



Israel Securities Authority

The COVID-19 Crisis – Compilation of Analyses

**The Department of Research, Development and Strategic
Economic Consulting**

Israel Securities Authority

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Introduction

This paper compiles several in-depth analyses performed by The Department of Research, Development and Strategic Economic Consulting of the Israel Securities Authority (ISA), with the assistance of additional ISA departments, examining the market activity during the COVID-19 crisis. The time frame includes the routine period that preceded the spread of the virus, the height of the crisis in the markets in March 2020, and the ensuing recovery.

The aim of the analyses was to monitor the real-time implications of the crisis, to identify and prevent market failures in advance, and to facilitate informed and data-driven decision-making at the ISA. The analyses presented herein comprise but a small part of the extensive work that was done. Their publication offers a real-time glance at the ISA's activity during this period, and allows the public to share the insights emerging from these analyses.

The analyses, appearing as separate chapters, focus on different aspects of capital markets and may (largely) be read independently of one another.

The background chapter is an extended introduction to the compilation, describing the development of the crisis from a macro-economic perspective, the reaction of the markets thereto and the immediate consequences of the crisis on ISA-supervised entities. In addition, the chapter describes the condition of the market on the eve of the crisis and compares it to the 2008 crisis case study.

Chapter 1 analyzes, on a day-by-day basis, the aggregate purchases of different players on TASE before the crisis, during its peak and in its aftermath.

Chapter 2 discusses the relationship between market risk and idiosyncratic risk during the crisis and over the course of the last decade, and describes trends in correlations between TASE securities' returns and the returns of their corresponding indices.

Chapter 3 describes the impairment to trading liquidity indicators (such as the bid-ask spread) during the crisis and the improvement in indicators after the peak of the crisis.

Chapter 4 focuses on the activity of market makers on TASE with respect to the trends described in Chapter 3. The chapter examines the effectiveness of market makers' actions during the crisis and in the routine period that preceded it according to a number of parameters.

Background – implications of the COVID-19 crisis on Israel's capital market

The COVID-19 crisis began in January 2020 as a health crisis, first in China and later worldwide, and rapidly developed into a crisis in the real economy further to preventive measures taken by governments around the globe and the need for extensive behavioral changes among populations (social distancing). The full magnitude of the crisis began resonating in financial markets at the end of February 2020. At that point in time, indications emerging from the data revealed that the global economy was sliding into the first recession since the big financial crisis of 2008, and it was estimated that GDP growth around the world in Q2 and Q3 of 2020 will be significantly negative. At that point, leading financial forecasters warned about a potential global financial depression should the crisis continue, similar to the great depression of the 1930s and to a certain degree, also to the aftermath of the 2008 crisis.

Unlike previous financial crises in the last half century, the reaction of the financial markets to the current crisis was exceptionally quick and violent, and risk assets (shares and corporate bonds) set negative multi-year records throughout the world, within a short timeframe of only one month. However, policymakers responded to the crisis faster than in previous crises. Both monetary and fiscal authorities, having learned from the consequences of the relatively slow reaction in 2008, acted in most Western countries to try providing cash-flow assistance to businesses and individuals so that they would be able to overcome the challenging period. Such measures included, *inter alia*, lowering of central bank interest rates, quantitative easing programs for the purchase of government bonds, corporate bonds and shares, provision of foreign currency credit facilities to commercial banks, government-backed grants and loans, discounts in taxes and fees and more. In Israel, the central bank established a quantitative easing program for the purchase of governmental bonds in the sum of around ILS 50 billion, and opened foreign currency credit facilities to relieve the distress of part of the institutional bodies. The government on its part paid furloughed employees from the first day, granted emergency assistance to the health system and helped affected business owners and self-employed individuals by providing grants and subsidized loans.

In the following background chapters, we will present the implications of the crisis on the capital markets in Israel and the world, provide a comparison with the 2008 crisis, and present the degree of impairment to the supervised entities.

The reaction of the markets to the crisis

The COVID-19 pandemic broke out in the beginning of 2020 while financial markets cruised around multi-year highs. Since the financial crisis of 2008, share markets experienced significant increases. These increases continued for around 11 years, during which there were no changes in the upward trend other than in a few isolated events. In such years, debt markets also saw a significant decline in yields – both in government bonds and in corporate bond spreads¹ (other than due to the European debt crisis in late 2011, which later revealed itself as a passing event in terms of the long-term trend). Such trends were driven by expansionary monetary policies implemented by the world's large central banks, which included near-zero risk-free interest rates, as well as a series of unconventional monetary steps (quantitative easing), with a view to incentivize the real economy to recover from the crisis. Some of such measures continued until the beginning of 2020, and interest rates remained low in most of the developed countries. This state of affairs reduced the ability of central banks to respond to the crisis with conventional measures that proved helpful in previous crises. The Israeli economy in itself, unlike other Western economies, was not materially impacted by the 2008 crisis, and even in its aftermath continued to present handsome growth rates of more than 3% a year (a per capita growth rate of around 1.5%), as well as low unemployment rates.

In the first two months of 2020, when the outbreak of the virus in China was in its first stages, global capital markets remained “indifferent” to the risk threatening the activity of the real economy. The recognition of the severity of the event began unfolding with the mass infection in South Korea and news reports thereon in the second half of February 2020. The ensuing spread of the disease to European countries (with Italy in the epicenter) and to the U.S. accelerated the price declines of the various risk assets. The intensity and magnitude of the price drops in the financial markets were significant, and within less than a month, most of the leading Western stock markets lost more than 30% in value, with a significant increase in credit spreads of high and low-rated corporate bonds. The reactions exacerbated as it became apparent that the disease is spreading rapidly in Western countries, and that governments are forced to respond by limiting business activity and imposing movement restrictions on entire areas and on large parts of the population.

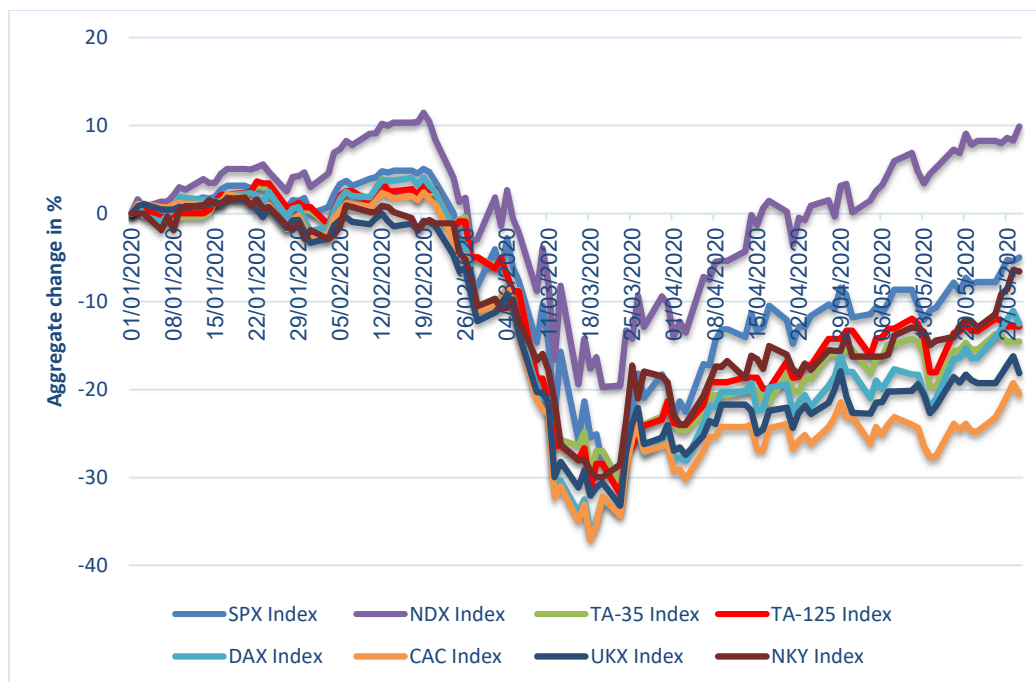
An additional noteworthy material event that simultaneously affected the markets and was indirectly influenced by the outbreak of the virus, was the Saudi resolution to withdraw from the strategic alliance with the OPEC cartel and unilaterally increase the state's oil production. This step led to a plunge in oil prices, of more than 50%, to a price environment of \$20-\$30 per barrel. This trend was later joined by additional influences, such as a shortage in storage areas (due to a decrease in demand) and a liquidity crisis in oil ETFs, with the combination of factors leading to negative prices towards the expiration of the contracts for delivery in May 2020.

It is further noteworthy that measures that were formerly considered as “game-changers”, and which were taken by central banks worldwide since the outbreak of the current crisis, such as aggressive lowering of interest rates and additional quantitative

¹ The spread between the corporate bond yield and the government bond yield measures the company's specific risk.

expansions, were initially met with a chilly reaction in the markets, and were unsuccessful in stopping the negative trend. Later, governments began taking aggressive steps, with an emphasis on emergency aid to affected businesses and individuals. In March 2020, large fiscal packages, made-up primarily of aid packages worth trillions of dollars, were passed by Western legislators. Towards the end of March 2020, indices around the world began correcting the declines, a trend that continued until the time of this writing, at the end of May 2020.

Diagram 1: The changes in worldwide leading share indices since the beginning of 2020



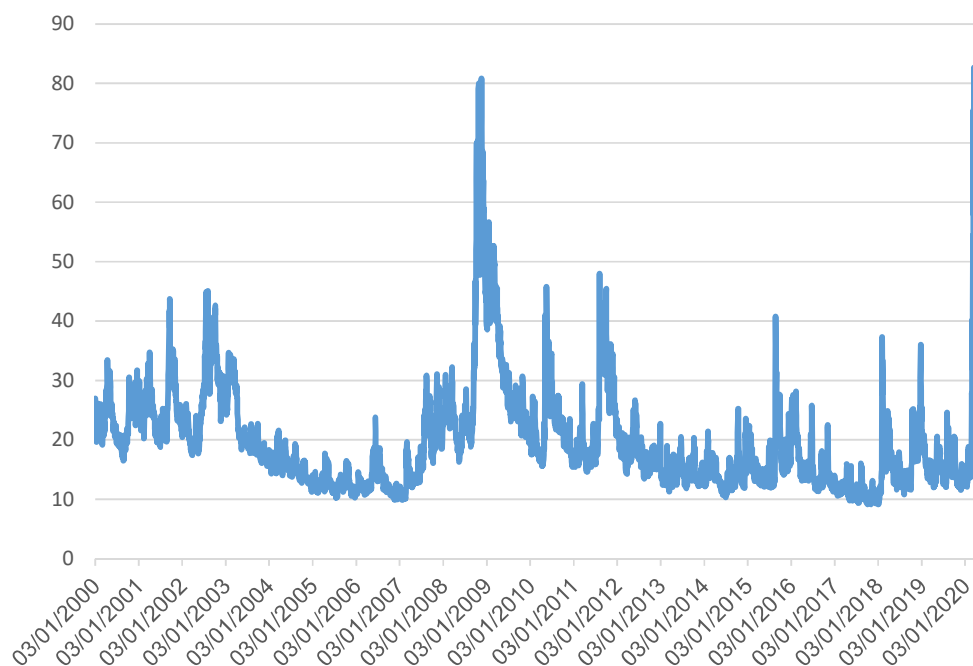
As aforesaid, most of the Western share indices experienced drops of around 30%-40% since the beginning of the crisis, until the low point recorded toward the end of March 2020. However, European indices dropped by greater percentages than their U.S. counterparts. Similarly, the TA-35 Index underperformed compared with the U.S. indices. Since the low point and until the end of May 2020, most of the indices, including Israeli TASE indices, have corrected almost 50% of the drops. U.S. stock indices exhibited remarkable results, including NASDAQ that resumed record setting. The inclination towards Tech companies played a major role in the recovery, as many companies were not significantly harmed by the crisis, and even profited from the conditions it created.

