Presentation and Analysis of Changes in Equity and Bond Indices

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Abstract

The Bank of Israel keeps current track of activity in the domestic bond and equity market as part of the process of managing economic policy. Developments in the capital markets have a direct impact on the economy's financial stability, access to credit, and the cost of raising funds for businesses and consumers. The Information and Statistics Department of the Bank of Israel maintains an information system based on data from the Tel Aviv Stock Exchange that include all securities traded on the Exchange as well as supplemental information about issuing companies.

The study below describes the Stock Exchange's methodology for calculating and updating the main equity and bond indices. On the basis of this methodology, the Bank of Israel calculates the contribution of each security to changes in index levels. This transition to individually granular analysis of securities allows us to aggregate the securities by additional characteristics, such as Stock Exchange industry or issuer's residency, and to determine the different the contributions of each group to index change. In the last part of the study, we present calculations and analyses of the equity and bond indices in the first few months of the Swords of Iron War.

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Background and goals of the study

The Bank of Israel tracks activity in the bond and equity market in two main areas for which it is responsible:

1. management of monetary policy—with emphasis on the mechanism of transmission of policy;

2. macro prudential support—with emphasis on the domestic securities market. Developments in these markets are monitored mainly to test their functioning, the evolution of risks, and the market's pricing of risks.

To analyze activity in the financial markets and examine the various classes of corporate bonds and equities, the Bank of Israel also monitors the Stock Exchange indices in which groups of equities and corporate bonds are aggregated.

The Tel Aviv Stock Exchange calculates the values of the indices in accordance with its methodology. Basing ourselves on the same methodology, we at the Bank of Israel calculated the contribution of each security to change in the value of the index.

The Bank also calculates baskets of bonds that represent groups of tradable corporate instruments that have characteristics in common. Examples are bonds included in the Tel Bond indices, as the Exchange defines them, and baskets based on Stock Exchange industries and bond ratings. The aggregation of bonds into baskets facilitates time analysis of the risks of groups of bonds and calculation of the contribution of each bond to change in the aggregate indices of the basket, such as yield to maturity and yield spread.

It became crucial to calculate the contribution of each security to change in the index in the aftermath of the 2008 financial crisis, which showed that aggregate data alone do not reflect the full contribution and that decisions about policy should be based on individually granular, high-quality, and high-frequency data.

The Bank of Israel calculates and analyzes each security's contribution to index change and aggregates these securities by additional characteristics for short-term (current) monitoring and analysis purposes. This method yields a deeper understanding of developments in the capital markets and gives support to the decision-making process.

1. Methodology

1.1 Calculation of main Stock Exchange equity and bond index methodology

The Stock Exchange index is a numerical data point that represents the average price of securities that belong to a certain group relative to benchmark values that were established when it was introduced. The value of the index varies commensurate with changes in the prices of its constituent securities and the weight of each security in the index.

The Tel Aviv Stock Exchange establishes and calculates the indices in accordance with the methodology and rules specified in its regulations, which are published on the Exchange's website.[1] The regulations specify, at

[1] https://info.tase.co.il/heb/about_tase/rulesandregulations/pages/rderivatives-maof.aspx

length, the way the composition and weights of securities in the indices are determined and gives additional rules and guidelines.

Equity indices

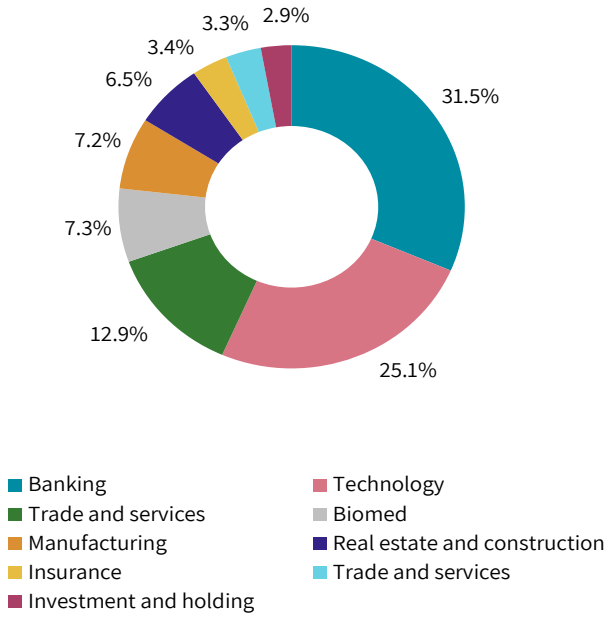
The leading equity indices on the Exchange are the Tel Aviv 35 and the Tel Aviv 125. These are considered flagship indices; the Tel Aviv 35 tracks the thirty-five equities that are traded at the highest market value and the Tel Aviv 125 does the same for the 125 equities so traded.

