Ministry of Finance, 2006). As part of the reform, domestic and international entities began providing purchase and sales quotes for the large bond series, thereby contributing to a significant rise in the trading volumes and liquidity of Israeli corporate and government bonds, and becoming the main factors in the development and deepening of Israel's bond market.

[3] The Committee to Examine the Requirements for Disclosure in the Prospectus[es] of Tradable Securities or Non-Convertible Bonds, August 2003.

This article examines whether the Israeli corporate bond market may be considered as a deep market for high quality corporate bonds traded. The study examines the tradability of corporate bonds by estimating the liquidity premium and comparing it to the US premium, which is used as a prime indicator for gauging market depth. We also assess the liquidity in the Israeli financial system, from the macroeconomic point of view, in comparison to countries considered to have a deep corporate bond market. Since 2014, a new measure of liquidity at the macro level has been published by the World Bank, and it is included here for the first time as well.

B. MARKET DEPTH IN ISRAEL: GLOBAL COMPARISON FROM A MACROECONOMIC PERSPECTIVE

Based on the macroeconomic interpretation of market depth and liquidity, the larger the financial system (relative to GDP), the more liquid it is and the more indicative of the financial system's overall "well-functioning". Ross Levine (Levine, 2005) enumerates the myriad financial system functions in the economy, such as efficient capital allocation, oversight of borrowers, risk dispersion, coordination between savings and deficit units, assistance in transaction execution, and more. Accordingly, one must address the problem of how "financial system functioning" should be defined and measured.

In an article that studied the various aspects of financial system functioning (Čihák, Demirgüç-Kunt, Feyen and Levine, 2012), the authors note that most economic research to date has used banking system size to GDP as a representative variable for financial system functioning. This is despite the fact that banking is not the sole financial system sector, meaning that its size does not necessarily reflect the system's efficiency, stability, or depth. In light of this, the Global Financial Development Database (GFDD) was created, as part of a World Bank research project in the wake of the global credit crisis. The GFDD is a broad-based (encompassing over 200 countries) dataset that contains a wide variety of annual financial indices, spanning the period 1960–2011, that are used to measure and assess the functions of the financial system as a whole. To compare the performance of different financial systems (between different countries), the GFDD divides these indicators on the basis of four different financial system characteristics: (1) *financial depth*, estimating the size of the financial institutions and markets; (2) *access* – the degree to which individuals use financial institutions and markets; (3) the *efficiency* with which the financial institutions and markets provide financial services; and (4) the *stability* of the financial institutions and markets. These four categories are measured separately for the financial institutions and the financial markets. Some of the GFDD variables were found to be relevant to market depth measurement at the macroeconomic level. Therefore, we use them in this study to determine whether the depth of the Israeli market is similar to that of countries that have been classified (or that have self-defined) as having deep markets, as per the information provided in an Ernst and Young study (2013).

It should be emphasized that assessing market depth at the macro level is very important, especially in light of its two-way relationship with market depth at the micro level. The professional literature documents a microeconomic impact on financial market liquidity, and shows that the behavior of the markets is correlated with business cycles. To illustrate, empirical studies such as those by Pastor and Stambaugh (2003), Longstaff (2004), and Acharya and Pedersen (2005) document a "flight-to-liquidity" phenomenon in the stock and bond markets, as a result of financial crises. This phenomenon manifests in a diversion of investments toward assets with greater liquidity. For instance, Acharya and Pedersen (2005) show that, in times of financial crisis, there is a spread-out impact on the liquidity of tradable assets, due to declining levels of liquidity in the market (commonality-in-liquidity). Articles such as those by Longstaff (2004) and Næs, Skjeltorp and Ødegaard (2011) describe the flight-to-quality phenomenon as an outcome of financial crisis, in which investors reduce their exposure to risky assets in favor of low risk assets such as government bonds. In another study, Brunnermeier and Pedersen (2009) provide a theoretical model that links between market liquidity (i.e., the ability to carry out transactions quickly and cheaply) and traders' funding liquidity in times of financial crisis (i.e., the ease with which investors and traders can obtain funding). The model shows that traders provide market liquidity, and their ability to do so depends on the funding available to them via the financial system. Conversely, the traders' funding (i.e., traders' capital and margin requirements) is dependent on the market liquidity. The model explains several empirical features documented in the literature, such as that trading liquidity can "dry up" quickly and suddenly, that it has commonality across a large number of assets (commonality-in-liquidity), that it is related to market volatility, and that it is subject to "flight to quality." This theory has been tested in empirical studies such as those of Hameed, Kang and Viswanathan (2010), and Karolyi, Lee, and Van Dijk (2012), who show that negative market returns contribute to a decline in stock liquidity and a rise in commonality-in-liquidity. Ben Bernanke (2013), former Chairman of the US Federal Reserve, also noted the importance of trading liquidity and its relationship to the stability of the financial institutions. He maintains that, during the crisis of 2008, the liquidity problem was much worse, due to the low volume of trade observed in the markets. There were many financial institutions that could not find the funding they needed to support the positions they held in financial assets (as in the repo market), and therefore faced two alternatives: entering a state of insolvency, or selling assets in the market under pressure and at substantial loss. When such pressured situations undermine the stability of an institution, fears arise that the institution will collapse, and these fears snowball into concerns about the stability of other institutions, in a form of "contagion." In this way, macroeconomic liquidity and stock market liquidity fuel each other and can suddenly dry up, as described in the Brunnermeier and Pedersen model.

In this section, we present a methodology for macroeconomically detecting countries with deep markets in domestic corporate bonds. The methodology consists of a comparative empirical test of financial development measures between countries with or without deep markets, in order to determine the macroeconomic factors relevant to the characterization of market depth. Applying the methodology to World Bank GFDD data can help formulate a model for classifying out-of-sample countries as having or not having deep markets, and by this means we can determine whether there is a deep market in Israel.

a. Methodology

In order to estimate the predictive ability of macroeconomic characteristics with regard to market depth, we use the discriminant analysis (DA) model. DA is a statistical model used to predict the probability of an observation belonging to one of k possible groups. The model is commonly used in the finance field; it was employed by Edward Altman (1968), who developed the Z score model for predicting the bankruptcy probability of industrial firms, and later of finance firms. We chose to use the DA model in order to predict the likelihood of a country belonging to the group of deep market nations, and in order to determine whether Israel is in this group.

DA characterizes a binary variable Y by means of a matrix of independent variables $\boldsymbol{X}$ distributed in a normal multidimensional distribution with an expected values vector μ_k and a variance-covariance matrix Σ_k. Therefore, in the simplest case of distinction between only two groups, the prior probability $P(X|Y)\ is$

(1) $$P(X|Y) = \begin{cases} Y = 1 & \sim N\ (\mu_1, \Sigma_1) \\ Y = 0 & \sim N\ (\mu_0, \Sigma_0). \end{cases}$$

Assuming the normality of $\boldsymbol{X}$, the DA computes the posterior probability of observation x belonging to group k via the product of the prior probability and the normal density function of group k,

(2) $$P(x|k) = \frac{1}{\sqrt{2\pi|\boldsymbol{\Sigma}_k|}} exp\left(-\frac{1}{2}(x - \boldsymbol{\mu}_k)^T \boldsymbol{\Sigma}_k{}^{-1}(x - \boldsymbol{\mu}_k)\right),$$

where $|\boldsymbol{\Sigma}_k|$ is the determinant of $\boldsymbol{\Sigma}_k$ and $\boldsymbol{\Sigma}_k{}^{-1}$ is the inverse matrix.

A DA analysis can be carried out on the basis of several discrimination functions, including the linear discriminant analysis (LDA) model. In this case, the LDA employs the linear discriminant function (LDF) that passes through the centroids of the various groups (i.e., the averages),

(3) $$LDF = a + b_1X_1 + b_2X_2 + \cdots + b_pX_p,$$

where X_j is the independent variable $(j = 1, \dots, p)$, a is the intercept and $b_1, \dots, b_p$ are the regression coefficients of the p independent variables. For each observation i of the sample, the LDF computes a score that defines the proximity of observation i to the selected base group, by means of which one can estimate the probability of this observation's belonging to the various classification groups.[4]

The LDA technique makes several statistical assumptions, including: (1) The independent variables are interval or ratio variables; (2) There is independence between the observations in the sample; (3) The independent variables are sampled randomly and independently from a population that has a normal distribution; and (4) Equal variance-covariance between the groups. In our case, the LDA will be performed on a dataset containing macroeconomic financial data for several developed and undeveloped economies, in order to estimate the predictability of the macroeconomic characteristics with regard to market depth.

b. The dependent variable

The dependent variable is a binary variable that has only two possible values – does a deep market exist, or not, per

(4) $$Y_i = \begin{cases} 1 & have\ a\ deep\ market \\ 0 & Do\ not\ have\ deep\ market \end{cases}$$

where Y_i is the value for country i. The dependent variable was obtained from an Ernst and Young report (2013) that surveys the depth of the domestic financial markets of 32 selected countries under IAS-19 and specifies which countries declared themselves to have deep markets or not.[5] The list of 31 countries defined as having deep markets for purposes of this study is provided in Table 1, and includes 18 eurozone countries.[6]

The eurozone countries are probably not monolithic on issues beyond currency, inasmuch as there are fundamental differences in economic development level, as reflected in per capita GDP differences between Eastern Europe and Western Europe/Scandinavia. The GDP levels of countries such as Slovakia, Latvia, and Estonia, for example, are lower than $20,000 per year, in contrast to Western Europe and Scandinavian countries where GDP is generally

[4] For each case in the dataset, a Mahalonobis Distance is calculated. The Mahalonobis Distance is measured as the Euclidean distance between a case and the k groups centroids, standardized by the covariance matrix (and hence is expressed as standard deviation). Accordingly, one can express the chance of each case belonging to each of the classification groups, i.e., in case for which the Mahalonobis Distance (from the center of a given group) is higher than 1.96 has less than a 5 percent probability of belonging to this group.