Compared with the 2008 crisis and the low point then recorded, in which stock markets lost more than half of their value, it is noted that while drops in stock and debt markets were more significant in 2008, they span over a far longer period of time than in the present crisis. Such steep plunges, as observed in March 2020, which included two-digit drops in the leading stock indices worldwide in the span of several days, are very irregular from a historic perspective. Moreover, despite the recent recovery and a certain improvement in the ability to estimate the expected damage, there is still a great

deal of uncertainty regarding the length of the crisis and the long-term effects that will be caused to the various economies.

An additional index reflecting the expected degree of volatility in stock markets is the VIX index (also known as the “Fear Index”)². In March 2020, this index reached the same levels recorded at the peak of the 2008 crisis, as demonstrated in the diagram below. The concurrent Israeli index, VTA-35, which has been calculated by TASE since mid-2019, reached similar levels.

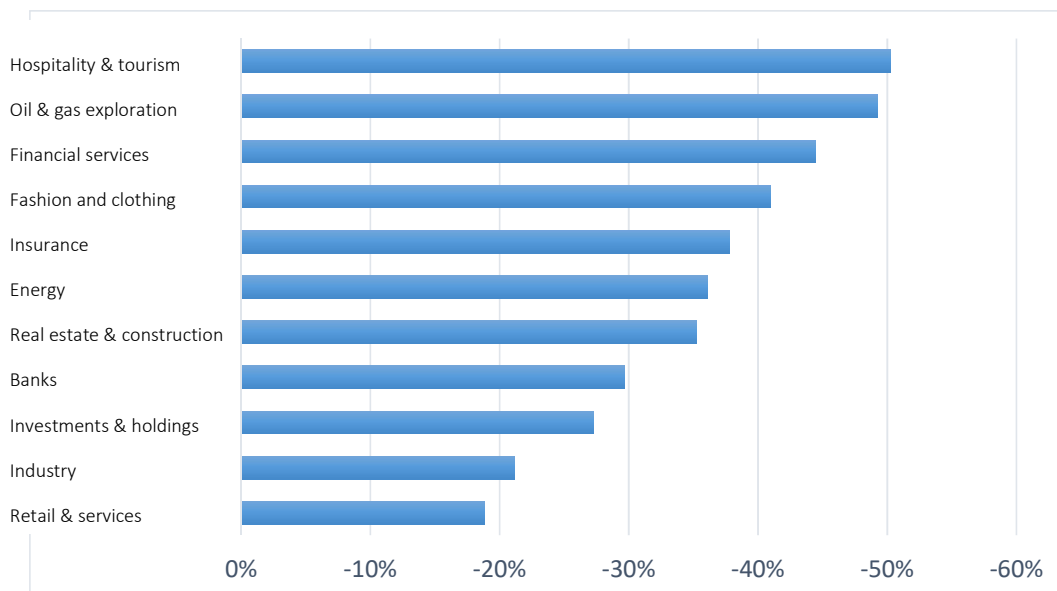
Diagram 2: The VIX index, 2007-2020



Broken-down by sector, the immediate victims of the current crisis were the tourism sector (mainly hospitality and airlines), the fashion and clothing sector, and industries that are exposed to China. Later, additional sectors began suffering due to the indirect influences of the crisis, primarily the energy sector (further to declines in oil prices), the income-producing real estate industry and the financial sector. The financial sector was impacted by market declines, which impair nostro investments, as well as by the forecast of future damage due to defaults on borrower undertakings, insurance claims, customer withdrawals and more.

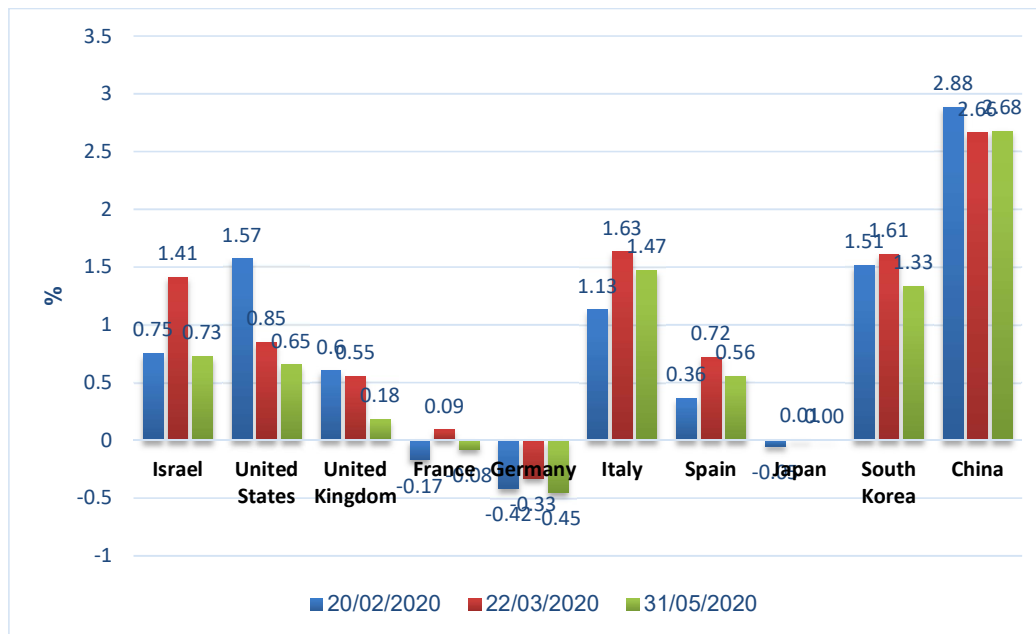
² The index is calculated according to the standard deviations inherent in the prices of the options on the S&P 500 index, which mature in the next month and are near the money.

Diagram 3: The market-value-weighted mean change in shares on TASE since the beginning of the crisis until its peak in key sectors



The bond market reacted severely as well. Government bond yields have increased significantly during the first month of the crisis. This was an irregular phenomenon in comparison with other crises that took place in the past decade, which drove investors away to the safety of the government bonds ("Run to safety"). One possible reason for this phenomenon was the irregular volume of mutual fund redemptions, about which we shall elaborate below, which have substantial investments in government bonds. Another possible reason was the expectation that the government will need to raise large sums through the issuance of bonds in order to finance the deficit, which will considerably increase market supply. Toward the end of March 2020, as fund redemptions abated and the program to purchase government bonds by the Bank of Israel was launched, government yields slid back to pre-crisis levels. The U.S market demonstrated the phenomenon we already witnessed in the past decade, of declines in the yields of government bonds alongside an increase in volatility (and a lowering of interest rates), while in Europe the beginning of the crisis was marked by rises in yields, as was the case in Israel.

Diagram 4: Yields of 10-year government bonds in various countries, February-May 2020



The beginning of March 2020 saw a significant increase in the spreads between corporate bonds and the government-bond-yield curve, and many bonds began trading at double-digit yields. The spreads of the BBB rating group increased within a matter of days to yields that characterized the European debt crisis of 2011, while spreads of the higher-rated bonds even exceeded the levels reached thereby in 2011, approaching their levels during the 2008 financial crisis. Toward the end of March, spreads grew more moderate. Such moderation trend withered at a certain point and in the case of lower-rated bonds, the spreads remain higher than pre-crisis levels.

Diagram 5: Development of spreads in corporate bonds in Israel with a duration of more than one year, by rating, 2008-2020

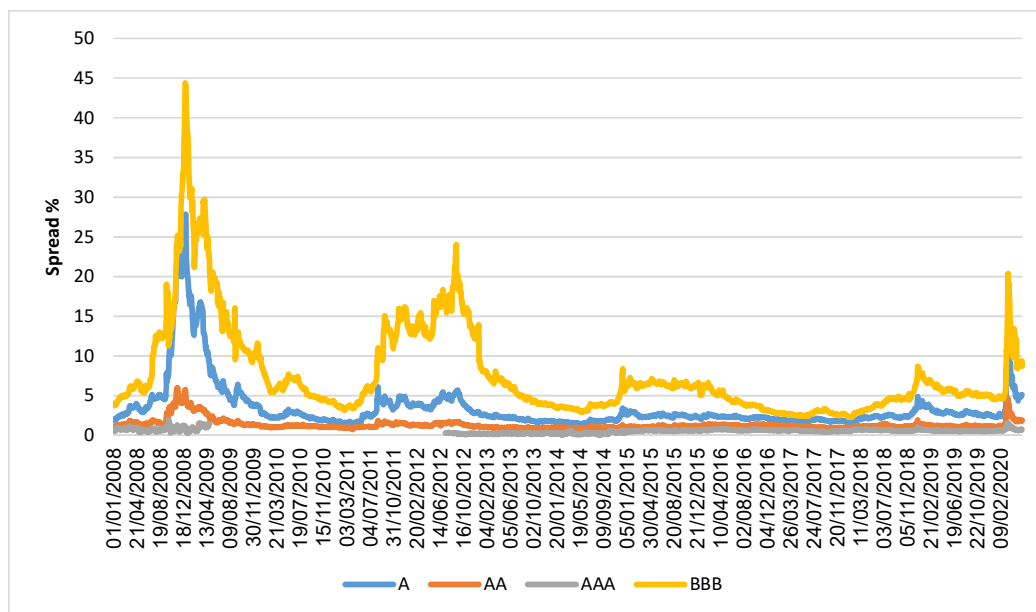
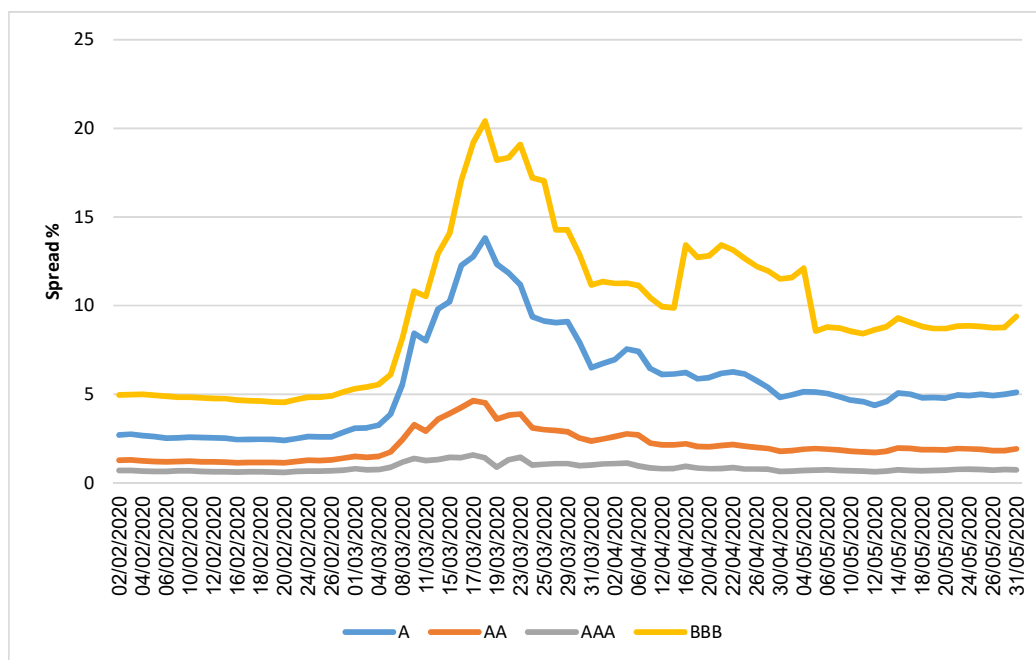
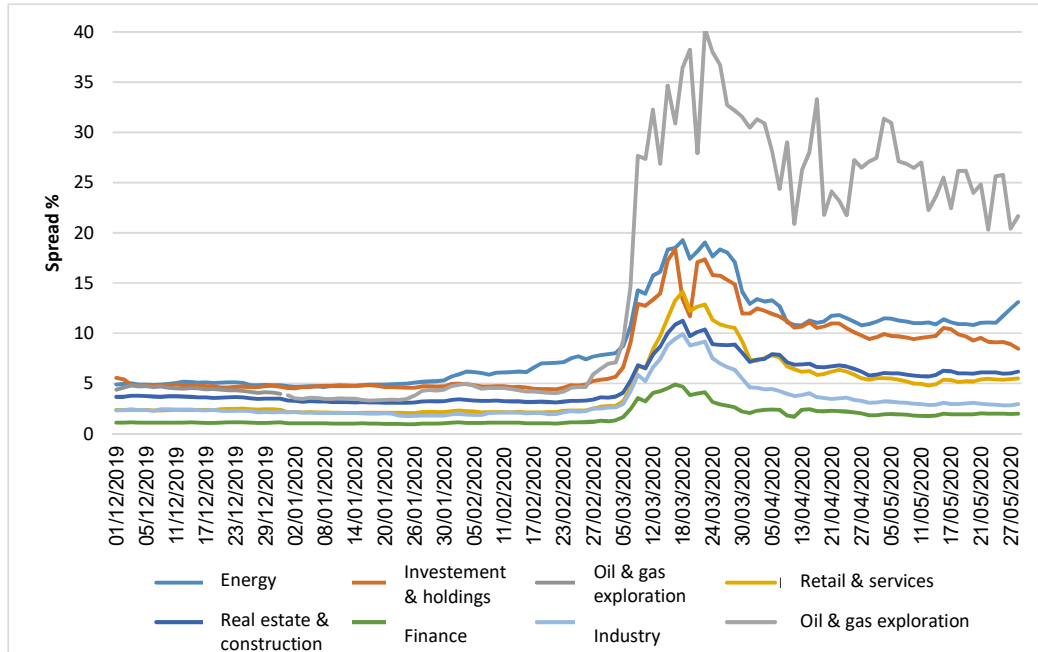