The inclusion of an equity in the indices is subject to certain threshold conditions that the Exchange establishes and updates from time to time.[2] At the present writing, these conditions include a minimum rate and value of the public's holdings in the security, a minimum price of the equity, a connection with Israel, and tradability.

The composition of securities in the indices is updated every half-year and the methodology used to calculate the indices varies per decision of the Tel Aviv Stock Exchange.

The market value of the Tel Aviv 35 at the beginning of 2023 was NIS 550 billion. In the first weeks of the war, it fell to NIS 483 billion. In October 2024, a year after the war began, the index was worth NIS 630 billion. The value of the index is composed mainly of technology, banking, and real-estate and construction equities. The rest of the equities belong to other Stock Exchange industries and account for 30 percent of index value.

Figure 1: Tel Aviv 35 Index—composition by industries, beginning of October 2023



Bond indices

The Tel Bond indices aggregate tradable corporate bonds and represent the aggregate change in the prices of the bonds included in them. The most prominent bond indices are the Tel Bond-20, Tel Bond-40, Tel Bond-60, and Tel Bond-Shekel.

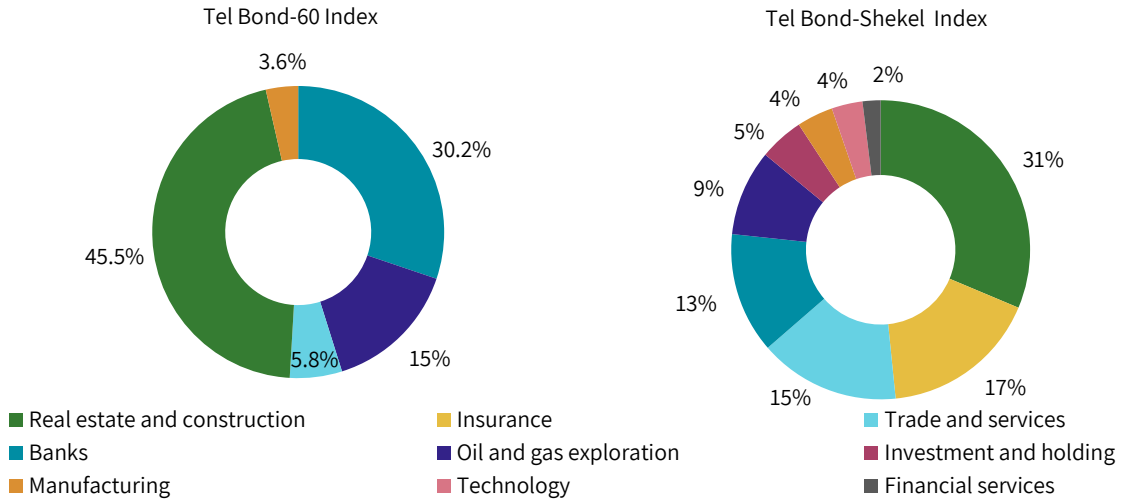
[2] The conditions for inclusion are specified and updated on the Exchange's website under "Equity Indices Universe: Tamar and Rimon," https://www.tase.co.il/he/content/knowledge_center/index_universe

The Tel Bond-60 is the flagship of the Tel Bond indices. It is composed of the sixty fixed-rate CPI-indexed bonds that have the highest market value of all CPI-indexed bonds. These instruments are included in the Tel Bond database and meet the threshold conditions that have been established for the index.

The Tel Bond Shekel index aggregates the fixed-rate NIS bonds that have the highest market value among all NIS bonds. These bonds are included in the Tel Bond database and meet the index's threshold conditions,[3]

The index values represent the aggregate change in the prices of the bonds included in the index and are determined in accordance with the methodology of the Tel Aviv Stock Exchange, which is updated from time to time. The method for determining the index's composition and setting its value is updated by the Tel Aviv Stock Exchange from time to time. The composition of the bonds included in the indices is updated once a month, in accordance with the threshold conditions and the characteristics of the bonds.

Figure 2 :Tel Bond-60 and Tel Bond Shekel indices by industry, beginning of October 2023



1.2 Calculating the contribution of each security to change in the index

The contribution of each security to the level of the index is determined *every day* by means of a formula that calculates the level of the index at the end of each trading day, as appears in the TASE regulations[4] and is specified in Chapter 7 of the MAOF manual in the Methodology of Equity Indices section on the Exchange's website.

We may express the difference in the index value between two successive days by means of the weight and price of the securities in the index and define the contribution of each security to change in the index value.