[5] The Ernst and Young report bases the deep market classification on an analysis of macroeconomic data sampled before 2013. The question arises of whether the variable averages for both periods that preceded the most recent period are similar to it, i.e., was there a deep market during 2004–09 in the countries declared as such in 2013? For this purpose we conducted an ANOVA that assessed the effect of the estimated period on the averages for both classification groups for all of the independent variables. The results showed no significant impact of the period on any of the macroeconomic variables examined.

[6] The Euro bloc comprises the following countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain.

above $30,000 or even $40,000 per year. In light of the relationship between financial sector development/size and economic growth, we should also expect to find a positive correlation between market depth and per capita income.

Table 1
Countries With and Without Deep Markets

Countries with deep markets		Countries without deep markets
Canada	South Africa	Australia
Eurozone	Sweden	Brazil
Japan	Switzerland	China
Norway	UK	Mexico
	US	Poland

Source: Ernst and Young, June 2013.

c. Independent variables

The main goal of analyzing the macro aspect of deep markets is to identify the macroeconomic factors that can be relevant when distinguishing between deep and not-deep markets. Accordingly, the starting point for our analysis is to examine the impact of the main measures of financial depth, representing the volume of the services provided by the financial system, as well as measures of market efficiency, representing the degree of efficiency with which trading takes place in the financial markets, according to Čihák et al. (2012) (and which are thus relevant to an assessment of market depth as defined in IAS-19, paragraphs 136, 83). Researchers have determined that the most useful measure of stock market efficiency is the turnover ratio—the ratio between annual trading and market value, while in the bond markets the bid-ask spread is commonly used, as well as the turnover ratio. These measures are hard to obtain due to the paucity of bond market data.[7] Therefore, the independent variables chosen are based on the efficiency and market depth measures, with a distinction being made between the development indicators of the financial institutions, the stock markets, and the bond markets retrieved from the GFDD database at the World Bank. A description of the indicators is provided below, and the computation method is given in the Appendix A.

(1) *Measures of financial system development*

Liquid liabilities to GDP is an indicator that relates to all of a country's financial institutions. Liquid liabilities are a currency's total liabilities plus the demand for interest-bearing loans from banks and other financial agents. Liquid liabilities to GDP is the broadest indicator of

[7] The reason why the data are hard to obtain is that in most of the sample countries bonds are traded on the over the counter (OTC) market, where there is a small number of very large market makers and trading generally takes place in large amounts and in a discontinuous manner. We found, on examination, that of all the countries in the sample, only Switzerland and the UK trade bonds in the continuous market (the UK allows only some tradable bonds to be traded).

financial activity volume, as it encompasses all of a country's financial agents (e.g., banks, insurance companies, and the like).

Financial system deposits to GDP is the ratio between all funds and savings deposited in the financial institutions to GDP. This is an indicator of the size and liquidity of the financial institutions, as the latter use these funds to provide loans. We would, therefore, expect to see a positive relationship between total deposits and market depth.

(2) *Stock market depth indicators*

Stock market turnover ratio is the ratio between the value of traded shares and the value of tradable shares in all local stock markets. This ratio can be regarded as a measure of stock market liquidity (and thus of market efficiency), as a high turnover ratio expresses a high volume of trade relative to market size. Therefore, we would expect to see a positive correlation between turnover ratio and market depth.[8]

(3) *Bond market depth indicators*

Debt securities to GDP is the ratio between total amount of domestic debt securities issued by a private or public entity to GDP, including long- and short-term bonds and short-term tradable securities. We would expect to see a positive relationship between the value of the bond market and market depth, as market size is generally correlated with tradability level. There is a distinction between bonds issued by private firms (private debt) and public bonds (public debt, issued by central governments, municipalities, etc.). Bond market size is measured separately for these markets.

Gross portfolio debt assets to GDP is the ratio between total debt assets and GDP.[9] We will expect to see a positive correlation between total debt assets and market depth.

d. Dataset characterization

This section presents this study's unique dataset, which was built in accordance with the restrictions and assumptions stemming from the LDA method. All sample data were retrieved

[8] Čihák et al. (2012) discuss additional comparative measures of stock market depth: (1) stock market capitalization to GDP, and (2) trading volume to GDP. The authors maintain that these indicators express, respectively, the size of the local stock market, and the level of liquidity relative to the country's real economic activity, and that these measures are, therefore, positively correlated with market depth. However, academic studies such as those by Levine and Zervos (1998) and Beck and Levine (2004) show that there is a high and significant correlation between the variables, which is also reflected in the present dataset (correlation of 0.7999). This correlation may create a multicollinearity problem and consequent bias in the LDA model assessed, and so we have decided to use the turnover ratio as our main indicator of stock market depth.

[9] This is a new measure of market depth, one that doesn't appear in Čihák et al. (2012). The measure is available in the GFDD database as of April 2013 for the period 2004–11.

from the World Bank's Global Financial Development Database for all of the countries listed in Table 1, and for Israel (a total of 32 countries), for the period 2004–11.

The GFDD data describe the level of economic relations across time and many different countries, and so, from an econometric point of view, there is a serial autocorrelation. In addition, the variance of the independent variables also varies over time, and in particular during the global subprime crisis, which was characterized by extreme volatility. The instability of financial system data across the time periods challenges the assumptions of independent variable normality and of serial correlation. In order to avoid potential bias, we divided the dataset into three subperiods: (1) the boom period that preceded the subprime crisis (2004–06); (2) the subprime crisis period (2007–08); and (3) the post-crisis recovery period (2009–11), with an average of macroeconomic data observations being calculated for each country separately in each subperiod. This division controls for data variance in the periodic cross-section, and helps lower the serial autocorrelation.[10]

In addition, we removed outlying countries from the dataset, in order to stabilize the sample data and avoid a potential bias of the LDA results. Outlying countries were defined as those with at least two observations found to be below the 5th percentile or above the 95th percentile on at least three different independent variables (for both country groups, separately). Outlier country detection was carried out iteratively via several different runs of the LDA model on the dataset. At the end of each run, the average classification probability of the three outlier-country observations was computed, and it was determined that these countries would be removed from the dataset should their average probabilities be lower than 50 percent (all three observations of a given outlier country would be deleted from the dataset). The outlier countries having been removed, the dataset contains data on six "deep market" indicators for 28 countries plus Israel, for a total of 87 observations.[11] The LDA model was tested on the financial data of the 28 countries, and on its basis an out-of-sample assessment would be made of the Israeli market, which would indicate the probability of Israel's being classified as a deep market country or not.

[10] We conducted a few nonparametric tests in order to determine the fulfillment of the model's assumptions. We tested the hypothesis that the order of appearance of the observations in the database is random by means of run tests for each of the variables. The results showed that for every variable the assumption of data randomness is not invalidated (at the 5% significance level). We also performed a Kolmogorv-Smirnov test to assess the assumption of normality for the two country groups, separately. The results indicated that each of the variables except for total debt assets to GDP and size of the public bonds market (public debt) are split normally (at the 5% significance level).

[11] The outlier countries are Australia, Slovenia, and Slovakia. For Australia, the average discriminant score was above the average score calculated for the group of deep market countries. It should be noted that Australia once self-defined as a deep market country, but later rescinded the designation; even so, a fair number of Australian firms, especially large exporters, are adopting IAS-19. For Slovenia and Slovakia, the results showed discriminant scores substantially lower than those of the "non-deep-market" countries. Clearly, therefore, the attribution of deep market status to these countries from their very ability to operate in the deep markets of the European bloc in a currency identical to that of the obligations to employees, as IAS-19 requires. That is, the justification for including them among the deep market countries is based on an accounting criterion, not an economic criterion.

e. Indicators of model adequacy and run method

Due to the asymmetrical number of observations between the countries with and without deep markets, we chose to run the LDA with the prior probability of the k group calculated empirically via the ratio between the number of observations in the k group out of the total number of observations in the sample. Additionally, in order to avoid reducing the sample size due to missing data, we chose to substitute the most current figure in the same subperiod for the same country.[12,13] The discrimination is performed via a linear discriminant function (LDF) under an assumption of equality of the variance-covariance matrix between the deep market countries and the "non-deep-market" countries. This assumption will be tested by the commonly used statistical means of the Box's M test, and should its value be significant, the LDA model will be re-executed on the assumption that there is a discrepancy between the variance-covariance matrices of the different classification groups. Model adequacy will be assessed through the statistical means of Wilk's lambda, which is calculated via the proportion of the variance not explained by the discrimination model relative to the general variance. A significant Wilk's lambda value will indicate a high degree of separation between the deep market and the "non-deep-market" groups. Model adequacy will also be assessed via a classification table defining the model's success rates by totaling the number and percentage of the cases that the model classified correctly compared with the initial classification that appeared in the dataset.

It should be noted that a high classification rate does not ensure good classification forecasts for new cases not included in the dataset. However, due to the paucity of cases, especially in the "non-deep-market" group, we refrained from dividing the dataset into a training set and a testing set, as is commonly done, choosing instead to test the model through cross-validation of the original dataset via the "leave one out" method.[14] Even so, we estimate that there will be no substantial bias between the classification results of new observations and those already in the dataset, as the number of observations in the dataset is considerably higher than the number of independent variables.

f. Results

(1) *Descriptive statistics*

Table 2 shows average, median, and standard deviation for each of the deep market measures assessed for the deep market country group, the "non-deep-market" group, and Israel, based on the dataset we built. One can easily see that for all of the measures substantially higher

[12] If there was no more current value from the subperiod, the missing value was replaced with an average measured over the remaining countries from the same classification group.

[13] Of the 196 data in the dataset, 37 were missing. Only 4 cases contained more than 2 missing data (Estonia and Luxembourg).