Diagram 6: Development of spreads in corporate bonds in Israel with a duration of more than one year, by rating, February-May 2020



Broken-down by sector, it is apparent that the sectors most adversely affected are oil and gas exploration, energy, investments and holdings, and retail and services. It should be taken into account that such breakdown does not differentiate between ratings, and thus different investment asset types and indices may behave differently, according to the composition and quality of debt thereof.

Diagram 7: Development of spreads in corporate bonds in Israel with a duration of more than one year, by sector, February-May 2020



The COVID-19 crisis versus the global financial crisis of 2008 – a comparison

The current financial crisis, which is the result of the outbreak of a pandemic, is difficult to compare with simple tools to previous financial crises in the last five decades. The nature and uniqueness of the health crisis force policymakers worldwide to impose varying degrees of quarantine and social isolation, which inflict self-financial harm, in an attempt to prevent the virus from spreading. However, as a certain point of reference, the global financial crisis of 2008 may serve as an example of the implications of a deep economic crisis, whose effects continue to resonate in the capital markets many years later. Therefore, we chose to present different characteristics of the Israeli capital market during the 2008 crisis in comparison with the situation today.

2008 saw a deterioration of the global financial crisis, which began as a domestic U.S. real estate crisis, and threatened to paralyze the global financial system, while causing severe liquidity distress in the global financial system, including in the core of the interbank financial market. Banks, other financial institutions and non-financial institutions around the world crashed, requiring massive assistance from governments worldwide. In the second half of 2008, the financial crisis deteriorated to a crisis in the real economy, with nearly every country worldwide experiencing a severe slowdown coupled with a rise in unemployment.

The financial markets in Israel, as in the world, were significantly impacted by the crisis, and their response reflected a concern from the implications of the crisis on the real activity in Israel: stock and corporate bond prices plummeted, risk asset volatility rose sharply, credit market spreads also increased, and there was a noticeable impairment of companies' ability to raise money in the market.

From a real economy perspective, export suffered most of the damage. The impairment to this component was significant, as was the decline in global trade. However, as the Israeli banking system was relatively little exposed to mortgage-backed assets, and the local housing market was marked by conservative behavior, and as export in Israel was relatively less affected than other open economies, the financial damage to the domestic product was relatively low.

In response to the crisis, various measures, primarily monetary, were taken in Israel, aimed at supporting market activity (counter-cyclical measures). The following monetary measures are noteworthy: a monetary expansion through a series of interest rate reductions, amounting to a total of 4%, and additional unconventional steps, such as the purchase of government bonds in an amount of approx. ILS 18 billion, and future direction of the monetary activity; purchases of large sums of foreign currency in order to prevent over-revaluation of the ILS rate; statements made by senior bank executives regarding the protection of deposits in commercial banks if necessary, with a view to prevent a public "bank run", and an increase of the reserve ratio by the Banking Supervision Department.

As noted, the monetary measures were the main response to the global crisis. The government on its part adopted a policy which in retrospect was neutral in terms of the business cycle, mainly comprised of the activation of automatic stabilizers and non-activation of the deficit ceiling. In addition, debt recycling funds were established, designated to provide credit to the corporate sector, in the form of special purpose funds funded by the state (24.7%), institutional investors (74.3%) and the founder (1%). The beginning of 2009 saw the launch of three funds that raised, over the next three years, around ILS 4.4 billion (of which 1.1 were government funds).

At such an early stage of the current crisis, it is difficult to assess the expected economic damage, but according to the latest forecast of the Bank of Israel Research Department³, Israeli product is expected to shrink by approx. 5.3% in 2020, the sharpest reduction ever, as a result of a plummet of 5% in private consumption, of 10.5% in investments and of 15% in export. The 2021 recovery forecast (which does not account for a second wave of infection) projects a product recovery rate of 8.7%.

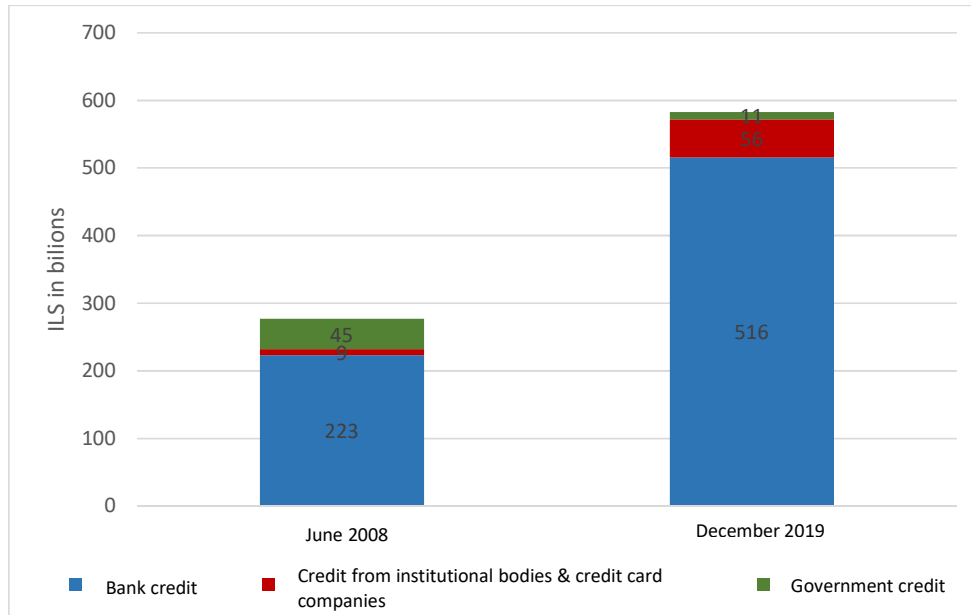
At this stage, unlike the 2008 crisis, the fiscal front provides extensive assistance for stabilizing the activity in the economy. The government deficit is expected to grow to approx. ILS 150 billion in 2020 (a product rate of around 11%) and the main budgetary expense at this stage is designated for assisting the business sector. Such aid includes government-backed loans, grants for reinstating employees, implementation of unemployment benefits and “first aid” to the health system. The monetary aid is also a significant factor, as the Bank of Israel undertook to buy government bonds in an amount of up to ILS 50 billion to ensure a stable government-yield environment in this period. Furthermore, the central bank supports the foreign currency market by opening designated repo facilities for the institutional entities. The Bank of Israel further clarified that it is considering also intervening in the corporate bond market to prevent a credit squeeze of strong companies in the public markets.

At this point, it is important to mention the trends in Israeli household credit since the 2008 crisis. According to late 2019 figures, the household debt balance amounts to approx. ILS 600 billion, versus ILS 277 billion in June 2008. In other words, **the total household debt doubled in the period. The banks provide 87% of the total household credit** (ILS 516 billion), and are thus the main source of credit for households (an increase since 2008, at which time banks provided 81% of such credit). Institutional entities and credit card companies jointly provide 9% of the total credit (ILS 56 billion). In June 2008, the debt provided by institutional entities and credit card companies amounted to only ILS 9 billion, comprising 3% of the total household credit. In other words, **the amount of credit provided by the institutional entities to households significantly grew**, in absolute terms and as a percentage of the total credit. Conversely, **the credit from the government significantly reduced** – from ILS 45 billion (16% of the total credit) to only ILS 11 billion (2% of the total credit).

64% of the total credit that was allocated was designated for financing apartment purchases by households (ILS 384 billion), a **similar share** to that of June 2008 (61%). However, in absolute terms, such credit volume doubled in this period.

³ The macro-economic forecast of the Research Department, April 2020 –
<https://www.boi.org.il/he/NewsAndPublications/PressReleases/Pages/06-04-20.aspx>

Diagram 8: Breakdown of household credit, 2008, 2019



Thus, since 2008, **the volume of household debt significant grew** (an increase from approx. ILS 280 billion to approx. ILS 600 billion), *inter alia* on the backdrop of a favorable interest-rate environment. As a consequence of such reality, **in the last decade, Israeli households have become more sensitive to any change in cash flow, a condition that may affect the intensity of the crisis.** The longer the crisis will continue, the stronger its expected direct impact on households, since it is likely they will suffer considerable cash flow difficulties (e.g., due to loss of employment, loss of rent income, impairment to capital market revenues, higher interest-rates on mortgages and other loans).

The condition of the Israeli capital market immediately before the crisis

This part will describe the condition of the Israeli capital market just before the current crisis and in comparison with the 2008 crisis. First, we will generally describe the business sector credit and will focus on the structure of the marketable bond market (volume, holders, sectors, ratings, yields, restructurings and pledges). Next, we will present the structure of the stock market.