The formula for calculation of index value is as follows:

[3] For bonds to be included in the total bond indices, they must meet certain threshold conditions that the Exchange lays down and updates from time to time. At the present writing, these conditions include the requirement of inclusion in the Tel Bond database and a minimum credit rating of Baaa3 on the Midrug scale or BBB- on the Maalot scale. The composition of the indices is updated once per month in accordance with compliance with the threshold conditions and the methodology for calculating and setting the index values may vary in accordance with decisions of the Stock Exchange,

[4] https://www.tase.co.il/en/content/about/tase_regulations—guidelines in accordance with Section 7 of the Stock Exchange Regulations (equity indices methodology).

I_t—the value of the index on Day t, calculated by means of the following formula:

$$I_t = I_{t-1} \cdot \sum_i w_t^i \cdot p_t^i$$

where:

w_t^i – is the weight of Security i on Day t, such that the following obtains on every t: $\sum_i w_t^i = 1$;

p_t^i – is the ratio of the closing price to the benchmark price of Security i on Day t;

That is, $p_t^i - 1$ is the holding yield of the security.

The difference between the index values on two successive days, $t-1$ and t, may be expressed by means of the weight and change in price of each security included in the index:

$$I_t - I_{t-1} = I_{t-1} \cdot \sum_i w_t^i \cdot p_t^i - I_{t-1} = I_{t-1} \cdot \left(\sum_i w_t^i \cdot p_t^i - 1 \right) = I_{t-1} \cdot \left(\sum_i w_t^i \cdot p_t^i - \sum_i w_t^i \right)$$
$$= I_{t-1} \cdot \left(\sum_i w_t^i \cdot (p_t^i - 1) \right) = \sum_i I_{t-1} w_t^i (p_t^i - 1)$$

Accordingly, the contribution of each Security i to the change in index value on Day t may be defined as:

$$c_t^i = I_{t-1} w_t^i (p_t^i - 1)$$

where $p_t^i - 1$ is the holding yield of the security.

Thus, according to the formula, the total contribution of the securities on Day t is equal to the difference in index value between Day t and Day $t-1$. In addition, the total sum of the contributions of all securities during the time between $t-j+i$ and Day t equals the difference in index value between Day t and Day $t-j$.

One may sum up the contributions of the securities to changes in index value and across various cross-sections such as industries, issuers' residency, and so on. In this manner, changes in the index parsed by these categories may be analyzed.

To facilitate analysis of the change in index value during a given period, we normalized the index and the contributions by dividing the index values by the index value on the first day of the selected period and multiplying the product by 100. This ensures that the index value on the first day of the chosen period will always stand at 100, allowing changes during the period to be examined conveniently and clearly.

1.3 Calculating aggregate indicators: Baskets based on bonds included in the Tel Bond indices

To analyze and monitor the market risks that pertain to bonds, a broader and more comprehensive analysis of the change in value of the index that serves as an indicator of prices of the bonds in the index is needed. To this end, we have to calculate additional aggregate indicators—yield spread, yield to maturity, and duration—based on the group of bonds of which the index is composed. To calculate the aggregate indicators, baskets of bonds composed of the population of the Exchange's bond indices must be developed.

The aggregate indicators are calculated on the basis of a weighted average of the individual-level data of each bond in the basket. The weight of each bond is determined by the ratio of the market value of the bond to the total market value of all bonds in the basket on the relevant trading day. Three indicators for the Tel Bond baskets are calculated every day: yield to maturity, yield spread, and duration.[5]

The contribution of each bond to change in the value of the aggregate indicator is calculated by multiplying the value of the indicator of each specific bond by the weight of the bond in the basket that day. The weight of the bond is determined in accordance with the ratio of the market value of the bond to the market value of the entire basket.

The 2008 financial crisis emphasized the need for granular and frequent high-quality analyses. It showed that aggregate data alone do not yield a full picture; therefore, analysis of the individual contributions of the bonds may yield crucial information for policy decision-makers.

We demonstrate this by calculating the basket-weighted yield to maturity.

First, we define the contribution of Bond i to the aggregate yield to maturity of a given basket:

w_t^i – the weight of Bond i in the basket on Day t, that is, the ratio of the market value of Bond i to the total market value of the basket on Day t, such that on every t one obtains : $\sum_i w_t^i = 1$

ytm_t^i – the yield of Bond i on Day t

YTM_t – the weighted yield of the basket on Day t:

$$\mathrm{YTM}_t = \sum_i w_t^i \cdot \mathrm{ytm}_t^i$$

c_t^i – the contribution of Bond i to the aggregate yield to maturity of the basket on Day t:

$$c_t^i = w_t^i \cdot \mathrm{ytm}_t^i$$

In the equation between Time $t - j$ and time t:

$$\mathrm{YTM}_t - \mathrm{YTM}_{t-j} = \sum_i w_t^i \cdot \mathrm{ytm}_t^i - \sum_i w_{t-j}^i \cdot \mathrm{ytm}_{t-j}^i = \sum_i \left(c_t^i - c_{t-j}^i\right)$$

Using this method, the contributions of each Bond i to each of the other main indicators—yield spread and duration—may be defined and calculated.