[14] In the leave-one-out method, each individual observation is classified via the LDF, which is estimated across the n-1 other observations in the sample. This process is carried out for every observation in the sample.

values were found for the deep market countries than for the "non-deep-market" countries, with Israel showing measures closer to those of the deep market countries. Israel's median values for stock market and bond market depth are similar to those of the deep market countries (40.64 percent versus 41.18 percent, respectively). By contrast, Israeli corporate bond market capitalization and total debt assets to GDP (18.86 percent and 12.67 percent, respectively) are low compared with deep market countries, though still high compared with "non-deep-market" countries. Our findings indicate that Israeli financial development is higher than that of the "non-deep-market" countries, and closer to the level of the deep market country group.

We looked at the correlation matrix between the development indicators, but are not presenting it here due to lack of space. Overall, we found a high correlation between total financial system deposits to GDP and liquid liabilities to GDP (0.905), which could create a multicollinearity problem in the model, which in turn would be expected to cause a rise in variance and deviation of the model assessments. We therefore decided to remove the liquid liabilities to GDP index and to leave financial system deposits to GDP, as the former is less relevant to an assessment of financial system development levels.

Table 2

This table shows market depth indicators examined in a comparative cross-section of deep market countries, "non-deep-market" countries, and Israel. The figures were calculated on a cumulative basis within each of the three defined subperiods, across a sample of 24 deep market countries, 4 "non-deep-market" countries (excluding Australia, Slovenia, and Slovakia) and Israel, with a total of 87 observations.

			Classification group	
Variable	Indicator	Israel	Deep market	"Non-deep-market"
Financial system deposits to GDP (%)	Mean	87.48	110.29	39.79
	Median	88.07	96.23	42.57
	Standard deviation	2.42	70.03	11.77
Liquid liabilities to GDP (%)	Mean	97.68	122.06	70.35
	Median	97.81	105.15	51.67
	Standard deviation	4.22	69.48	51.02
Stock market turnover ratio (%)	Mean	93.51	79.46	50.30
	Median	83.48	69.59	39.98
	Standard deviation	17.76	51.83	26.74
Outstanding domestic private debt securities to GDP (%)	Mean	18.69	41.01	12.20
	Median	18.86	34.81	13.73
	Standard deviation	7.48	26.62	7.49
Outstanding domestic public debt securities to GDP (%)	Mean	41.74	46.86	30.39
	Median	40.64	41.18	31.66
	Standard deviation	2.73	34.21	10.30
Gross portfolio debt assets to GDP (%)	Mean	12.57	71.01	3.07
	Median	12.67	51.73	2.83
	Standard deviation	.81	80.39	2.14
Number of observations		**3**	**72**	**12**

(2) *LDA model results*

The LDA model was run via the stepwise method on macroeconomic data for the 28 sample countries.[15] The independent variables entered into the model are: financial system deposits to GDP, stock market turnover ratio, outstanding domestic private debt securities to GDP, outstanding domestic public debt securities to GDP, and gross portfolio debt assets to GDP. The dataset included averages for these variables that were calculated across three different time periods, and for a total of 84 observations (excluding the three Israeli observations).

Table 3 displays the results of a one-way analysis of variance (ANOVA) for the differences in the averages between the groups for each of the chosen independent variables. The results show statistically significant differences (at the 5% significance level) between the averages of the "deep market" countries and those of the "non-deep-market" countries for most of the independent variables, except for turnover ratio and outstanding domestic public debt securities to GDP (these indicators are very close to being significant with P-values of 0.052 and 0.057, respectively). The ANOVA results indicate that the difference between the two country groups, with and without deep markets, is expressed mainly on the

[15] We performed a preliminary analysis that estimates the LDA model via the Enter Method, according to which all of the discriminant variables are entered together into the discriminant model. The results showed that the variables with high correlation to the discriminant function are financial system deposits to GDP, and outstanding domestic private debt securities to GDP, while the classification results showed success rates of 89.3 percent. In order to improve the accuracy rate of the discriminant model, we decided to use the Stepwise system, which builds the LDA model iteratively.

financial system deposits to GDP and the outstanding domestic private debt securities to GDP measures (P-value < 0.00), making it reasonable to assume that these are the variables that best discriminate between the groups.

Table 3

The table presents a one-way ANOVA to examine the equality of the averages between the deep market and the "non-deep-market" countries for each of the independent variables. The dataset contains averages that were calculated across the three defined time periods, for 24 “deep market” countries, 4 “non-deep-market” countries (excluding Australia, Slovenia, and Slovakia), and Israel.

	F	df1	df2	Sig.
Financial system deposits to GDP (%)	24.779	1	66	.000
Stock market turnover ratio (%)	3.911	1	66	.052
Outstanding domestic public debt securities to GDP (%)	3.741	1	66	.057
Outstanding domestic private debt securities to GDP (%)	16.667	1	66	.000
Gross portfolio debt assets to GDP (%)	9.132	1	66	.004

All of the financial indicators were entered as independent variables in the LDA model executed on the existing dataset. The LDA results were obtained after two steps via the stepwise method, and included only two independent variables: financial system deposits to GDP (percent), and outstanding domestic private debt securities to GDP (percent). However, the Box's M statistic used to test the variance-covariance matrix equality hypothesis came out highly significant (P-value < 0.00), invalidating the hypothesis. This result was expected due to the great difference in the dispersion values of the “deep market” and the “non-deep-market” countries, especially for the financial system deposits to GDP and the outstanding private debt securities to GDP indicators, as we saw in Table 2.

The linear discriminant function (LDF) obtained is composed of the two variables found to be significant:

(5) $$LDF = -3.196 + 0.021 \cdot Financial\ Systems\ Deposits\ to\ GDP + 0.033 \cdot Outstanding\ Domestic\ Private\ Debt\ Securities\ to\ GDP.$$

The statistical analysis outcomes that appear in Table 4 below suggest the existence of a substantial difference between the average discriminant scores for the classification group centroids. The Wilk's lambda value obtained is highly significant (P-value < 0.000) and indicates the existence of a substantial difference between the discriminant group centroids, and so the model demonstrates a high discriminant level between the countries belonging to the “deep market” group and those that do not belong to this group.

Table 4

This table displays the group centroids of the “deep market” and the “non-deep-market” countries obtained via the LDF, and the Wilk's lambda value for testing the hypothesis that a difference exists between the group centroids. The group centroids are the scores of the various classification groups, which are calculated via the averages of the independent variables in the discriminant model for each classification group separately. The LDF was applied to the dataset, which contains averages calculated across the three defined time periods.

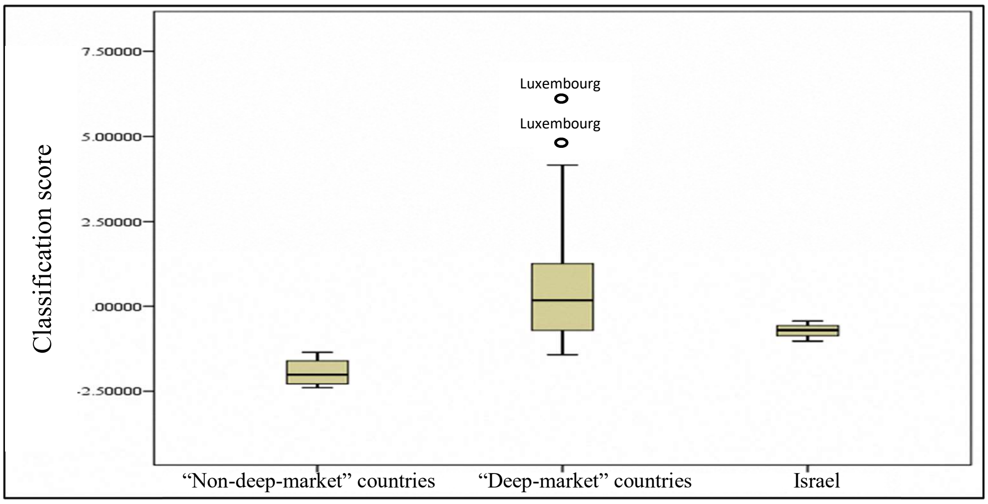
Deep Classifier	Group Centroids	Wilks Lambda	Chi-square	df	Sig.
Not Deep	-1.954	0.543	39.740	2	0.000
Deep	.419				

The LDF's classification adequacy was tested via a classification table that summarizes the percentage of the observations that the LDA model classified correctly compared with their original classifications in the dataset. Results show classification rates of 91.7 percent in the deep market group and 95.7 percent for the non-deep-market group. Overall, 95.1 percent of the observations in the dataset were correctly classified. The high accuracy rate suggests high model adequacy relative to market depth, and therefore, in our view, the model can be used to determine whether out-of-sample observations from countries not in the dataset belong to one of the groups. This assessment will be based on an estimation of the probability of the country's belonging to the deep market group via the discriminant function obtained.