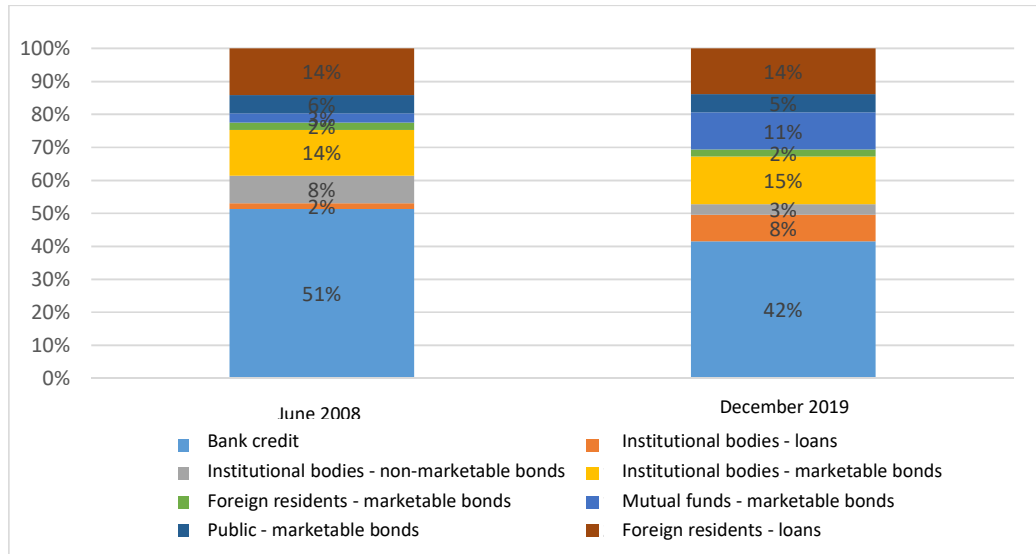
Breakdown of the business sector credit

The three main factors making-up the credit market are: **the lending sectors** – banks, institutional entities and market credit providers; **the borrowing sectors** – entities that take credit in the market; and **the financial instruments** through which the credit is provided. The non-financial business sector, which is made-up of the Israeli business companies, is the main borrower in the market.

At the end of 2019, the total business sector debt crossed the ILS 1 trillion threshold, versus approx. ILS 700 billion in June 2008 (an expansion of approximately 50% in the period). The share of the bank credit out of the business sector financing decreased from 51% to 42%, amounting to approx. ILS 450 billion today.

The nonbank credit includes private loans provided by institutional bodies and foreign residents as well as corporate bonds (non-marketable and marketable on TASE). Both the size and share of nonbank credit increased in the period. The share of **private loans** out of the total credit **increased** from 16% to 22%. In addition, **there was a significant expansion in the share of the corporate bond market**, which doubled in size in the period. At the end of 2019, around one third of the total business sector credit was financed through marketable corporate bonds. Conversely, **the share of non-marketable corporate bonds significantly decreased** (from approx. 8% to only 3% of the total credit).

Diagram 9: Breakdown of the business sector credit, 2008, 2019



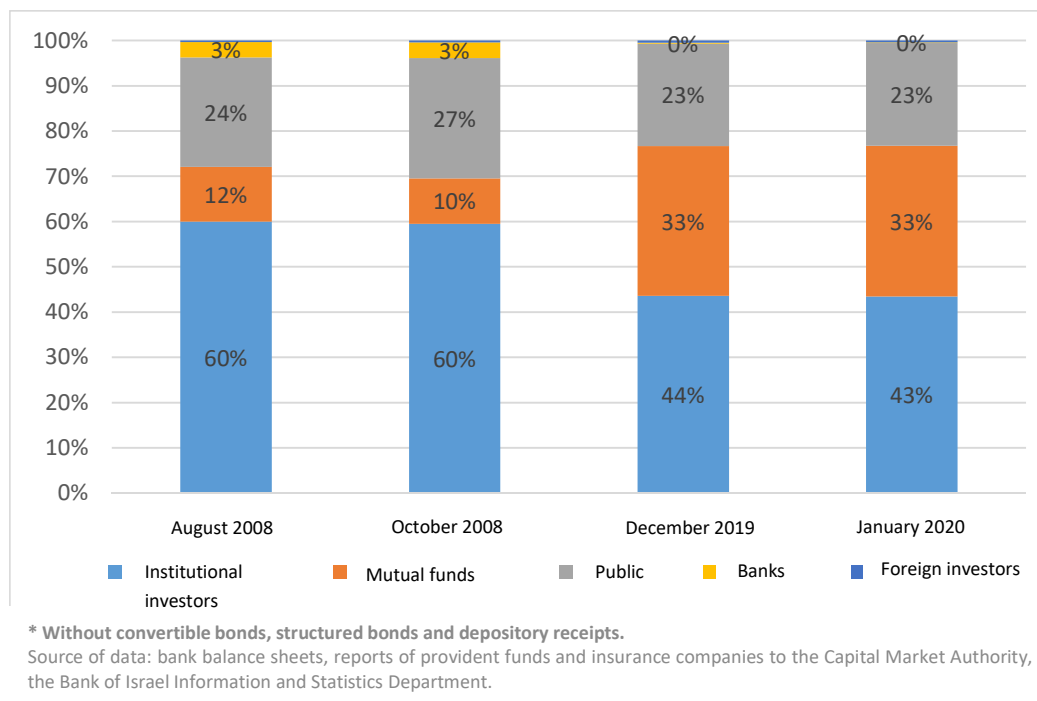
A breakdown of the nonbank credit according to the contribution of the various bodies reveals that **the share of institutional financing did not change significantly**, amounting to around 26% of the total business sector credit (versus 24% in June 2008). In addition, the share of the credit provided by foreign residents did not change, amounting to around 16%. Conversely, **the holding by mutual funds** (which now also include ETFs) of marketable corporate bonds⁴ out of the total business sector credit **increased** from 3% to 11%. The total share of the mutual funds and the other holdings of the public was approx. 17% in the end of 2019.⁵

At the beginning of 2020, the institutional bodies held around 43% of the total marketable corporate bond market value, versus 60% just before the 2008 financial crisis. In other words, **the share of the institutional bodies in the marketable corporate bond market decreased** (*inter alia*, due to the implications of the Hodek Committee report). However, **in absolute terms their holdings grew by more than 50%** - from ILS 93 billion in 2008 to ILS 150 billion at the beginning of 2020. **The holding by mutual funds of marketable corporate bonds also significantly increased** (from ILS 20 billion to ILS 120 billion), and their holdings comprise **around one third** of this market today (versus around 10% in 2008). In addition, the share of the direct holdings of **the public did not change** in the period, amounting to approx. 23% of this market.

⁴ Including such type of bonds of the financial sector.

⁵ Importantly, part of such increase derives from the transformation of ETNs to ETFs in 2018, i.e., their assets were not counted as part of such figure in 2008, although their size was very small in such period. This fact applies to all other data in this chapter that pertains to mutual funds.

Diagram 10: Breakdown of the main holders of marketable corporate bonds, 2008-2020



In conclusion, the composition of the business sector credit **changed** over the course of the decade. The **share of the bank credit dropped** to 42% and the financing of the business sector via **nonbank credit** (private loans and the marketable corporate bond market) **substantially increased**.

The total share of **institutional financing did not significantly change**, and at the end of 2019 amounted to around 26% of the total business sector credit. Conversely, **the share of the mutual funds out of the total business credit market increased** from 3% to 11%, and together with the holdings of the public, amounts to around 17%.

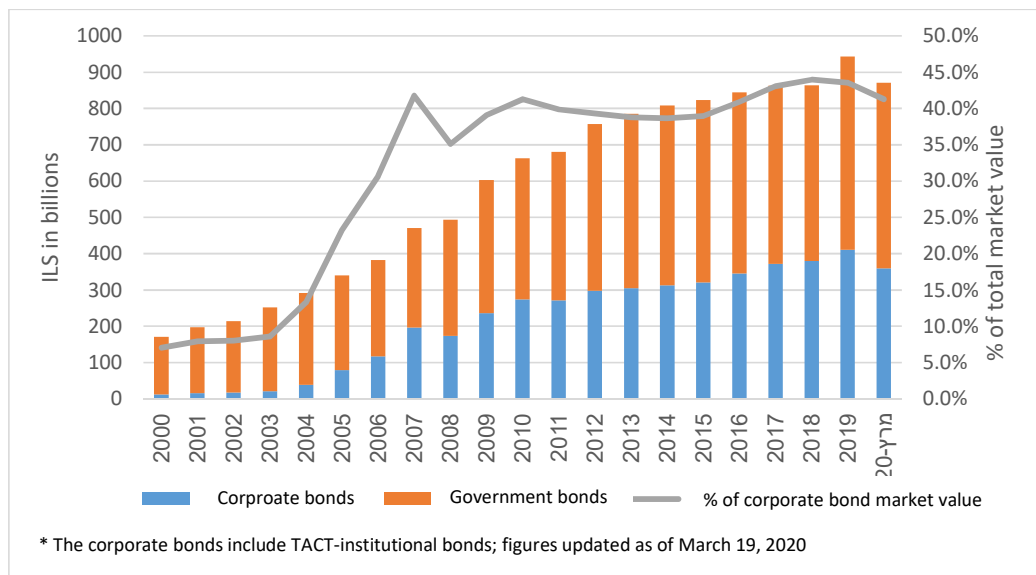
In the last decade, the marketable corporate bond market expanded to around one third of the total business sector credit. The share of **the institutional bodies out of the corporate bond market considerably decreased** (from 60% to 43%), while **the share of the mutual funds in this market increased** from 12% to 33%.

The macro-level importance of the credit market should be considered at this point: a developed credit market contributes to growth by enabling an efficient and continuous allocation of the financial sources to where they are most needed, while correctly pricing the risks inherent in the object of the loan. Moreover, a functioning credit market is crucial for a well-functioning real economy, and impairment to any one of its components may create a ripple effect of secondary damage to additional components, which will be harmful for the entire market. Thus, for example, many cases of insolvency in the bond market may cause widespread bankruptcy and debt write-off, which will impair the investors' confidence in the capital market. This will compromise the ability to raise debt in the primary and secondary markets and in the bank system, which in turn will cause a standstill in the provision of additional credit to companies, leading to an expansion of the crisis to additional companies, and so on and so forth.

The bond market

The Israeli corporate bond market has vastly grown over the course of the last two decades. In late 2019, the value of the corporate bond market was ILS 411 billion (including TACT-institutional bonds), and its **absolute value doubled** compared with the end of 2007. The government bond market also doubled in the period, and its value amounted to ILS 532 billion at the end of 2019. Consequently, the corporate bond market value comprised 44% of the total bond market in late 2019, **similar** to its proportion before the outbreak of the 2008 financial crisis.

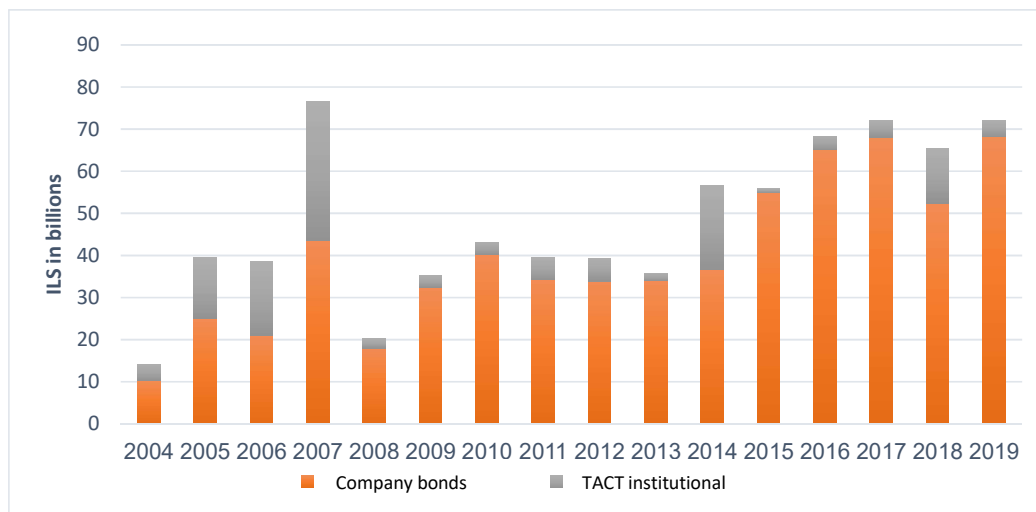
Diagram 11: Breakdown of the total bond market value on TASE, 2000-2020



The primary market – corporate bonds

In 2019, 132 companies issued corporate bonds⁶ with a total value of approx. ILS 72 billion. In the four years 2016-2019 the companies raised ILS 60-70 billion each year, twice the annual volumes raised in the five years that followed the 2008 crisis.