2. Applying the methodology to data for 2023–2024

The years 2023–2024 were characterized by much volatility, uncertainty, and increase in domestic-economy risk in view of two major events: the impact of the legislative changes and the Swords of Iron War. The implications

[5] For elaboration, see study on baskets of corporate bonds in Bank of Israel. S*tatistical Bulletin for 2019:* https://www,boi,org,il/publications/regularpublications/statistic_bulletin/%D7%9E%D7%91%D7%98-%D7%A1%D7%98%D7%98%D7%99%D7%A1%D7%98%D7%99-2019

of the national-security events that began on October 7, 2023, have had an ongoing impact on the foreign-currency and capital markets, economic activity, and inflation.

In this part of the study, we examine how key events in the course of the Swords of Iron War were reflected in the markets of tradable equities and bonds on the Tel Aviv Stock Exchange by calculating the contribution of each security to the change in index value on the basis of the methodology that the Exchange uses to calculate the values of its indices.

The initial months of the war saw acute uncertainty in national security and a profusion of significant events. In this study, we chose to focus on three key events: the day the war broke out, October 7, 2023; the onset of the ground incursion into the Gaza Strip, October 27, 2023; and the end of the cease-fire and the first roadmap for the return of hostages, December 1, 2023.

2.1 Presentation and analysis: the Tel Aviv 35 Index

The effect of the war on the Tel Aviv 35 Index from the first day of the war to the onset of the land incursion into the Gaza Strip was a steep 15 percent decrease in the prices of equities traded on the Exchange. As a result, the Tel Aviv 35 Index dropped from 1,830 points on the last pre-war day of trading to 1,605 points.

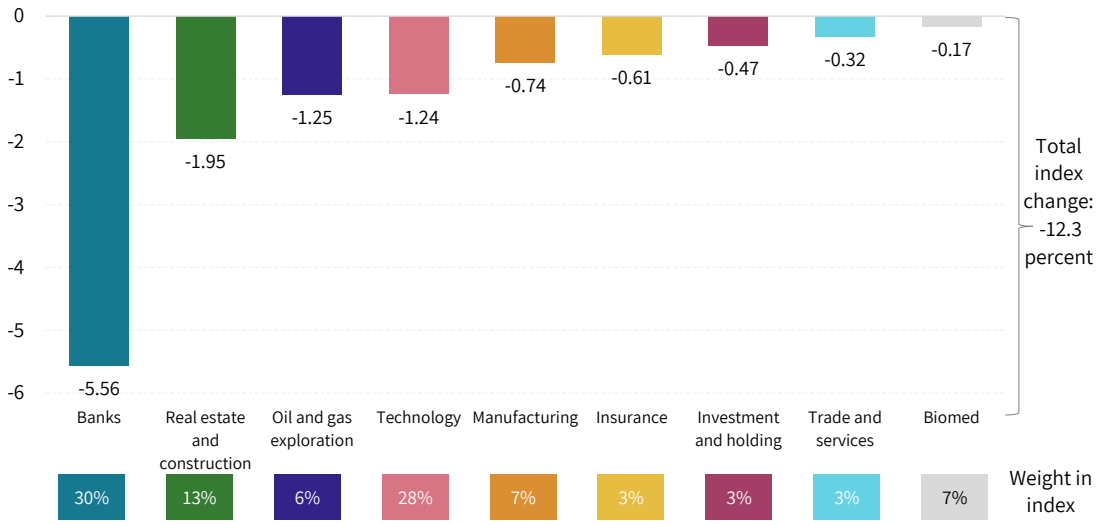
After Israeli forces entered the Gaza Strip and in the aftermath of the cease-fire and the roadmap for the return of some of the hostages, the market responded by rising steeply. As a result, the Tel Aviv 35 Index and other leading indices returned to their pre-war level.

Figure 3: Tel Aviv 35 Index from the beginning of the war to the end of 2024

In the next figures, we present the change in the Tel Aviv 35 Index by calculating the contribution of each security to the change in index value on the basis of the aforementioned methodology used by the Exchange to calculate the index. The Tel Aviv 35 Index fell steeply in the first three weeks of the war—by 12.3 percent relative to its point of departure.

By parsing the total change in the Tel Aviv 35 Index into the contributions of each of its constituent equities and aggregating the equities by issuer's Stock Exchange industry, we are able to analyze the contribution of each industry to the change in index value.