(3) *Out-of-sample examination of Israel*

Based on the LDF estimated, Israel's discriminant score was calculated for the three time periods, with a Mahalonobis distance from the classification group centroids computed for each case in standard deviation terms, according to which the classification probability was calculated. Figure 1 describes a box plot of Israel's discriminant score versus the discriminant score of the observations from the “deep market” country group and the “non-deep-market” group, by means of which one can discern that Israel is much closer to the “deep market” country group and is situated fare above the upper range of the “non-deep-market” countries. In particular, Israel's average discriminant score (-0.705) is far above the 95th percentile of the discriminant score obtained for the “non-deep-market” countries (-2.014). Thus, the likelihood of Israel belonging to the “non-deep-market” country group is small. In addition, it can be seen that two of Luxembourg's observations are outliers: between 1.5 and 3 times the inter-quarterly range assessed for the “deep market” group. Luxembourg's outlier status stems from a highly developed banking system. The country's total average financial deposits to GDP for 2004–11 was 352 percent of GDP. Despite this, we left Luxembourg in the sample, as it does not seriously affect the LDF, and so does not compromise the classification of the other observations in the sample.[16]

Figure 1
Israel's Classification Score Versus the "Deep Market" and the "Non-Deep-Market" Country Groups

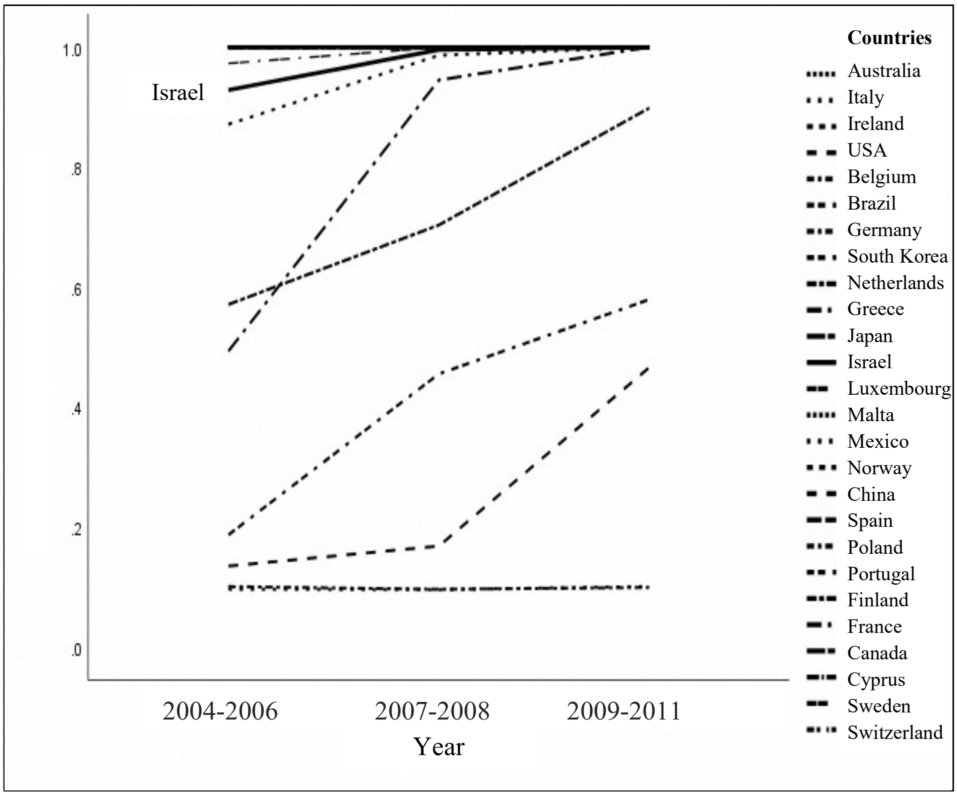


Israel's classification score was calculated via the LDF based on the average figures for financial deposits to GDP and outstanding domestic private debt securities to GDP for Israel, across the three different time periods.

Figure 2 shows the posterior probability of Israel belonging to the "deep market" group across the timeline, compared with the rest of the countries in the sample. One can see that Israel (solid line) is prominently classified in the "deep market" country group; during the real estate boom period (2004–06), Israel's posterior probability is higher than the probability of "deep market" countries such as Italy, Finland, and Norway. This trend also persists during the post-crisis recovery period (2009–11), when Israel's posterior probability is higher than that of Finland, and even than that of the UK, and very close to the posterior probability of Italy, Norway, and Sweden. Numerically, Israel's posterior probability of being included in the "deep market" country group is 93 percent, 98 percent, and 99 percent, respectively, for the three subperiods. The substantial rise in Israel's posterior probability appears to be an outcome of the development and deepening of the domestic private bond market, as well as the development of Israel's financial institutions.

[16] We examined another LDA model that included the sample countries without Luxembourg. The LDF obtained was similar to the present LDF, and cross-validation of the observations via the leave-one-out method showed the same classification outcomes.

Figure 2
Posterior Probability of the "Deep Market" Group Along the Timeline



The graph describes the posterior probability of classification in the "deep market" country group across the timeline, in a comparative cross-section of the 28 sample countries, and Israel. The posterior probability of each observation is calculated based on the Mahalonobis distance of the observation's discriminant score from the "deep market" country group centroid.

g. Section summary and main conclusions

In general, the discriminant function suggests that Israel has the highest possible probability of being classified in the "deep market" country group, with a major strengthening trend during the period 2004–11. We discovered that this trend is observed as the result of a substantial deepening of activity in Israel's domestic private debt securities market, which more than doubled during this period. We also saw that, along with the growth in the private debt securities market, there was an increase in Israeli financial system deposits (though not of the same order of magnitude), and there is still a very large gap between the development level of Israel's financial institutions and their counterparts in the "non-deep-market" countries. In the absence of a practical definition for establishing the existence of a "deep market" per IAS-19, we estimate that one can use the classifying DA model in order to determine whether a particular country would likely be classified as a "deep market" country per IAS-19, and thereby help to clarify the standard.

C. CREDIT RISK AND LIQUIDITY PREMIUM

In this section, we look at market depth in terms of the liquidity of Israel's high-quality corporate bonds. We use the model described by Duffie and Singleton (1999), who showed that the spread between the yield of a risky bond (corporate bond) and a government bond supports the following equality:

$$R - r = PD \cdot LGD + Liq \tag{6}$$

where R is the yield to maturity of a corporate bond (or, in general, any risky bond), r is the yield to maturity of a government bond, PD is the probability of default of the bond issuer over a given horizon (generally a year), LGD is the loss in percentages for the bond holder out of the nominal value in the case of a loss given default (Loss Given Default), and Liq is the liquidity premium.[17] Hence, the spread observed in the market (R-r) is equal to the product of PD · LGD, which reflects the net credit risk premium, and another premium that the bond holder requires due to the asset's illiquidity (Liq). Many articles, such as those by Longstaff, Mithal, and Neis (2005), Liu, Longstaf, and Mandell (2006), and Acharya, Amihud, and Bharath (2013) show that liquidity is indeed priced in to corporate bond yields.

Other studies show that the liquidity premium in the bonds market varies over time, with business cycles. For example, Bao, Pan, and Wang (2011) and Dick-Nielson, Feldhutter, and Lando (2012) demonstrate that the liquidity effect on the observed spread increases dramatically at times of financial crisis, especially for low-quality bonds. Friewald, Jankowitsch, and Subrahmanyam (2012) showed similar findings affirming the macroeconomic impact on bond market liquidity. A comparison of the liquidity premium between assets, between markets, and across different time period teaches us about the varying price of illiquidity; accordingly, the use of liquidity indicators shows us how and to what extent the economic price of market depth varies between assets and over time.

One groundbreaking study on measuring liquidity in the financial markets is that of Yakov Amihud (2002), who developed a measure for assessing the illiquidity of an asset based on market data. This measure, called ILLIQ, has become one of the most important and commonly used indicators worldwide in the study of financial market liquidity. Originally, the ILLIQ was computed as follows:

[17] The LGD is sometimes supplemented by the recovery rate (RR) – the percentage of the nominal value that the bond holder receives in the event of default, calculated as RR=1-LGD. The LGD varies depending on the asset's attributes.

(7)
$$ILLIQ_{i,M} = \frac{1}{D_{i,M}} \sum_{t=1}^{D_{i,M}} \frac{|R_{i,t,M}|}{VOL_{i,t,M}},$$

where $D_{i,M}$ is the number of days in Month M in which Asset i was traded, $|R_{i,t,M}|$ is the absolute rate of return of Asset i on Day t in Month M, and $VOL_{i,t,M}$ is the trading volume in dollars of Asset i on Day t in Month M. Intuitively, the index measures the impact of the trading volume in the denominator on the return in the nominator. Thus, the ILLIQ is a measure of price impact. This concept is similar to Albert Kyle's model (Kyle 1985).

a. Estimating the liquidity premium

There are different approaches to estimating the liquidity premium. We adopted the analysis method employed by Dick-Nielsen et al. (2012) in order to facilitate a comparison of the premium reported in their article in time periods similar to those in which we examined the Israeli market. According to this approach, the dependent variable is the bond's yield spread from the government yield curve at the time of estimation, and the independent variables include a control for the bond attributes, along with a liquidity element. The time-series regression is as follows:

(8) $$Spread_{i,t} = \alpha + \sum_{j=1}^{J} \beta_j X_{j,t} + \varepsilon_{i,t},$$

where $Spread_{i,t}$ is the spread between the yield to maturity of Asset i in Month t and interest rate swap; $X_{j,t-1}$ is a vector of $j = 1,2,..,J$ explanatory factors, and β_j are the regression coefficients of these factors. Some of the factors can be specific to Bond i, but not necessarily (Equation 1 in the Dick-Nielsen, Feldhutter, and Lando article). We distinguish between the corporate and the government bonds, and between bonds with and without consumer price index linkage. Following is a discussion of the independent variables in the regression:

Bond rating is measured in terms of the numerical value of the rating of each bond i in month t, $RATE(k)_{i,t}$ as calculated per Table 5, where the indexation base is marked $k=\{I,NI\}$, for the indexed bonds and the unindexed bonds. If the bond rating changed over the course of the month, the average was calculated. This variable estimates the bond's credit risk, which is negatively correlated with the bond's yield to maturity. Most of the cases in the dataset received a Maalot S&P rating, so we chose to use this rating as representative of the bond's credit risk, while missing values were replaced by Midroog-Moody's rating data, which were converted as shown in Table 5. We assigned serial numbers to the bond rating values per the following code: A=3, AA=2, AAA=1, regardless of the "+" or "-" signs in the main ratings.

Table 5
Midroog-Moody's and Maalot S&P Corporate Bond Ratings Mapping Table.
The dataset contains 341,840 records of daily frequency data for tradable corporate and government bonds during the period 2004–14

Classification	Maalot (S&P)	Moody's
Highest quality	AAA	Aaa
High quality	AA+	Aa1
	AA	Aa2
	AA-	Aa3
Medium-high quality	A+	A1
	A	A2
	A-	A3

DUR is the average duration of bond i, indexed or unindexed, during month t $DUR(k)_{i,t}$. High-DUR bonds are usually less liquid, as they are generally bought by "buy-and-hold" investors for long-term investment (Friewald et al. 2012), and we would therefore expect to find that the spread and the liquidity premium increase along with DUR.