Diagram 12: Amount of corporate debt raised in Israel, 2009-2019



In March 2020, around 700 series of corporate bonds were traded in the market, issued by around 250 TASE-traded companies (of which 85 companies issued only bonds).

⁶ Marketable corporate bonds (including convertible bonds) and bonds traded on the TACT-institutional system.

The market value

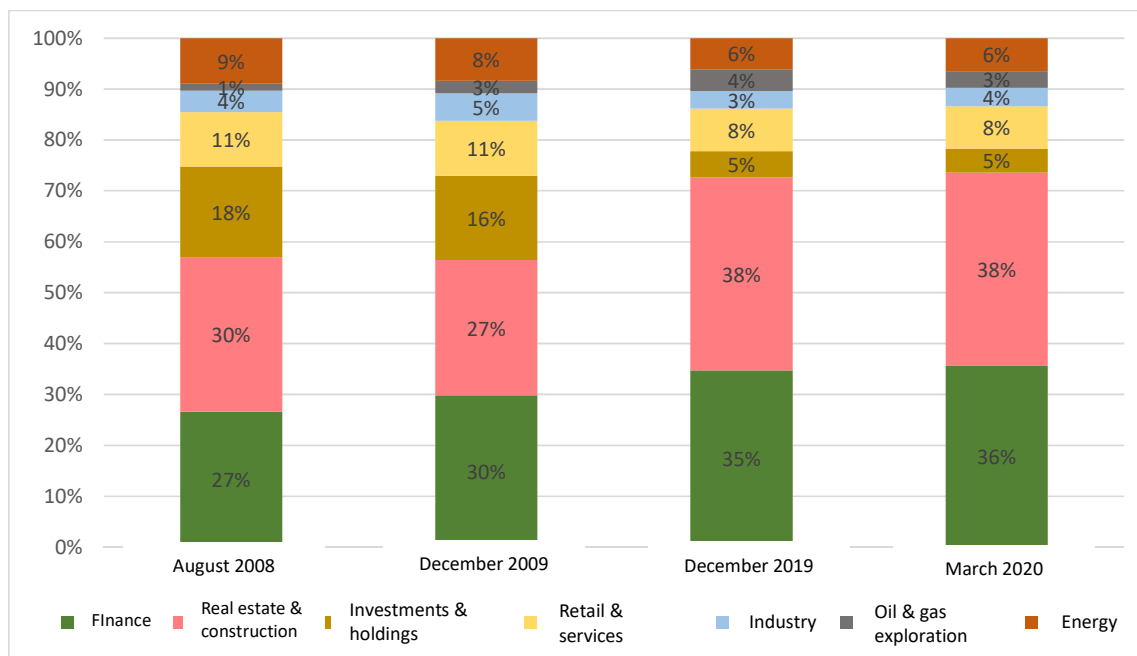
The value of the tradable corporate bond market **increased** by 12% in 2019, and amounted to ILS 380 billion at the end of 2019. In the last decade, the market value of the corporate bonds **more than doubled** in size.

Breakdown by sector

A breakdown of the tradable corporate bond market **by sector** reveals that the composition of this market materially changed. The **financial sector increased** from 27% (August 2008) to 35% in late 2019. In addition, **the share of the real estate and construction sector significantly increased** – from 30% to 38%. Conversely, the **investment and holding sector decreased** from 18% to 5%. The joint share of the retail, services and industry sectors also dropped to around 11% of the market (versus 15% in 2008). The **oil and gas sector grew** to 4% (versus only 1% in 2008). In addition, the share of the **energy sector decreased** from 9% to 6% over the course of the decade.

In other words, the tradable corporate bond market is currently far more exposed to the financial and real estate sectors than it was before the outbreak of the financial crisis in 2008.

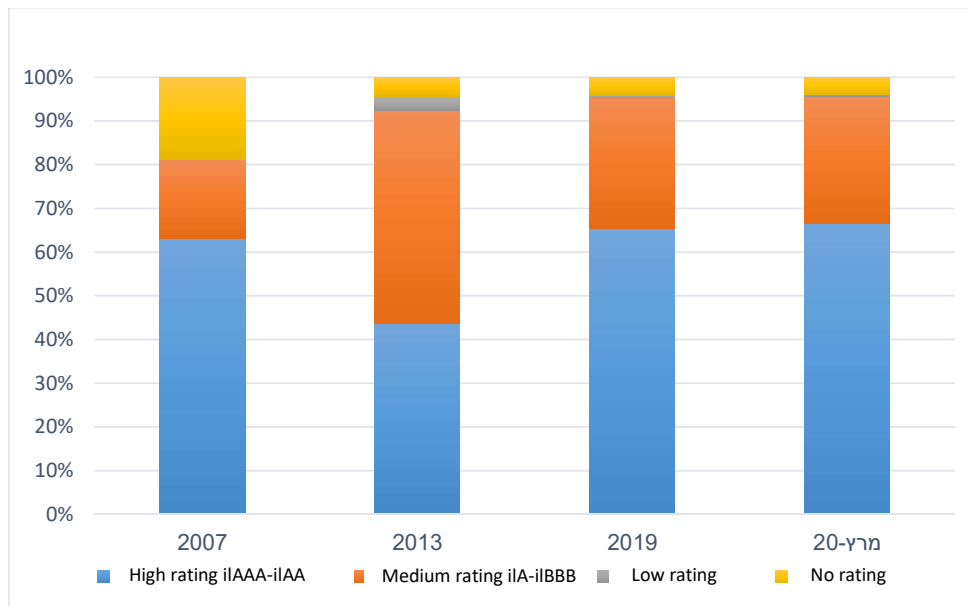
Diagram 13: Breakdown of the marketable corporate bond market value by sector, 2008-2020



Breakdown by credit ratings

Around 67% of the tradable debt value has **high local ratings** (ilAA-ilAAA), **similarly to the end of 2007**. In addition, 29% of the marketable debt value has **medium ratings** (ilA-ilBBB), versus 18% immediately before the outbreak of the 2008 financial crisis. A mere 4.5% of the debt value **has low or no ratings** (versus 2007, in which around 19% of the debt value had low or no ratings).

Diagram 14: Breakdown of the total marketable corporate debt by rating, 2007-2020

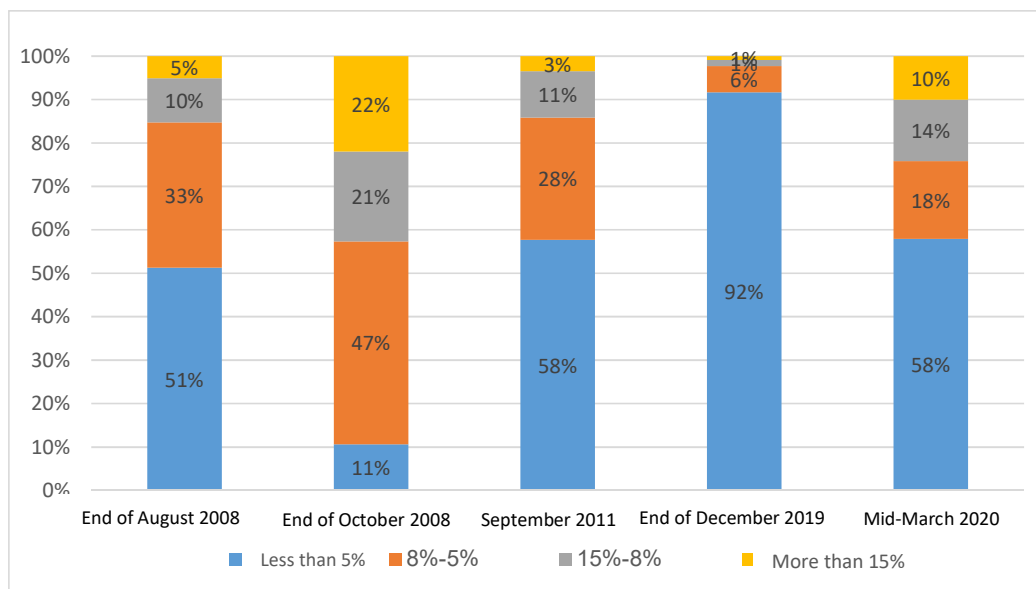


Breakdown by yield to maturity (YTM)

Recent years were characterized by a **low interest-rate environment**, in which most series of corporate bonds were traded at a YTM lower than 5%.

At the end of 2019, around 92% of the tradable corporate bond market value was traded at a YTM of up to 5%. The condition of the corporate bond market before the current crisis was materially different to its condition before the outbreak of the 2008 crisis, when only 52% of its market value was traded at a YTM of up to 5% and 33% was traded at a YTM of up to 8%. Such data should naturally be considered according to the differences in the central bank interest-rate environments. See Diagram 15 below:

Diagram 15: Breakdown of the tradable corporate bond market value by yield to maturity, 2008-2020



Bond debt restructuring

After the outbreak of the 2008 crisis, we witnessed a wave of debt restructurings in the corporate bond market, reaching a value of approx. ILS 56 billion. Over the course of 2008-2019, 128 different companies underwent 171 bond debt restructuring processes, of which 38 companies underwent two to four restructurings or are still in the midst of such process.

2009 saw the highest percentage of new debt restructurings, around 7% of the total tradable corporate bond market (ILS 15 billion). In such year, 50 companies began restructuring processes.

In recent years, both the number of companies and the value of debt entering restructuring processes significantly decreased. In 2019, six companies started new bond debt restructurings, with a total debt amount of approx. ILS 3.5 billion.

Around 31% of the volume of the new debt restructurings (10% of the number of processes) between the years 2008-2019 had a medium rating (iA-ilBBB) at the beginning of the process; around 39% of the debt volume (11% of the number of restructurings) had a low rating; and around 30% of the debt volume (79% of the number of restructurings) was not rated.

At the end of March 2020, the total debt under restructuring was approx. ILS 2.5 billion, involving 6 companies with 9 bond series.

Table 1: Bond debt restructurings, 2008-2019

Year processes began	Number of companies*	Adjusted par value of new debt restructurings** (ILS in millions)	Total adjusted par value of the tradable debt*** (ILS in million)	% of new debt restructurings out of the total tradable debt	Market value of new debt restructurings** (ILS in millions)	% of market value out of the adjusted par value of new debt restructurings
2008	7	903	182,740	0.49%	308	34%
2009	50	15,097	213,123	7.08%	5,943	39%
2010	17	1,469	237,605	0.62%	805	55%
2011	25	5,953	254,493	2.34%	2,604	44%
2012	31	9,998	262,447	3.81%	4,035	40%
2013	10	5,814	263,631	2.21%	3,050	52%
2014	9	3,337	256,630	1.30%	1,946	58%
2015	7	2,056	267,821	0.77%	965	47%
2016	6	5,106	291,687	1.75%	2,814	55%
2017	4	838	310,529	0.27%	633	75%
2018	3	1,766	339,752	0.52%	1,275	72%
2019	6	3,535	376,601	0.94%	2,294	65%
Total	128	55,873			26,671	48%

* A company may appear several times if its bond series commenced restructuring processes in different years, or if it is undergoing its second to fourth restructuring process.