Figure 4: Contribution to change in Tel Aviv-35 by Stock Exchange industries, first three weeks of the war

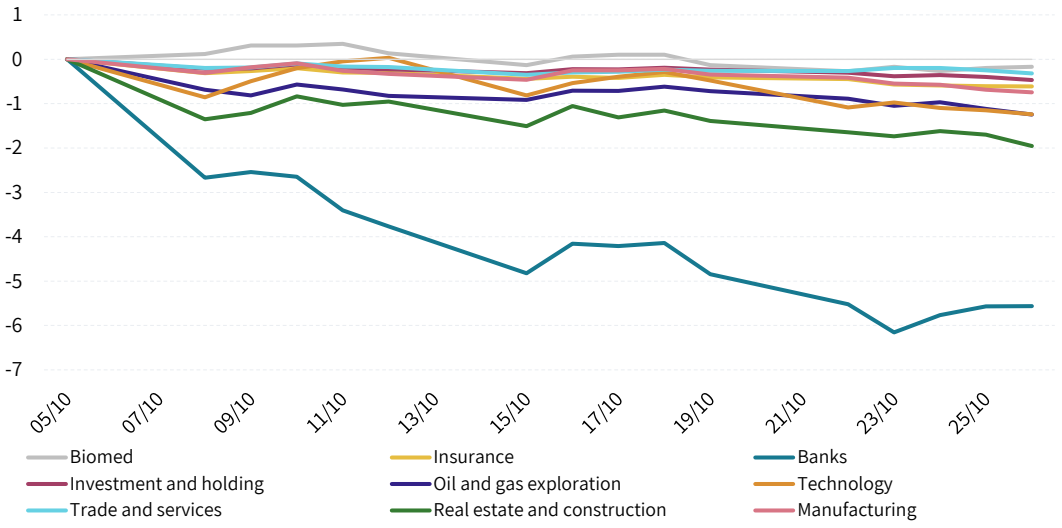


The contribution of the decline in prices was a substantial 45 percent of the total decrease in the index during the term reviewed—5.56 percent of the 12.3 percent decline in the total index. The average weight of bank shares in the index at that time was 30 percent. This indicates that the banks' equities led the downward move of the index, contributing more than their weight in the index. Real-estate equities contributed to the decline beyond their 13 percent weight: 1.95 percent of the 12.3 percent total or 16 percent of the decline.

By calculating the contribution of each security to the change in index value and aggregating the securities by additional characteristics such as industry, we are able to perform short-term (ongoing) analysis and monitoring. If we calculate the contribution over longer periods of time, during which the index undergoes major changes, distortions may occur. Therefore, we disapprove of using these calculations for overly lengthy terms.

Another manifestation of the downward trend of the banks' equities in the first three weeks of the war is shown in the figure below, which parses the cumulative contribution by Stock Exchange industries over time

Figure 5: Cumulative contribution to index change by Stock Exchange industries during the first three weeks of the war (normalized to 0 at the beginning of the period)



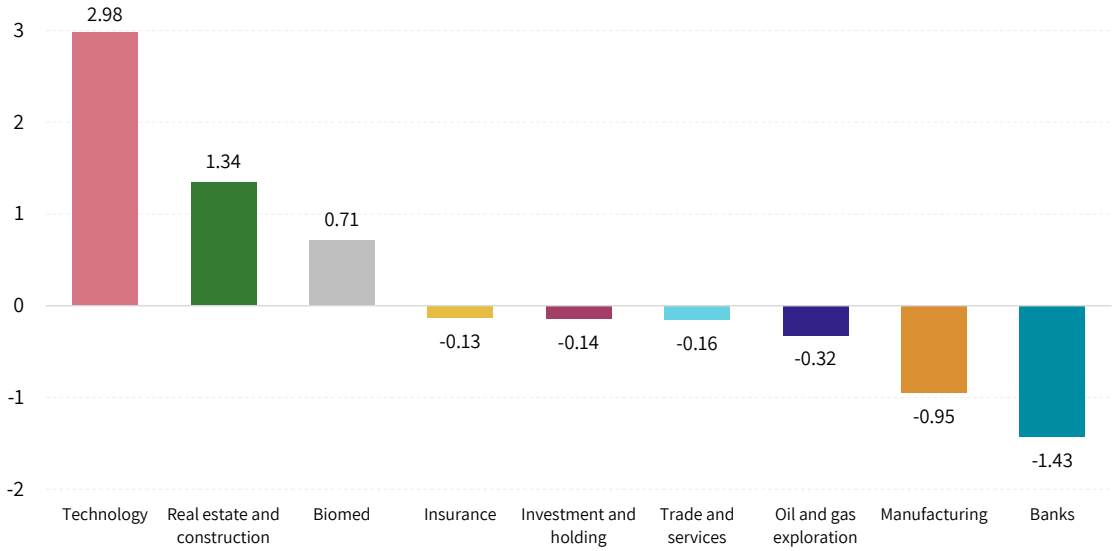
To calculate the cumulative contribution to change over time, we use a schema of the daily contribution of each equity in the index during the period reviewed. Analysis of the cumulative contribution to change in the Tel Aviv 35 Index shows that the cumulative contribution of the banks' equities was negative throughout the term

examined and appears to be substantially higher than the cumulative contribution of the equities included in the other industries.