In order to compute the liquidity factor, we first calculated measure based on a slightly different version of Amihud's ILLIQ, as follows:

(9) $$Illiq_{i,t} = \frac{1}{N_{i,t}} \sum_d \log\left(1 + \frac{|R_{i,d,t}|}{Vol_{i,d,t}}\right)$$

where $Illiq_{i,t}$ is the average illiquidity measure for bond i in month t, calculated as an equal-weight average of the ratio between the absolute value of the bond yield on day d $(R_{i,d,t})$ and the trading volume, in millions of shekels $(Vol_{i,d,t})$, measured across $N_{i,t}$ trading days for the bond over the month. This version (Karolyi et al. 2012) of the ILLIQ is intended to moderate the impact of outlying observations on the measure, and thus should facilitate a more reliable estimate than the original measure.

The liquidity factor was calculated by sorting the average monthly liquidity measure, $Illiq_{i,t}$ for all of the bonds traded that month, from the highest to the lowest value, separately for each CPI sector. The assets for which $Illiq_{i,t}$ computation was possible were divided into two equal parts, and the difference between the average yield to maturity for all high illiquidity bonds (H) and the average yield of all low illiquidity bonds (L) was measured. Essentially the illiquid minus liquid factor, IML, was measured here, in a manner similar to Amihud, Hameed, Kang, and Zhang (2015). Therefore, $IML(k)_t$ directly measures the liquidity premium.

Following Fama and French (1993), we created two corporate bond pricing factors, TERM and DEF, which catch unexpected changes in the term structure and credit risk.
$TERM(k)_t$ is the average of the difference in the yields to maturity (in annual terms) between long-term government bonds (Shahar/Galil) traded in month t, and short-term government bills (*Makam*) in the same month.[18]
$DEF(k)_t$ is the average of the difference in the yields to maturity (in annual terms) between low-rated corporate bond series traded in month *t*, and government bond series in the same month. Because the database contains short-term and long-term corporate bonds, the yield to maturity of the government bonds was computed per the yield average between *Makam* and long-term government bonds, so as to obtain an average duration similar to that of the corporate bonds. The DEF variable thus catches the insolvency risk premium.

We are interested in comparing the different types of bond and the different time periods; we therefore performed a time-series regression that will enable us to assess the degree to which the various factors contribute to the spread of the indexed and unindexed bonds separately, marked $Y(k)_{i,t}$. Again, we are performing the regression per Dick-Nielsen, Feldhutter, and Lando (2012), with the explanatory factors available to us for the Israeli market.

$$(10)\quad Y(k)_{i,t} = \alpha_k + \beta_{i,TERM(k)} TERM(k)_t + \beta_{i,DEF(k)} DEF(k)_t + \beta_{i,RATE(k)} RATE(k)_{i,t} + \beta_{i,DUR(k)} DUR(k)_{i,t} + \beta_{i,Liq(k)} IML(k)_t + \varepsilon_{i,t}$$

b. The dataset

The dataset was obtained from the Israel Securities Authority, and contains daily trading data for all corporate bonds rated A- and above by one of the two rating agencies, Maalot S&P and Midroog-Moody's, and for all government bonds traded in Israel during the period January 2004–January 2014.[19] The dataset contains general data on the bonds, such as company number, bond serial number and issue data; it also contains daily trading data, such as closing price, nominal value, adjusted nominal value, gross yield to maturity, average duration, market value, and daily trading volume, along with categorical variables that describe the bond rating data and the sector to which the bond belongs.[20] The dataset contains a total of 341,813 records, 105,408 of which are records for 224 tradable government bonds (Makam, Shahar and Galil), and 236,405 of which are records for 258 tradable corporate bonds issued by 67 different firms.

Based on the existing dataset, we built a secondary dataset so that we could examine alternative measures of illiquidity. We looked at the percentage of bond "zero-trading days" in month *t*, the average daily trading volume of the bonds over the month, the average daily

[18] The daily yield average was calculated across bond series with durations above the 75th percentile.
[19] The dataset does not include bonds with special elements such as convertible bonds, variable-rate bonds, currency-linked bonds, redemption-by-installment bonds, or callable bonds.
[20] The sectors are: indexed government bonds (Galil), unindexed government bonds (Shahar), indexed corporate bonds, and unindexed corporate bonds.

yield of the bonds over the course of the month, and the average of Amihud's daily liquidity measure observed in that month per Equation (7). These data are calculated as an equal-weight average across the bond's trading days within the month. We restrict the monthly dataset to bonds with more than five trading days during the month, with a daily trading volume of over NIS 10,000, as well as tradable bonds during the period from a month after issue to a month before redemption, as illiquidity levels are anomalous at the extremes.[21]

During the sample period, major changes took place in the structure of the market, and the subprime crisis occurred, evolving into a financial crisis. As in the study by Friewald et al. (2012), we chose to control for the impact of the financial crisis through separate analysis of the following time periods: (1) the period before the subprime crisis (2004–06); (2) the subprime crisis period (2007–09); and (3) the post-crisis recovery period (1/2010–1/2014).

c. Descriptive statistics

Table 6 shows the average and standard deviation values for yield to maturity, duration, trading volume, and market value of all tradable government bonds (except for Makam) and corporate bonds, sorted by rating and CPI indexation sector; it also shows the number of observations, the number of series traded, and the number of issuing companies. One can see that a disparity exists in the number of tradable series and the number of issuing companies between the indexed corporate sector and the unindexed sector for each rating level, which suggests higher trading activity in the indexed sector than in the unindexed sector. As expected, the corporate bonds' yield to maturity rate declines as rating rises, for both indexed and unindexed bonds, except in the case of the AAA rating, where the rating appears to have been lowered after high yields were recorded (it is likely that the yield on the indexed bonds is real, while the yield on the unindexed bonds is nominal). Most of the durations of the unindexed corporate bonds ranged from 3.98–4.64 (except for the A rated), while in the indexed sector they are generally longer at the corresponding rating level. The average daily trading volume in the indexed sector ranges from NIS 1.52 million to NIS 2.64 million, higher than the non-indexed sector across all rating levels. A similar trend was also observed on the market value measure, which rises over a billion NIS in most rating groups in the indexed corporate sector, versus a range of NIS 160–800 million in the non-indexed sector. Panel B shows a similar trend for the indexed bonds, with their trading volume and market value substantially higher than those of the unindexed bonds. We can also discern a major gap in the activity levels of government and corporate bonds, expressed in the average trading volumes and market values of each CPI sector.

[21] Similarly, Dick-Nielson et al. (2012) filtered retail size transactions in order to avoid possible bias in the estimation of the liquidity premium, and Friewald et al. (2012) expect that bonds issued recently or on-the-run will have higher liquidity. This filtering leaves us with 318,403 daily trading records, including 224,315 daily trading data for 245 tradable corporate bond series issued by 63 different companies.

Table 6

This table displays average and standard deviation (in parentheses), daily trading data (yield to maturity, duration, trading volume, and market value), and summarizes the number of observations, the number of series, and the number of issuing companies per CPI sector and bond rating. The dataset contains 341,840 records for all government and corporate bonds traded during the period 1/2004-1/2014.

Panel A: Unindexed Bonds

Measure	Bond Rating												Shekel Bonds (Shahar)	
	AAA		AA+		AA		AA-		A+		A			
Yield to maturity (%)	(2.11)	6.39	(1.75)	4.15	(1.61)	4.63	(2.1)	4.79	(1.14)	4.45	(7.14)	13.23	(1.28)	2.71
Duration (years)	(1.55)	4.64	(1.67)	3.98	(1.73)	4.44	(1.9)	4.54	(1.93)	4.51	(0.72)	2.73	(4.16)	4.94
Trading volume (NIS million)	(6.84)	0.7	(4.23)	2.04	(5.47)	2.89	(3.17)	1.41	(3.72)	1.93	(1.11)	0.62	(51.7)	28.76
Market value (NIS billion)	(0.28)	0.23	(0.55)	0.70	(0.65)	0.80	(0.43)	0.50	(0.36)	0.81	(0.1)	0.16	(6.93)	6.14
No. of records	**2,972**		**11,646**		**12,575**		**15,814**		**6,606**		**152**		**52,878**	
No. of series (companies)	**7 (4)**		**19 (8)**		**28 (16)**		**33 (24)**		**11 (8)**		**3 (2)**		**66 (2)**	

Panel B: Indexed Bonds

Measure	Bond Rating												Indexed Bonds (Galil)	
	AAA		AA+		AA		AA-		A+		A			
Yield to maturity (%)	(1.2)	3.63	(1.56)	2.94	(1.93)	3.38	(2.29)	3.39	(1.85)	3.04	(6.91)	9.53	(1.47)	4.32
Duration (years)	(2.31)	4.43	(2.21)	4.45	(2.2)	5.05	(2.15)	4.77	(2.1)	5.1	(1.53)	4.38	(2.97)	4.88
Trading volume (NIS million)	(7.68)	2.64	(9.58)	2.93	(7.99)	3.22	(6.25)	1.97	(5.57)	2.56	(4.01)	1.52	(113.1)	116.1
Market value (NIS billion)	(1.36)	1.06	(1.11)	1.06	(1.07)	1.10	(0.87)	0.75	(0.58)	1.03	(0.33)	0.56	(5.45)	12.74
No. of records	13,821		34,101		63,075		60,890		13,800		953		23,520	
No. of series (companies)	24 (5)		44 (10)		101 (35)		104 (48)		25 (14)		17 (6)		26 (1)	

Table 7 displays descriptive statistics across the monthly averages calculated for each of the tradable bond series in a cross-section of the different time periods: before, during, and after the subprime crisis. Table 7 summarizes the differences in median, mean, and standard deviation for each of the variables, and describes the main trading characteristic differences during each of the time periods. The median value of Amihud's illiquidity measure shows a substantial decline between the time periods for the government bonds, and in particular for the corporate bonds, which constitutes evidence of a rise in the market's liquidity level and a deepening of this market. To illustrate, the ILLIQ measure for corporate bonds dropped from a value of 0.0132 during the pre-crisis period (2004–06), reflecting a price impact of 1.32 percent (for a million-shekel transaction), to a value of just 0.0023 during the post-crisis period (2010–14). For government bonds there is also a substantial decline, from 0.0013 in the pre-crisis period to a value of close to zero in the post-crisis period, reflecting the impact of negligible trading on the bond price. The ILLIQ decline is also reflected in a major drop in the measure's average value and standard deviation, thereby supporting the market-deepening trend expressed by the median value.