** As of the date on which the company began the restructuring process.

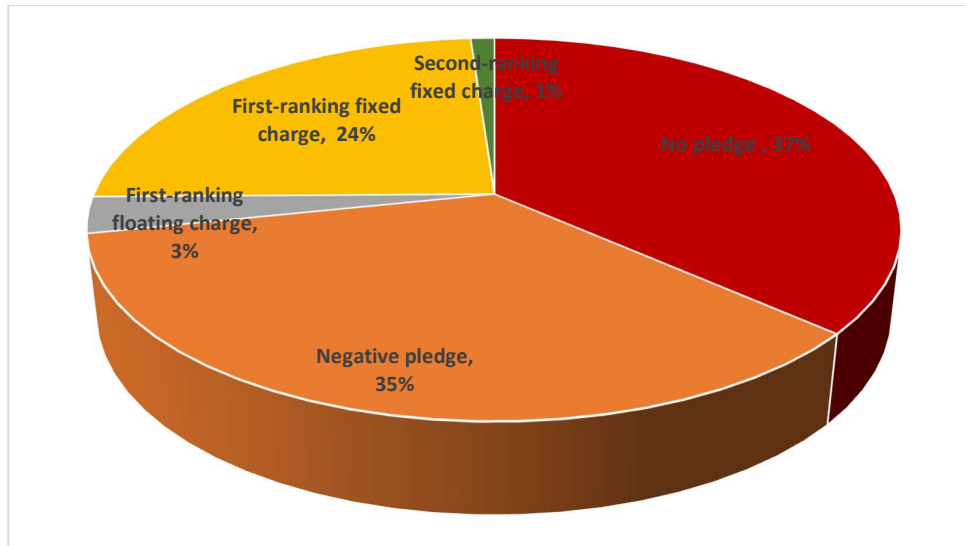
*** Company bonds and convertible bonds (as of the end of the period).

Pledges

In March 2020, 37% of the total tradable corporate debt was not subject to any pledge in favor of the investors, 35% was subject to a negative pledge (an undertaking not to grant a new pledge to a third party), and 24% was subject to a first-ranking fixed charge (the pledging of specific property of the company in favor of the investors)⁷. In other words, two thirds of the debt traded on TASE were issued without a specific pledge.

⁷ In addition, 3% of the marketable debt volume was subject to a first-ranking floating charge, and 1% was subject to a second-ranking fixed charge.

Diagram 16: Corporate debt balance by type of pledge, March 2020



In conclusion, the tradable corporate bond market expanded (doubled in value) and matured since the 2008 financial crisis. At the end of 2019, the market was characterized by high credit ratings, low pricing of credit risks (alongside low interest-rate environments in Israel and overseas) and few insolvency cases of companies that issued tradable debt on TASE. In addition, the exposure to the financial and real estate sectors has considerably grown.

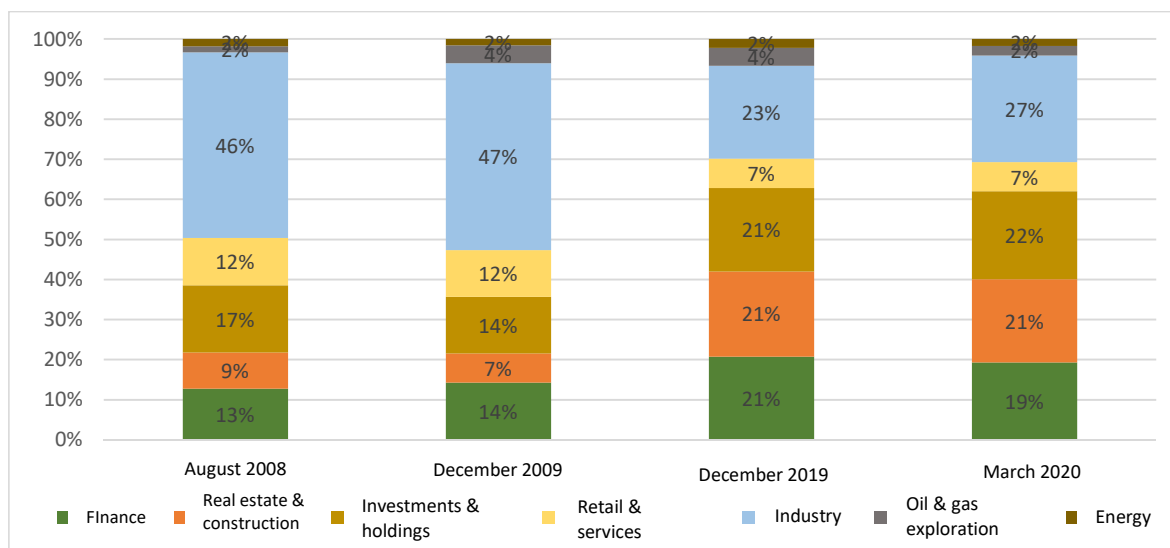
The stock market

At the end of 2019, 442 public companies were traded on TASE. In 2019, the market value of the stock and participation units traded on TASE went up by 17% to ILS 817 billion. Since August 2008, the stock market value increased by around 33%, but the number of public companies on TASE dropped by around 30%.

Since August 2008, material changes took place in the segmentation of the market. The share of the industrial sector was cut by half, the share of the financial sector grew from 13% to 19%, the share of the real estate and construction sector tripled in size, and the share of the retail and services sector shrank from 12% to 7%.

In other words, **similarly to the corporate bond market**, the stock market became far more exposed to the financial and real estate sectors, compared with 2008.

Diagram 17: Breakdown of the stock market and participation units, by sector, 2008-2020



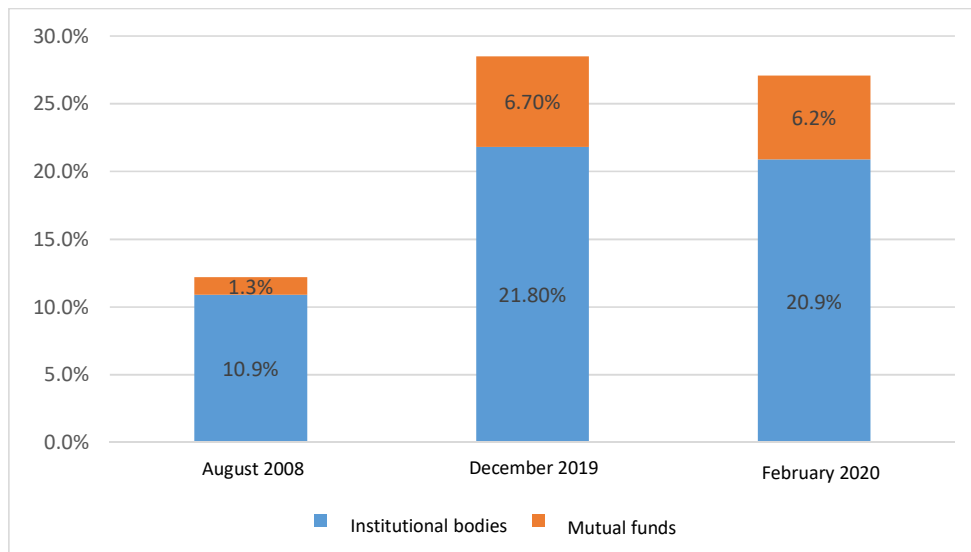
Since August 2008, the stock market grew by only 33%, while the total assets managed under medium and long-term asset managers tripled in size. While the institutionals did not increase the proportion of their stock investments, and it remained at approx. 9% of their assets (unlike the mutual funds, which increased from 7% to 14% of their total assets⁸), the money managed by all types of institutionals continued flowing into the Israeli stock market. As a consequence, their share of the stock market considerably grew.

As emerging from Diagram 18, the institutional holdings in the stock market doubled from 12% in August 2008 to 28% in late 2019 (rising from 11% to 22% without the mutual funds). As the Israeli stock market is still characterized by a relatively high percentage of companies that are controlled by controlling shareholders and a relatively low percentage of free float, in global terms (even after the percentage of free float increased from 50% in August 2008 to 63% at the end of 2019), the share of institutional

⁸ The aforesaid was affected, *inter alia*, by the transformation of ETNs to ETFs.

holdings from the free float considerably grew – from 23% to 43% in such period.

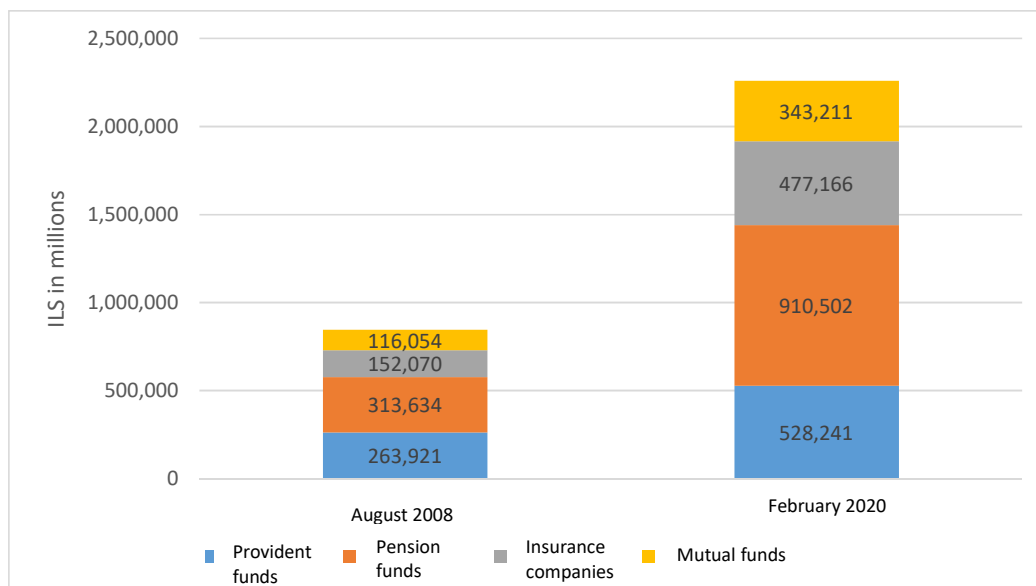
Diagram 18: Institutional holdings out of the value of the share market and participation unit, 2008-2020



Public savings on crisis eve

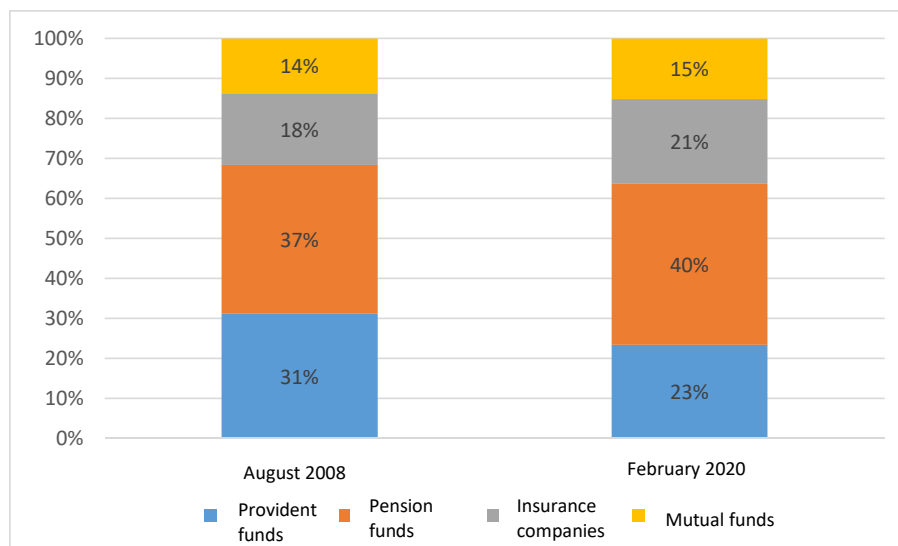
The institutionals, i.e. the provident funds, pension funds, insurance companies and mutual funds, manage the public's long-term savings (pensions) and medium-term savings (mutual funds). In addition, as a result of the expansion of the mandatory pension in 2008, which brought about an inelastic increase in pension funds, and the rises in the value of assets that accompanied the bull market after the 2008 crisis, the last decade saw a considerable increase in the volume of assets under institutional management, as Diagram 19 demonstrates. **Assets almost tripled in size since August 2008, amounting to approx. ILS 2.3 trillion in February 2020.**