Within about three months after the war began, the Tel Aviv 35 Index surpassed its pre-war level: 1,835.31 points on December 31, 2023, up 1.89 percent from its value at the beginning of the war.

To determine whether the recovery of the Tel Aviv 35 Index traced to a specific group of companies or a specific industry, we analyzed the contribution of the constituent equities of the index by Stock Exchange industries.

Figure 6: Contribution to change in Tel Aviv 35 Index by Stock Exchange industries, October 5–December 31, 2023



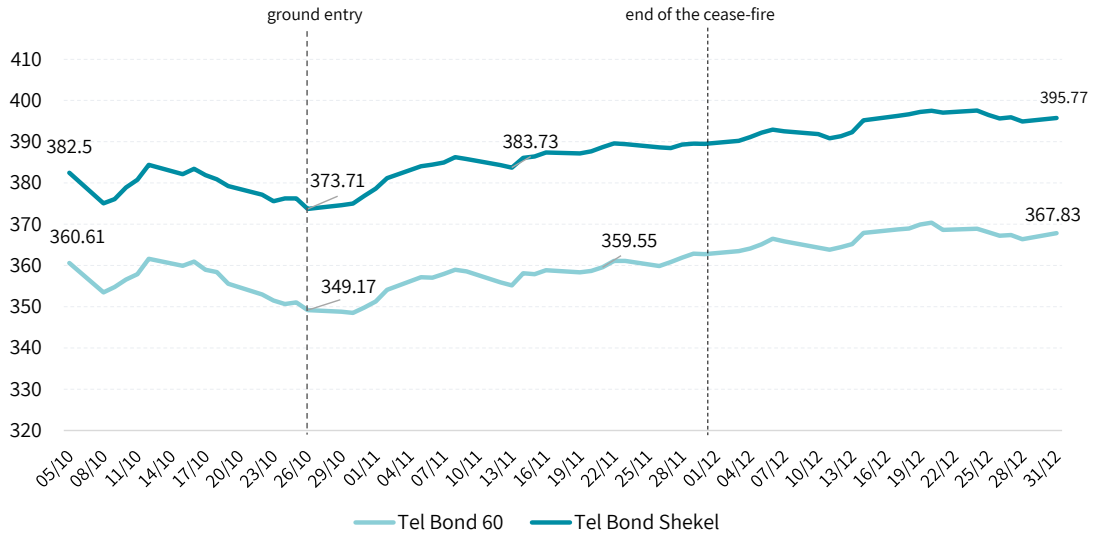
Technology, real estate and construction, and biomed equities made positive contributions to the increase in the index, whereas bank and manufacturing equities continued to affect the index negatively.

2.2 Presentation and analysis: The Tel Bond Shekel and Tel Bond 60 indices

The Tel Bond indices posted mild declines in the first three weeks of the Swords of Iron War relative to the abrupt downturns in the equity indices at that time: the Tel Bond Shekel lost 2.2 percent, sinking to 373.71 points, and the Tel Bond 60 fell by 3.1 percent, to 349.17 points.

The bond indices rebounded to their pre-war levels in the second half of November. By the end of 2023, the Tel Bond Shekel gained 3.47 percent relative to its level at the beginning of the war and the Tel Bond 60 advanced by 2 percent during that time.

Figure 7: Tel Bond Shekel and Tel Bond 60 indices 60



By dividing the total change in the Tel Bond Shekel index by the contributions of each of its constituent bonds and aggregating the bonds by issuer's industry, we are able to detect the contribution to change in index value by issuer's industry and to compare the industry-level contributions to the leading bond indices

Figure 8: Contribution to change in the Tel Bond Shekel index by Stock Exchange industries in the first three weeks of the war