The average and median of the monthly average trading volume point to a deepening of the Israeli market, with government bonds indicating a major upward trend in trading volume, from a median value of NIS 7.68 million during the pre-crisis period to NIS 45.08 million and NIS 62.37 million, respectively, in the two subsequent periods. The considerable increase in average trading volume, especially during 2007–09, appears to be an outcome of the reforms instituted in the years 2005–06, as noted above. The median value of the average trading volume in corporate bonds shows a rise of over 60 percent during the period in question, from NIS 0.91 million before the crisis to NIS 1.47 million during the post-crisis period, thus highlighting a market-deepening process.

Table 7 also shows high variability in the average duration of government bonds (standard deviation of 2.83 in the pre-crisis period versus 4.67 after the crisis), stemming from differences between the short-term bond series (*Makam*) and the long-term ones (Shahar/Galil), though no significant differences exist in the bond series' median and average values between the time periods. For the corporate bonds, there is a drop in the average duration between the periods, which describes an upward trend in the issuing of shorter-term bond series at the expense of long-term ones. Duration variability did not change substantially over time.

The median and average values for the percentage of "zero-trading" days over the month indicate a major decline during the periods in question, both for government bonds (from an average of 16.75 percent before the crisis to 0.005 percent after the crisis), and for corporate bonds (from an average of 30.25 percent to 5.35 percent, respectively). The increased market trading activity is meaningfully expressed in the corporate bond market: during the period 2004–06, about half of the most active bond series (over 5 trading days per month) were still not being traded for more than 22 percent of the monthly trading days, while in subsequent years the median value dropped to near-zero. That is, during this period there were almost no days when the various bond series were not traded. By comparison, Dick-Nielsen et al. (2012) report a median value of 60.7 percent on the zero-trading measure calculated for tradable bonds in the American OTC market, though they filtered out private investor trading.

Table 7

Table 7 presents median, average, and standard deviation for the Amihud measure, average trading volume, average duration, and percentage of days with no price change, measured for all government and corporate bonds rated A and above over each month. A segmentation by each of the time periods is displayed: pre- crisis (2004–06), during the subprime crisis (2007–09), and post-crisis (1/2010–1/2014)

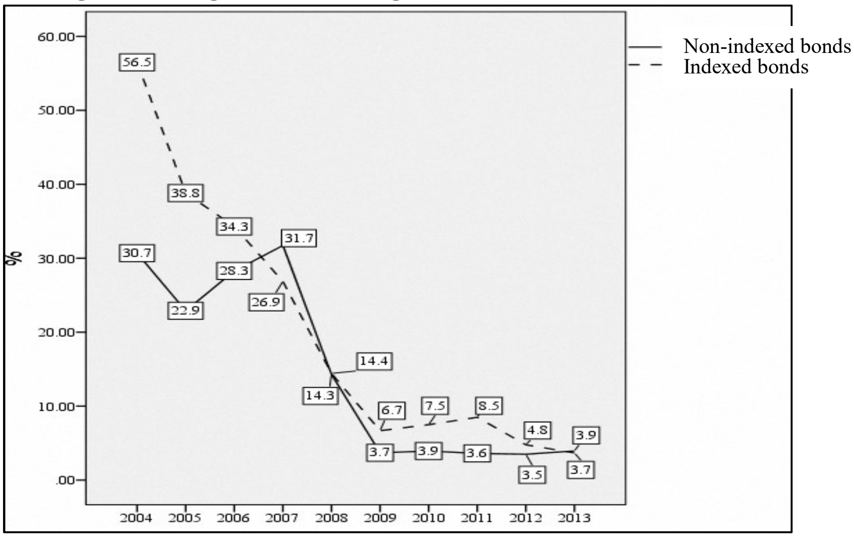
Variable	Indicator	Corporate Bonds			Government bonds		
		1-2010/2014	2007–09	2004–06	1-2010/2014	2007–09	2004–06
Amihud measure average (change for each million NIS)	Average	.0121	0.0345	.0235	0.0001	0.0022	.0123
	Median	.0023	.009	.0132	.0000	.0000	.0013
	Standard deviation	.0272	.0806	.0446	.0003	.0088	.0282
Average daily trading volume (NIS million)	Average	2.63	2.85	2.08	74.39	70.38	24.39
	Median	1.47	1.49	.91	62.37	45.08	7.68
	Standard deviation	3.67	3.99	3.40	58.80	81.19	35.27
Average duration (years)	Average	4.31	5.08	5.37	4.55	3.91	3.57
	Median	4.06	5.16	5.27	2.97	2.63	2.98
	Standard deviation	1.97	2.18	1.98	4.67	3.92	2.83
Percentage of zero-trading days (%)	Average	5.35	13.91	30.25	.00	2.23	16.75
	Median	.00	.00	22.73	.00	.00	.00
	Standard deviation	13.41	22.32	29.14	.00	8.24	22.29
No. records		**5,404**	**3,898**	**1,407**	**1,551**	**1,265**	**1,746**

Figure 3 describes the development over time of the annual average, across the months of each year separately, for the annual percentage of "zero-trading" days and for the monthly average of Amihud's illiquidity measure. The averages were calculated each month for each corporate bond series, and then an equal-weight average was calculated across the indexed and unindexed series separately. In 2004, the average number of "zero-trading" days per month was 30.7 percent in the indexed sector, and 56.5 percent in the unindexed sector, versus average values of 3.9 percent and 3.7 percent for 2013, respectively. One can also discern that, during the credit crisis period, there was a temporary rise in the percentage of "zero-trading" days of unindexed bonds, though the indexed bonds showed a continuous drop on this parameter.

Figure 3

Time development of the average percentage of zero-trading days over a month, and of the monthly illiquidity measure average for corporate bonds

Average Percentage (Zero Trading)



Average Amihud Illiquidity Measure (Illiq)

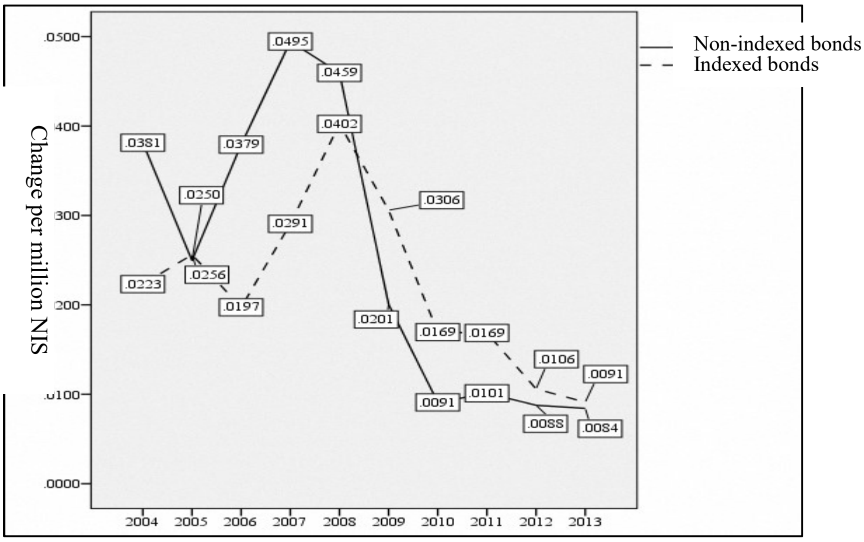


Figure 3 shows that the average illiquidity measure has been declining over the years, for both indexed and unindexed bonds, except for a temporary rise in illiquidity during the credit crisis period (2007–09). The average monthly illiquidity measure calculated for 2013 is 0.0091 for CPI-linked bonds and 0.0084 for unindexed bonds (reflecting a bond price impact of 0.91 percent and 0.84 percent for a million-shekel transaction), which are close to the average value of 0.5047 percent reported in Friewald et al. (2012), and which was calculated over the period preceding the subprime crisis (February 2006 to June 2007) for quality, investment grade bonds. The current data for 2013 indicate a relatively high liquidity level and trading frequency in the Israeli corporate bond market. It is worth noting that Abudy and Wohl (2017) affirm the present study's findings, according to which the liquidity of Israeli bonds is similar and even preferable to that of some American bonds, the main reason, according to them, being the involvement of "small" investors in the continuous trading practiced in Israel, as opposed to the OTC market for bonds in the US and most of the world.

d. The liquidity premium on Israeli high-quality bonds

The results set forth below were converted to a premium computation for each of the yield-to-maturity explanatory factors, according to the time and asset group cross-sections examined. The discussion will focus mainly on the size of the Israeli liquidity premium and its comparison to “deep market” countries in the sample period, 2010/11–2014.

(1) *The indexed sector*

Table 8 displays the premiums for each of the factors that determine the yield to maturity for high-quality bonds in the indexed sector. One should note that the premium sum in each row produces the average yield to maturity for that period. For example, the average yield to maturity for all bonds in the high-quality rating group, A (which includes assets rated AA- and above) between January 2010 and January 2014 was 2.58 percent, of which the illiquidity premium was 6 basis points, and statistically significant (t=2.37). This finding attests to a relatively low premium, similar to the premiums found in the US, as will be seen below.