Diagram 19: Total assets under institutional management, August 2008, February 2020



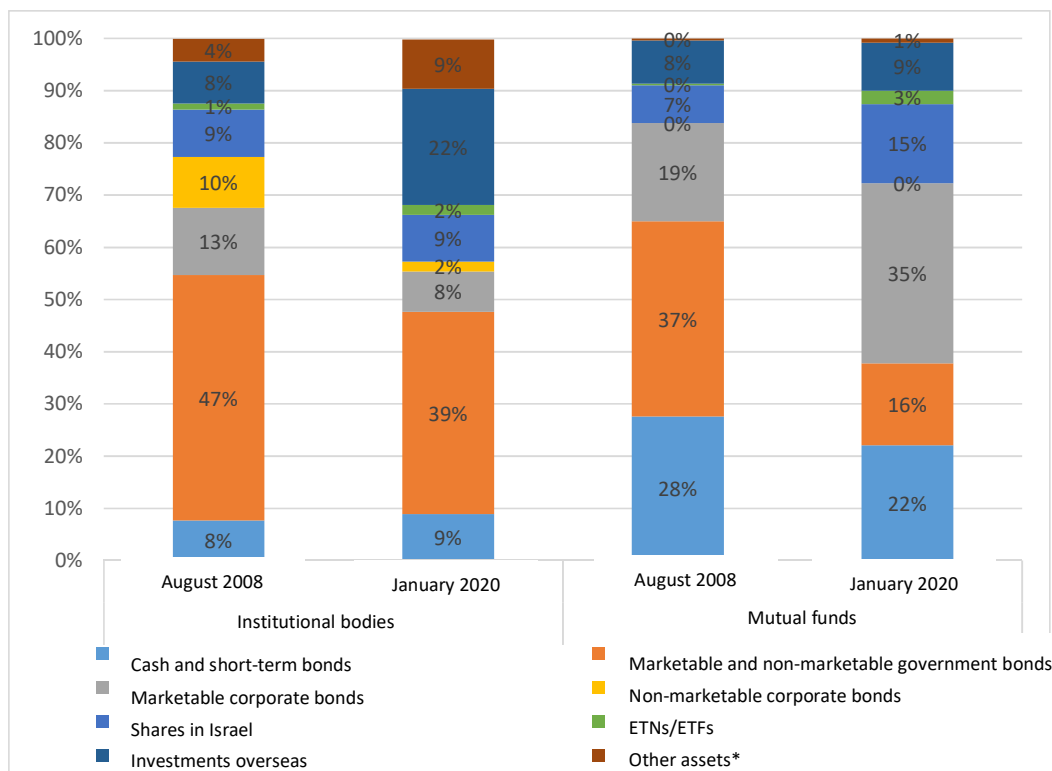
Most of the assets was managed by the pension funds (around ILS 910 billion, comprising 40% of total AUM), and as demonstrated in the next diagram, the inter-body breakdown did not significantly change, other than a decrease in the share of the provident funds in favor of the pension funds and insurance policies. This process apparently took place following the decision, implemented in 2008, to equate tax conditions and facilitate the transition between the various products. The medium-term savings through the mutual funds comprise approx. 15% of the total funds under institutional management, a percentage that remained fairly stable throughout the period.

Diagram 20: Total assets under management by institutional type, August 2008, February 2020



The increase in assets since August 2008 was reflected in all of types of assets in which the institutionals invest. However, the asset mix **materially changed**.

Diagram 21: Breakdown of the total assets under management by type of asset, August 2008, January 2020



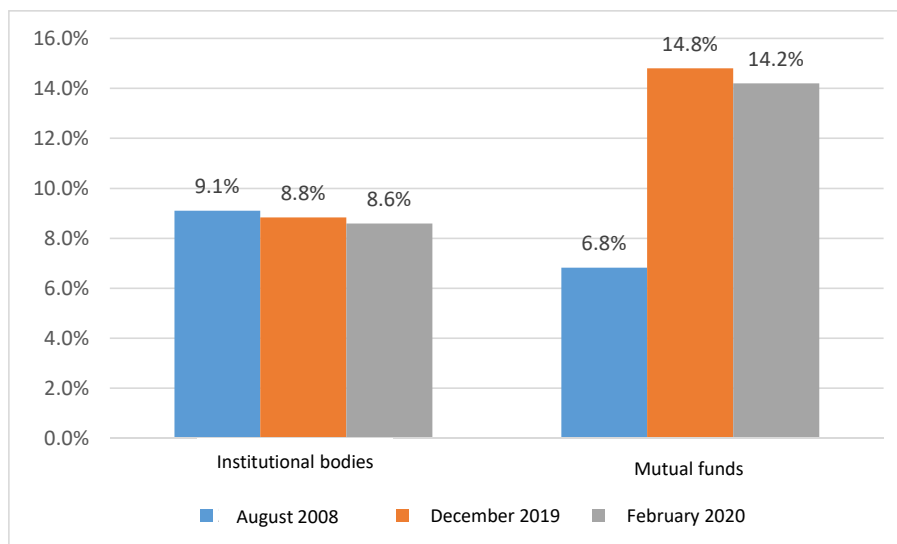
* Other assets: institutional investors – including loans, mortgage portfolios, certificates of participation in mutual funds, property rights, future assets and other structured products. Mutual funds – including certificates of participation in foreign funds and future assets. Source: reports of insurance companies, provident, pension funds and mutual funds.

Diagram 21 demonstrates that the share of government bonds, including the designated bonds, considerably decreased both in long-term savings assets (from 47% in 2008 to 39% in January 2020) and in mutual funds (from 37% in 2008 to 16% in January 2020), consistent with the fiscal downward trend in the government debt to product ratio over the course of the last decade.

In addition, it is apparent that the percentage of shares holdings in mutual funds increased, growing in that period from 7% to 15%⁹. Conversely, for other institutional bodies the proportion of shares out of total assets did not significantly change (remaining at a level of 9%).

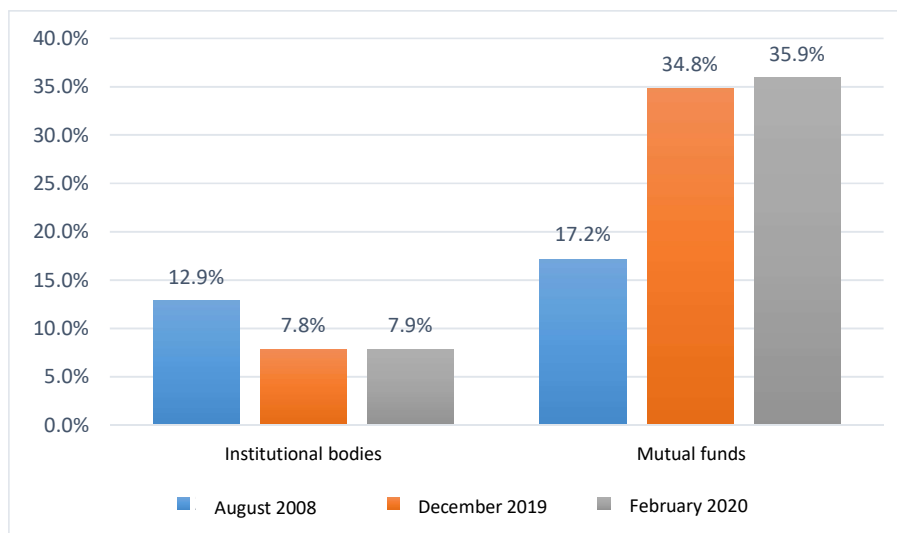
⁹ The increase derives, *inter alia*, from Amendment 28, which brought about the addition of ETFs to the mutual fund sector in late 2018.

Diagram 22: Institutional holding of shares, out of total assets under management, 2008-2020



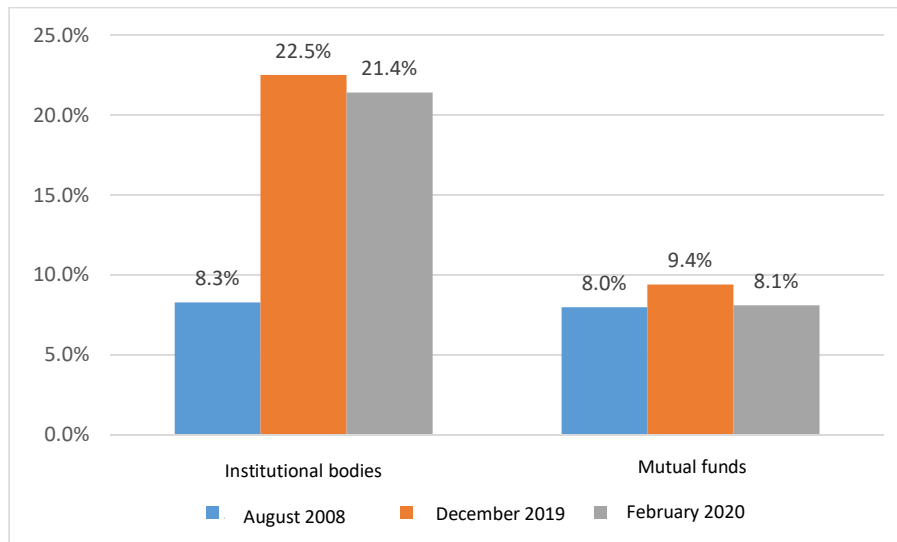
In addition, the share of the assets invested by institutional bodies in tradable corporate bonds considerably decreased (from 13% to 8%). Conversely, the mutual funds doubled their holdings (from 19% to 35%) in such bonds. Moreover, the share of the institutional holdings in non-tradable corporate bonds dropped from 10% to only 2%.

Diagram 23: Institutional holding of tradable corporate bonds in Israel, out of total assets under management, 2008-2020



The share of the assets invested overseas by institutionals tripled in size over the last decade (up from 8% to 22.5%). In other words, a significant part of the increase in the assets under the management of such bodies was directed to investments overseas. Conversely, the share of foreign securities out of the assets of the mutual funds remained unchanged (8%-9%).

Diagram 24: Percentage of foreign assets in institutional portfolios, 2008-2020



An additional trend, which mainly manifested in the second half of the decade, was the increase in the volume of non-tradable assets in the portfolios managed by the institutional bodies (i.e., other assets). This global upward trend, taking place in Israel and overseas, is mainly expressed in investments in real estate and private equity funds.

Importantly, even when the share of a certain asset type, such as shares, did not increase, or even decreased, as in the case of corporate bonds, in monetary terms the exposure to such asset types has grown, in view of the material increase in the total assets under management.