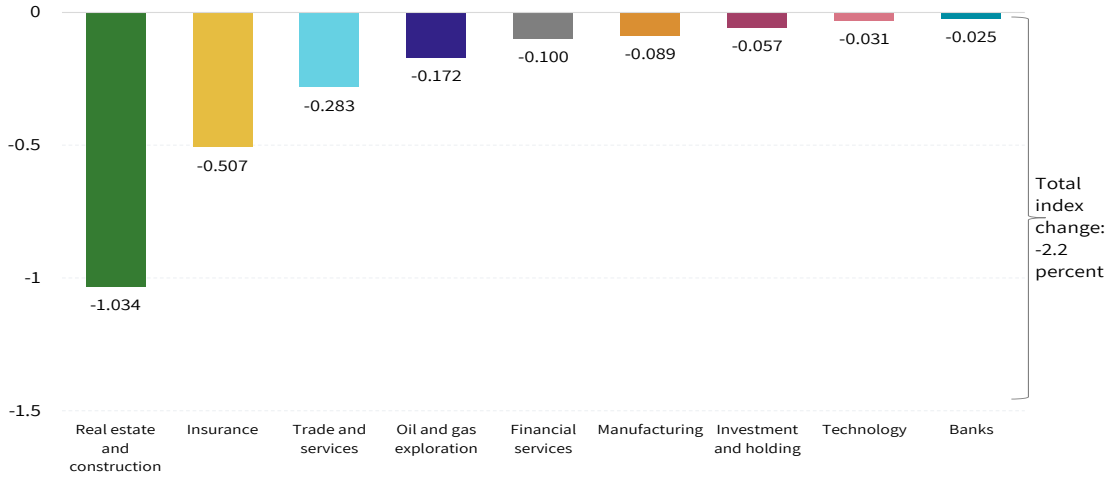
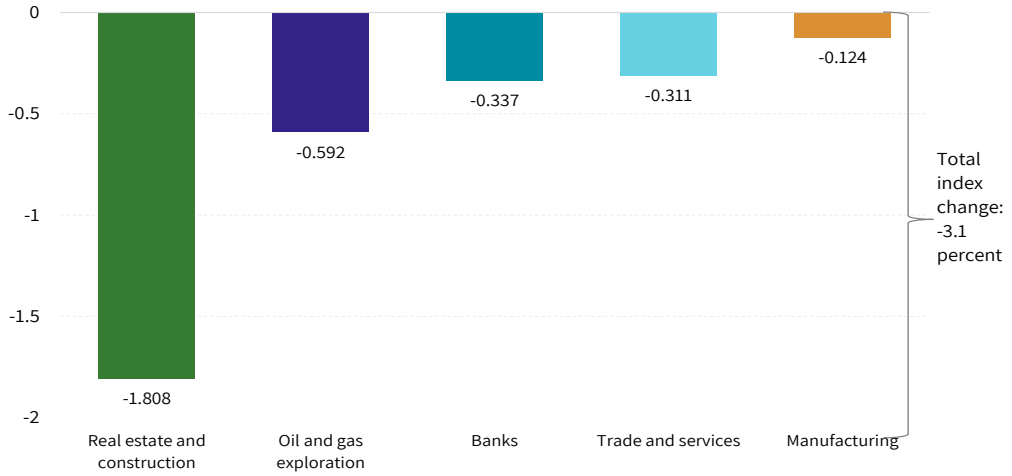


Figure 9: Contribution to change in the Tel Bond 60 index by Stock Exchange industries in the first three weeks of the war



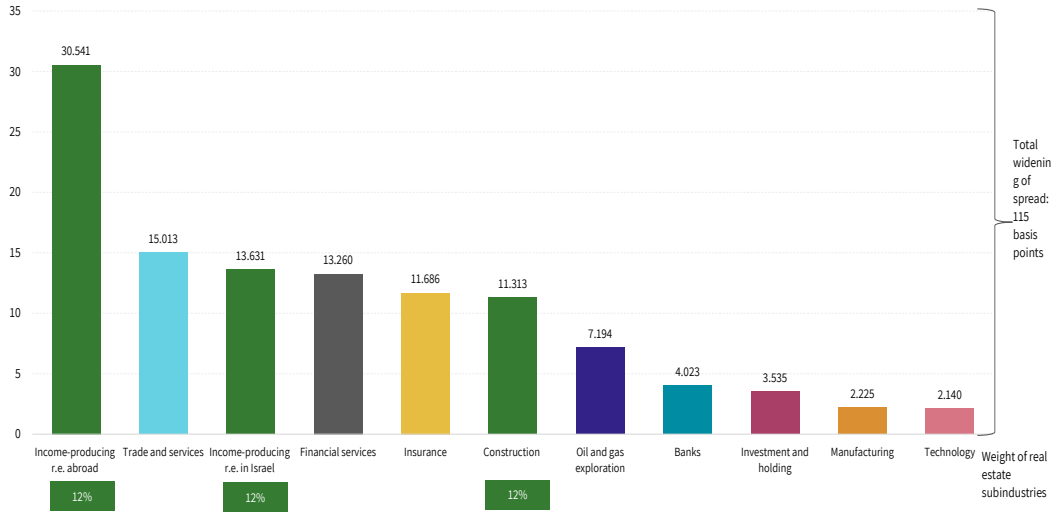
Real estate and construction bonds accounted for much of the decrease in the Tel Bond Shekel index during the period reviewed: 1.03 percent out of a total decrease of 2.3 percent, 45 percent of the total. The average weight of this industry's bonds in the index during this time was 32 percent, meaning that they were overweighted in their contribution to the downturn.