Table 8

This table provides the cross-section regression coefficients calculated on bonds rated A and above in the indexed shekel sector, and the liquidity gap by median. The dataset contains 2,379 monthly records for 51 CPI-indexed Galil government bonds, and 8,419 monthly records for indexed tradable corporate bonds issued by 59 different companies and traded during the period January 2004–January 2014

Variables	t-stat			Coefficients		
	2004–06	2007–09	2010–1/2014	2004–06	2007–09	2010–1/2014
Intercept	1.46	-0.43	-10.2	0.75	-1.22	-4.45
TERM	-13.41	-3.69	-17.0	0.26	-0.29	-0.58
DEF	7.90	10.65	16.27	0.26	3.07	0.72
RATE	1.79	-1.72	-5.13	0.00	-0.03	-0.03
DUR	5.18	1.45	15.81	2.66	3.92	6.87
ILLIQ	-9.12	0.79	2.37	-0.11	0.2	0.06
Total Yield (%)				3.85	5.67	2.58
R^2 (%)	17.9	26.8	13.9			

The illiquidity premium during the crisis period was 30 basis points, though this finding was not significant; during the real estate boom period of 2004–06 the illiquidity premium was found to be negative. This finding indicates a difference, contrary to what was expected, between the highest and the lowest medians for the illiquidity measure. A possible explanation for this is that the yield to maturity of the bonds included in each half were affected by other factors, such as the bonds' rating (which was not found to be significant).[22] Accordingly, we hypothesize that a relatively low rating for the more liquid half (characterized by high yields to maturity) relative to the less liquid half is what caused the negative difference. A case such as this can occur when bonds that are low-rated (though still within the A group) are traded intensively and thereby become liquid, despite their low average credit rating.

Table 9

Average illiquidity measure and percentage of "zero trading days" over the month, indexed sector. The dataset contains 8,419 records for 183 CPI-indexed corporate bonds issued by 59 different companies that were traded over the period between January 2004 and January 2014.

[22] The correlations between the explanatory factors did not generally exceed 50 percent, and were, for the most part, substantially lower than that. Alternative regressions were also examined, such as the use of extreme quarters as an explanatory factor for liquidity, weighting the observations with each bond's market value, with and without omitting anomalous observations. The results were not essentially different from those reported here.

Variable	Period	Corporate Bonds					
		AAA	AA+	AA	AA-	A+	A
Average Amihud measure (change for each million NIS)	2006–2004	.0272	.0222	.0205	.0218		
	2009–2007	.0333	.0282	.0312	.0401	.0759	
	1/2014–1/2010	.0008	.0044	.0122	.0200	.0088	.0062
Percentage of zero trading days (%)	2006–2004	32.59	33.70	32.66	22.83		
	2009–2007	21.08	14.64	12.83	12.63	11.41	
	1/2014–1/2010	0.00	1.07	5.44	10.23	2.25	.03
No. records	2006–2004	90	510	330	303	0	0
	2009–2007	471	491	1379	943	35	0
	1/2014–1/2010	32	588	1216	1433	575	23
Total records		**593**	**1589**	**2925**	**2679**	**610**	**23**

In order to test the impact of the bond's rating on illiquidity, we examined the average illiquidity measure and the average number of zero trading days across the monthly dataset for each of the rating groups in periodic cross section. Table 9 indicates that the illiquidity measure average for AA- rated bonds during the period 2004–06 was lower than for the AA+ rating (0.0218 versus 0.272). We also find that the trading frequency for this rating was higher (percentage of zero trading days of 22.83 percent, versus 33.7 percent). This trend, as noted, reverses itself in the subsequent periods, especially during 2010–14, a period characterized by higher trading frequency and higher liquidity as a function of the bond rating. The lack of significance of bond rating in explaining the yield to maturity, along with the finding of high trading activity in the lower quality bonds in Group A, is consistent with the sense of euphoria and the disregard for risk that characterized the Israeli bond market during the pre-crisis period.

(2) *The unindexed sector (the shekel sector)*

The other sector examined here, though its importance is marginal in light of its relatively low weight in the asset portfolio of the institutional entities and of the Israeli public as a whole, and given its relatively low share of trading in the corporate bond market (27 percent of the monthly trade dataset value), is the unindexed sector (the shekel sector), at all A level investment ratings. A priori, it is reasonable to assume that this sector is less liquid than the indexed sector, given that it is significantly smaller. Table 10 below displays the results of a regression similar to the previous one, only for this one the independent variable DEF was calculated relative to AA rated bonds, and the illiquidity factor gap was computed on differences between averages of the 75th percentile and the 25th percentile basis, instead of the two halves.

As before, the findings show that, here as well, the liquidity premium during the first period, 2004–06, is not significant. In contrast, in the crisis period the liquidity premium jumped to 123 basis points and was found to be significant (t=3.27). After the crisis, during the period 1/2010-1/2014, the liquidity premium remained statistically highly significant (t=6.59), but declined substantially to a level of 24 basis points.

Interestingly, the rating of the bonds in the shekel sector was found to be insignificant in all three periods, despite the fact that the DEF factor attests to a significant credit risk premium. A possible explanation for this is a not-high correlation between ratings and the spread observed in the market, as this spread is a function of the probability of insolvency, the recovery rate, and the liquidity premium. Because the liquidity premium proved to be significant in the other two periods, and the credit risk was also found to be significant per the DEF factor, it is likely that the rating is not an accurate and/or up-to-date reflection of the liquidity premium, the recovery rate, or the probability of insolvency as they are expressed in the market price.

Table 10

This table displays the cross-section regression coefficients calculated on bonds rated A or higher in the shekel sector, and the liquidity gap per estimates between the 75th percentile and the 25th percentile. The dataset contains 1,091 monthly records for 24 unindexed government bonds (Shahar), and 2,290 monthly records for 62 unindexed tradable corporate bonds issued by 35 different companies and traded during the period between January 2004 and January 2014.

Variables	t-stat			Coefficients		
	2004–06	2007–09	2010–1/2014	2004–06	2007–09	2010–1/2014
Intercept	-0.09	1.78	8.6	-0.24	7.85	4.00
TERM	-0.43	-1.37	5.45	-0.25	-1.48	1.71
DEF	1.92	4.98	17.84	-0.49	2.45	0.71
RATE	-0.47	-0.93	0.74	0.00	-0.02	0.00
DUR	2.16	-0.86	-4.84	6.54	-3.21	-2.49
ILLIQ	0.93	3.27	6.59	0.06	1.23	0.24
Total Yield (%)				5.62	6.83	4.17
R^2 (%)	6.7	14.8	25.8			

e. International comparison

In light of the above findings, the question arises of whether the corporate bonds traded on the Israeli market can be considered "high-quality" for purposes of IAS-19 (in the micro sense). In order to answer this question, we compare the Israeli liquidity premiums to the premiums reported in the literature on the American market, apparently the world's deepest market. It should be noted that determining a criterion for comparing the Israeli liquidity premium to those of countries considered to have deep markets is consistent with the strict IFRIC interpretation for setting an absolute comparison measure for HQCB classification[23], as measuring the liquidity premium is absolute, not relative. In a sense it is similar to the idea that a bond with an international rating of AA+ or over is considered high-quality. This

[23] IFRIC noted that 'high quality' as used in paragraph 83 of IAS 19 reflects an absolute concept of credit quality and not a concept of credit quality that is relative to a given population of corporate bonds

interpretation is stringent, as there can be no doubt that the standard refers to the local rating, and the term "absolute," as it is understood, refers to a nominal measure of quality, and not to a relative measure.

Table 11 was taken from the Dick-Nielsen et al. article (2012, Table 4), in which research was carried out on 5,376 bonds traded on the US OTC market; as with the sample we used, callable bonds, convertible bonds, and bonds with other attributes that could potentially affect pricing were not included. Panel A displays the average liquidity premium between the first quarter of 2005 and the first quarter of 2007, before concerns about the real estate bubble began to permeate the capital market. The table shows that the liquidity premium of bonds rated BBB, approximately equivalent to the Israeli rating AA, for a redemption period longer than five years, was 4.7 basis points.[24] Similar but shorter-term bonds of 2–5 years paid a liquidity premium of 4.0 basis points. A-rated bonds paid premiums of 2.5 to 3.2 basis points.

Table 11
US Liquidity Premiums Before and After the Crisis, Basis Points
Panel A: Pre-subprime crisis (2005:Q1–2007:Q1)

Rating	Liquidity Component (basis points)			Number of Observations		
	0–2 years	2–5 years	5–30 years	0–2 years	2–5 years	5–30 years
AAA	0.6	0.9	1.1	162	178	193
AA	0.7	1.0	1.3	704	667	498
A	1.5	2.5	3.2	1540	1346	1260
BBB	2.8	4.0	4.7	517	270	553
Spec	45.0	44.0	83.9	270	324	480

Panel B: Post-subprime crisis (2007:Q2–2009:Q2)

Rating	Liquidity Component (basis points)			Number of Observations		
	0-2 years	2-5 years	5-30 years	0-2 years	2-5 years	5-30 years
AAA	2.5	4.5	79	110	149	155
AA	23.5	37.1	64.7	493	572	483
A	26.6	51.0	74.5	762	878	890
BBB	64.3	115.6	98.1	123	159	256
Spec	123.6	224.0	242.7	133	129	201

Source: Dick-Nielsen et al. (JFE 2012, Table 4)

Panel B shows that at the height of the crisis, between the second quarter of 2007 and the second quarter of 2009, the BBB rated bond premium surged to 98.1–115.6 basis points, with the shortest-term bonds paying the highest premium, contrary to the rest of the findings. A-

[24] We performed a t test of the difference between the Israeli premium, 6 basis points, and the American premium, 4.7 basis points, which due to the lack of data was taken as a fixed value. The difference was found to be non-significant; one may not, therefore, reject the null hypothesis regarding the equality of the premiums. $t_{st} = \frac{\hat{\beta}-\beta_0}{s.e(\hat{\beta})} = \frac{0.06-0.047}{0.025316} = 0.5135$

rated bonds paid 51–74.5 basis points, while even AA-rated bonds paid liquidity premiums of 37.1–64.7 basis points, depending on the maturity date.

Table 12, also taken from the Dick-Nielsen et al. article (2012, Table 5), shows the liquidity premium rate as a percentage of spread in the pre-crisis (Panel A) and during the subprime crisis (Panel B). Results show that the liquidity premium as a percentage of spread is estimated at 4–11 percent of the total spread for bonds rated between BBB and AA before the crisis, but that these shares rose to 26–42 percent during the crisis.

A comparison of the Israeli liquidity premium to that of the US suggests that the liquidity premium in the indexed sector between 1/2010 and 1/2014, which was 6 basis points, provides a rationale for considering the Israeli indexed sector to be a "deep market". The liquidity premium as a percentage of spread during the period 1/2010–1/2014 was 7.8 percent, similar to the range measured in the US market (4–11 percent). The finding that the crisis-period liquidity premium was 20 basis points in this sector indicates that the market was deep compared with the US market, where the liquidity premium as a share of spread was 26–42 percent during the same period. According to this indicator, the Israeli market was more liquid than the US market during the crisis, in light of the fact that the US market was the source of the crisis and the main focus of concern. It is thus reasonable to assume that, during this period, US investors demanded a higher liquidity premium than that required by Israeli investors.

Table 12

US Liquidity Premium Before and After the Crisis, Percentage of Spread

Panel A: Pre-subprime crisis (2005:Q1–2007:Q1)

Rating	Liquidity Component (basis points)							
Maturity Fraction in pct.	0–1 years 3	1–2 years 7	2–3 years 13	3–4 years 13	4–5 years 13	5–8 years 11	8–10 years 8	10–30 years 10
Number of Observations	1596	1613	1241	891	641	1187	578	1218
Rating Fraction in pct.	AAA 3	AA 4	A 11	BBB 8	Spec 24			
Number of Observations	533	1869	4148	1340	1075			

Panel B: Post-subprime crisis (2007:Q2–2009:Q2)

Rating	Liquidity Component (basis points)							
Maturity Fraction in pct.	0–1 years 11	1–2 years 20	2–3 years 23	3–4 years 27	4–5 years 31	5–8 years 44	8–10 years 33	10–30 years 43
Number of Observations	809	819	675	657	556	817	568	598
Rating Fraction in pct.	AAA 7	42	26	29	23			
Number of Observations	414	1549	2533	539	464			

Source: Dick-Nielsen et al. (JFE 2012, Table 5).

The data we saw in Table 10, in the shekel sector analysis, indicate that the Israeli liquidity premium in the non-indexed sector was 24 basis points during the period 1/2010–1/2014, and 123 basis points during the crisis, in 2007–09. A 24-basis-point premium in the last period of the sample is higher than the premium measured in the US market, where, as noted, bonds rated A to BB paid liquidity premiums of 2.5–4.7 basis points with durations similar to the Israeli bonds.[25] To compare, the premium for speculative grade bonds in the US during the pre-crisis years was 44.0–83.9 basis points. It thus appears that, though the liquidity of the shekel corporate bonds is preferable to that of the speculative grade bonds, they cannot be considered high quality for "deep market" purposes per this criterion. If we look at an alternative criterion, the liquidity premium as a percentage of spread, which was 77 percent during the crisis period and 32 percent in the last period, then in both periods this percentage is higher than that measured in the US, 26–42 percent during the crisis and 4–11 percent during the recovery period. One cannot, therefore, maintain that the shekel sector itself satisfies the conditions of a "deep market".

C. CONCLUSION

This work aimed to determine whether Israel has a "deep market" for high-quality corporate bonds, as defined by International Accounting Standard 19 (IAS-19). Our examination looked at two aspects of the term "deep market": the macroeconomic aspect, which relates to the financial system's ability to provide liquidity to the real sector, and the microeconomic aspect, which relates to the size of the liquidity premium in Israel's corporate bond market. Our macroeconomic assessment was carried out on the basis of World Bank data, compared with similar data for the group of countries determined to have deep markets and the group of countries determined not to have deep markets. The macroeconomic assessment was conducted based on the basis of daily trading data (monthly average) for corporate bonds between early 2004 and early 2014, classified in terms of linkage sectors and ratings.

The macroeconomic analysis suggests that Israel should unequivocally and definitively be classified as a country with a deep market. Based on a statistical classification model, we found that the probability of Israel belonging to the group of countries with deep markets in the macroeconomic sense reaches 95 percent. This finding is derived primarily from the size of the corporate bond market to GDP and from financial system deposits to GDP. The microeconomic analysis, relying on a broad dataset of over 340,000 records for Israeli bonds, found that CPI-indexed corporate bonds rated AA- and above are those that meet the standard

[25] As in the analysis we performed for the indexed sector, here as well we executed a test *t* for the difference between the Israeli premium of 24 basis points and the US premium of 4.7 basis points, which due to the lack of data was taken as a fixed value. The difference was found to be highly significant, and so the null hypothesis regarding the equality of the premiums should be rejected. $t_{st} = \frac{\hat{\beta}-\beta_0}{s.e(\hat{\beta})} = \frac{024-0.047}{0.0364} = 5.299$.

definition of high-quality, on condition that they are "plain vanilla" bonds with no option components or special terms. The liquidity premium of these high-quality corporate bonds was found to be similar to the liquidity premium in the US market, regarded as the world's deepest market. In contrast, we found that corporate bonds in the non-indexed sector cannot be considered liquid for purposes of IAS-19, due to the relatively high liquidity premium in this market segment, which apparently stems from relatively small trading activity. Based on these findings, the Israel Securities Authority determined that a “deep market” for high-quality corporate bonds exists in Israel, and it is the indexed sector.

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APPENDIX A

Bank deposits to GDP (%)

Demand, time and saving deposits in deposit money banks as a share of GDP, calculated using the following deflation method:

$$\frac{0.5\left(\frac{F_t}{P_t}+\frac{F_{t-1}}{P_{t-1}}\right)}{\frac{GDP_t}{\underline{P_t}}}$$

where t is the time period, F is demand and time and saving deposits, P and $\underline{P}$ are the repective end-of period and average annual CPI, and GDP is the Gross Domestic Product in local currency (IFS line NGDP); GDP is from World Development Indicators, and end-of period CPI and average annual CPI are calculated using the monthly CPI values extracted from the IMF's International Financial Statistics (IFS line PCPI).

Liquid liabilities to GDP (%)

Ratio of liquid liabilities to GDP, calculated using the following deflation method:

$$\frac{0.5\left(\frac{F_t}{P_t}+\frac{F_{t-1}}{P_{t-1}}\right)}{\frac{GDP_t}{\underline{P_t}}}$$

where t is the time period, F is liquid liabilities, P and $\underline{P}$ are the repective end-of period and average annual CPI, and GDP is the Gross Domestic Product in local currency (IFS line NGDP). Raw data are from the electronic version of the IMF's International Financial Statistics. Liquid liabilities (IFS lines 55L, FFCD or, if not available, line 35L, FDSB); end-of period CPI (IFS line PCPI); and average annual CPI is calculated using the monthly CPI values (IFS line PCPI). For Eurocurrency area countries liquid liabilities are estimated by summing IFS items 34a, 34b and 35, or alternatively FDSBC, FDSBT, and FDSBO.

Stock market turnover ratio (%)

Ratio of the value of total shares traded to average real market capitalization, the denominator is deflated using the following method:

$$\frac{\frac{T_t}{\underline{P_t}}}{0.5\left(\frac{M_t}{P_t}+\frac{M_{t-1}}{P_{t-1}}\right)}$$

where t is the time period, T is total value traded, M is stock market capitalization, P and $\underline{P}$ are the end-of period and average annual CPI, respectively, extracted from the IMF’s International Financial Statistics.

Outstanding domestic private debt securities to GDP (%)

Total amount of domestic private debt securities (amounts outstanding) issued in domestic markets as a share of GDP. It covers data on long-term bonds and notes, commercial paper and other short-term notes. Table 16A (domestic debt amount): all issuers minus governments / GDP. End of year data (i.e., December data) are considered for debt securities. The figures are deflated using the following methodology:

$$\frac{0.5\left(\frac{F_t}{P_t}+\frac{F_{t-1}}{P_{t-1}}\right)}{\frac{GDP_t}{\underline{P}_t}}$$

where t is the time period, F is the level domestic private debt, P and $\underline{P}$ are the end-of period and average annual CPI respectively, and GDP is the Gross Domestic Product in local currency (IFS line NGDP). GDP is from World Development Indicators. End-of-period CPI is taken from IFS line PCPI month of December (or if not available Q4). Average annual CPI is constructed from the monthly CPI figure taken from IFS line PCPI.

Outstanding domestic public debt securities to GDP (%)

Total amount of domestic public debt securities (amounts outstanding) issued in domestic markets as a share of GDP. It covers long-term bonds and notes, treasury bills, commercial paper and other short-term notes. Table C3, previously Table 16 (domestic debt amount): governments / GDP. End of year data (i.e. December data) are considered for debt securities. The figures are deflated using the following methodology:

$$\frac{0.5\left(\frac{F_t}{P_t}+\frac{F_{t-1}}{P_{t-1}}\right)}{\frac{GDP_t}{\underline{P}_t}}$$

where t is the time period, F is the level domestic public debt P and $\underline{P}$ are the end-of period and average annual CPI respectively, and GDP is the Gross Domestic Product in local currency (IFS line NGDP) . GDP is from World Development Indicators. End-of-period CPI is taken from IFS line PCPI month of December (or if not available Q4). Average annual CPI is constructed from the monthly CPI figure taken from IFS line PCPI.

Gross portfolio debt assets to GDP (%)

IFS line 79AEDZF / GDP. Local currency GDP is from IFS. The exchange rate is from World Development Indicators.