Bank bonds, in contrast, made a negligible contribution to the decrease in both indices, the Tel Bond Shekel and the Tel Bond 60. In the Tel Bond 60, bank bonds accounted for 30 percent of the index but contributed only 0.337 percent to the decline.

Concurrently, the aggregate spread of the bonds that make up the Tel Bond Shekel index widened by 115 basis points—from 1.75 percent to 2.89 percent—during this time. Real estate and construction bonds contributed 55 basis points to the increase; the other industries' bonds made smaller contributions.

The real estate and construction industry is composed of three subindustries that are distinct in their business activity. By analyzing the contribution of the bonds by subindustries, we can determine each subindustry's contribution to change in spread and compare it with the other industries' contributions.

Figure 10: Contribution to change in Tel Bond Shekel spread by Stock Exchange industries during the first three weeks of the war

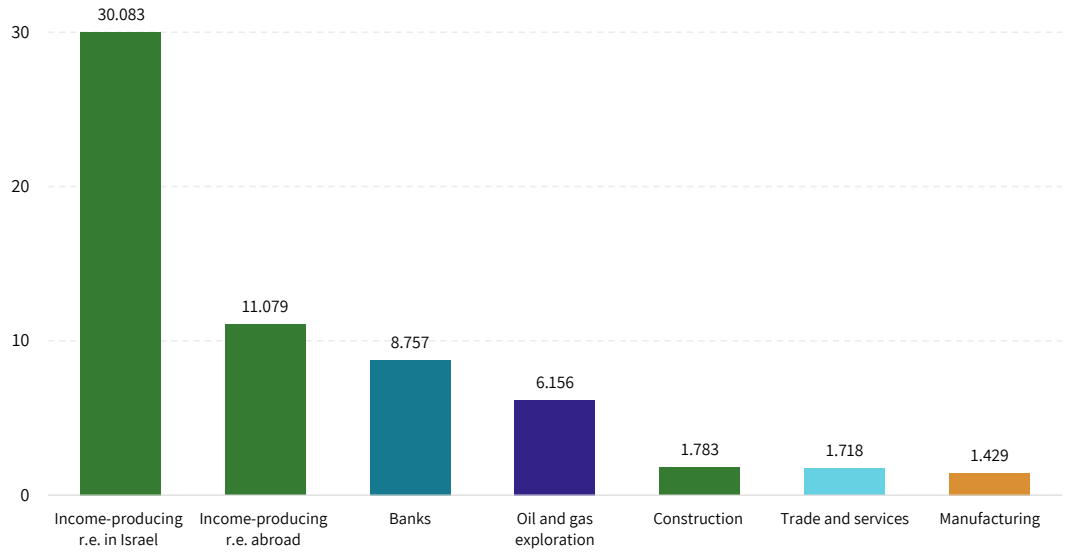


Bonds included in the Income-Producing Real Estate Abroad subindustry, which does most of its activity outside the domestic market, contributed 30 basis points to the widening of the Tel Bond Shekel spread. In contrast, bonds associated with the Income-Producing Real Estate in Israel subindustry contributed only 13 basis points. .Despite this difference, each of these subindustries had the same 12 percent average weight in the basket

In the Tel Bond 60 index, the spread of the basket, based on its constituent bonds, widened strongly in the first .three weeks of the war: from 141 basis points to 202 basis points—61 points in less than three weeks

By aggregating the contributions of each bond in the index by Stock Exchange industries and by subindustries of the real estate and construction industry, we discover the large contribution of the Income-Producing Real Estate in Israel subindustry to the total widening of the spread. Bonds associated with this subindustry accounted for approx. 30 basis points—roughly half—of the widening. Their weight in the basket, based on the population of the Tel Bond 60 Index, was 38 percent at the time reviewed.

Figure 11: Contribution to change in basket spread based on the Tel Bond 60 population, by Stock Exchange industries during the first three weeks of the war



Conclusion

In this study, we described the way the contribution of each security to the value of the Stock Exchange indices is calculated, parsing the securities by the issuing companies' industries and subindustries. We also presented the method of computing the contribution of each bond to the aggregate indicators of bond baskets based on the population of the Stock Exchange's Tel Bond indices.

This method of analysis is an important instrument for monitoring and ongoing (short-term) analysis because it yields a deep understanding of the contribution of each group to changes in the indices.

Above we demonstrated the use of these data for analysis of the changes in the main equity and bond indices against the background of events in the first months of the Swords of Iron War. We found that the Tel Aviv 35 Index fell steeply in the first three weeks of the war, mainly due to tumbling prices of bank and real estate equities, but recovered by the end of 2023. The Tel Bond Shekel and Tel Bond 60 indices, in contrast, posted mild downturns at the beginning of the war, powered mainly by decreases in the prices of real estate and construction bonds, but recovered quickly and returned to their pre-war level by year's end.