Immediate influences on ISA-supervised bodies

Reports of publicly traded corporations

As described above, the companies traded on TASE experienced significant drops in value and rises in the yields of the bonds they issued to the public.

As part of their regulatory obligations, the companies are required to report to the public on any material influence on their business. On March 8, 2020, an announcement was released on the ISA website regarding “Disclosures on implications of the COVID-19 outbreak on the business operations of reporting corporations”¹⁰.

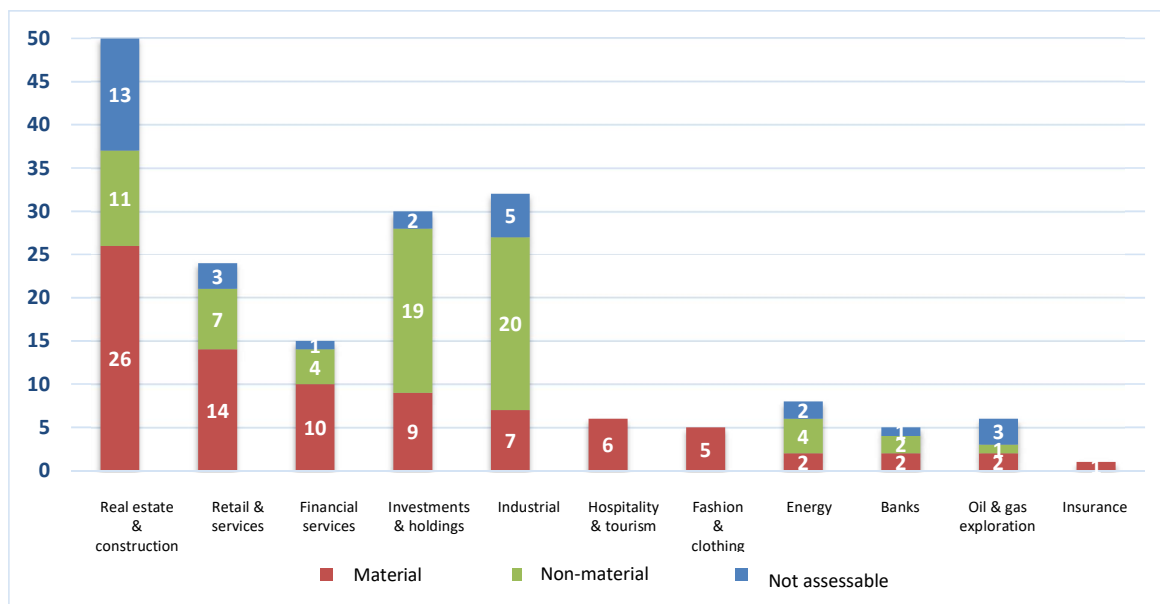
By the end of May 2020, a total of 194 companies released 352 immediate reports on possible implications of the crisis. The reporting companies’ market value was, at the time, ILS 213 billion, comprising 30% of the total stock market value on TASE. Such companies dropped by a weighted average of 21% since February 20, 2020. The balance of bonds issued by such companies was ILS 157 billion par value, comprising 47% of the total balance of marketable corporate bonds on TASE.

The first reports were by companies in the immediate circle of effect: fashion and clothing, hospitality and tourism, airlines, as well as industrial and retail companies that manufacture in China or purchase therefrom. Thereafter, reports were released by second-circle companies, primarily from the energy, oil and gas exploration, real estate and construction, financial services and retail and services sectors.

Diagram 25 describes the breakdown of the companies that released immediate reports on the implications of the crisis, by sector and by the estimated impact on the company’s business condition. The estimate is based on the short-term impact.

¹⁰ Click here to view http://www.isa.gov.il/sites/ISAEng/1489/1511/Documents/corona_notice.pdf

Diagram 25: Number of reporting companies, by sector and by estimated materiality of impact on the business condition



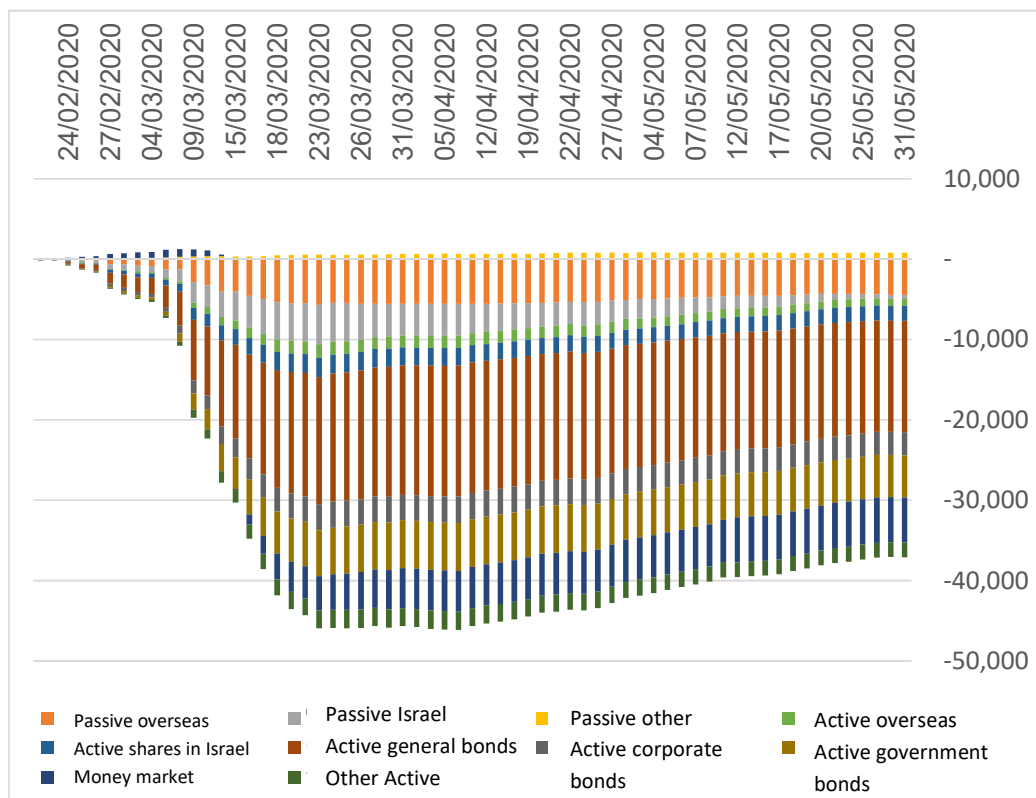
In total, a material impact was estimated in 91 companies. At the end of May 2020, the market value of such companies was ILS 90 billion (14% of the market cap), and the balance of their marketable debt was ILS 79 billion par value (24%).

Mutual funds

Due to concerns of investors about the condition of the markets and continued drops, many investors chose to redeem their mutual funds. As a consequence, during the crisis exceptionally high net redemptions were recorded in mutual funds. **Since the beginning of the crisis at the end of February and until its peak at the beginning of April, more than ILS 44 billion were redeemed from mutual funds.** In March 2020 alone, around ILS 42 billion were redeemed from mutual funds. These redemptions joined a decrease in the value of the funds, deriving from a depreciation in the value of the assets due to the sharp declines recorded on TASE. Thus, the value of the funds plummeted from around ILS 357 billion just before the crisis to around ILS 255 billion at the lowest point – nearly 30% decrease. Since that low point, the value of the assets increased, aggregating to the net creation of around ILS 9 billion, which began accumulating since the end of March. At the end of May 2020, the total value of mutual fund assets amounted to approx. ILS 300 billion.

Diagram 26 describes the development of cumulative net redemptions since the beginning of the crisis, broken-down by fund class.

Diagram 26: Net and cumulative creations/redemptions (ILS in billions), by fund class



As illustrated in the diagram, redemptions took place in all fund classes, with the largest sums redeemed in the “general bonds in Israel” class (which is also the largest class). A statistical analysis of the composition of the assets in the “general bonds in Israel” class reveals that around 60% of the assets in this class are invested in corporate bonds, around 25% in government bonds and around 10% in shares. The extensive holdings of government bonds in a class experiencing such significant redemptions, coupled with additional redemptions in the "government bonds" class, can explain why yields of Israeli government bonds increased at the beginning of the crisis, instead of decreasing as expected at times of crisis.

It is further apparent that in the recovery period, the passive funds in Israel raised net amounts identical to the redemptions made during the crisis.

In conclusion it is noted that unlike long-term savings, in which the ability to withdraw the investment is limited, in the mutual funds, which allow for daily liquidity, irregular withdrawals developed within a short period of time during the crisis. One of the challenges emerging from significant redemptions in a short timeframe is a potential shortage of liquidity. Redemptions require fund managers to sell assets quickly, while they struggle to find buyers at reasonable prices. This dynamic may exacerbate the stock market drop, and may further drive managers to dispose of assets with greater liquidity (such as government bonds) and continue to hold assets that are not as liquid, and therefore potentially riskier. This and other challenges will be further discussed below.

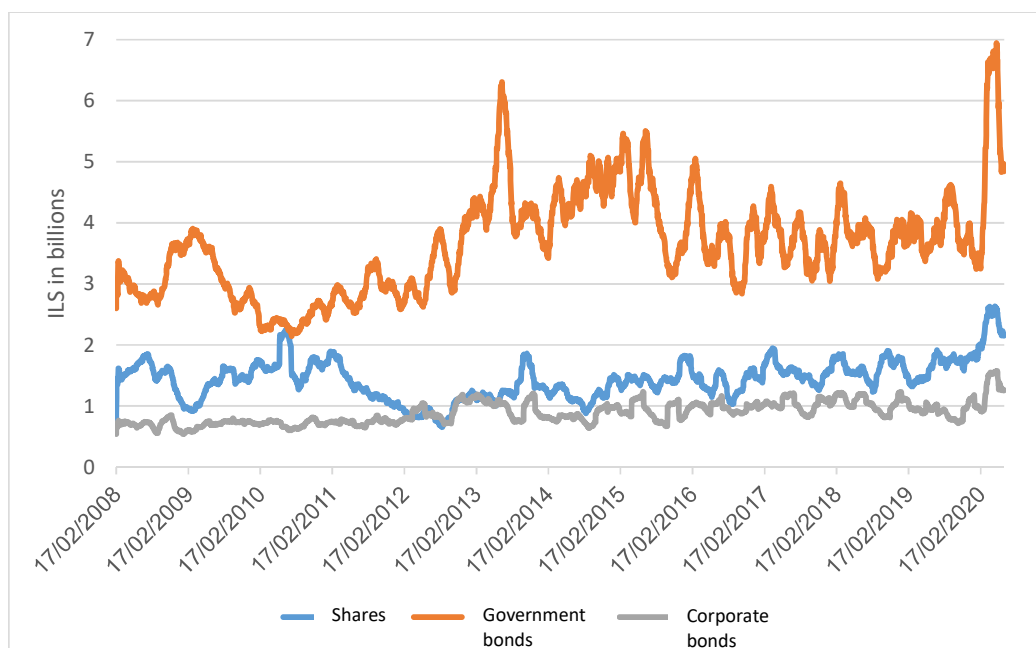
Chapter 1 – The activity of the different investors in TASE around the crisis

This chapter examines the day-by-day activity of the different TASE players. First, we will review trends in the volume of transactions in the various securities (trade turnovers, number of orders and number of active accounts). Next, we will try to identify major trends in the interactions between the various players by aggregating the daily buying and selling of the different types of traders, around the crisis.

Trading volumes

A central indicator of the volume of activity during the crisis is the trading turnovers. The turnovers in all types of TASE-traded securities soared during the crisis to record values. Diagram 1.1 demonstrates the increase at the peak of the crisis and the decline thereafter.

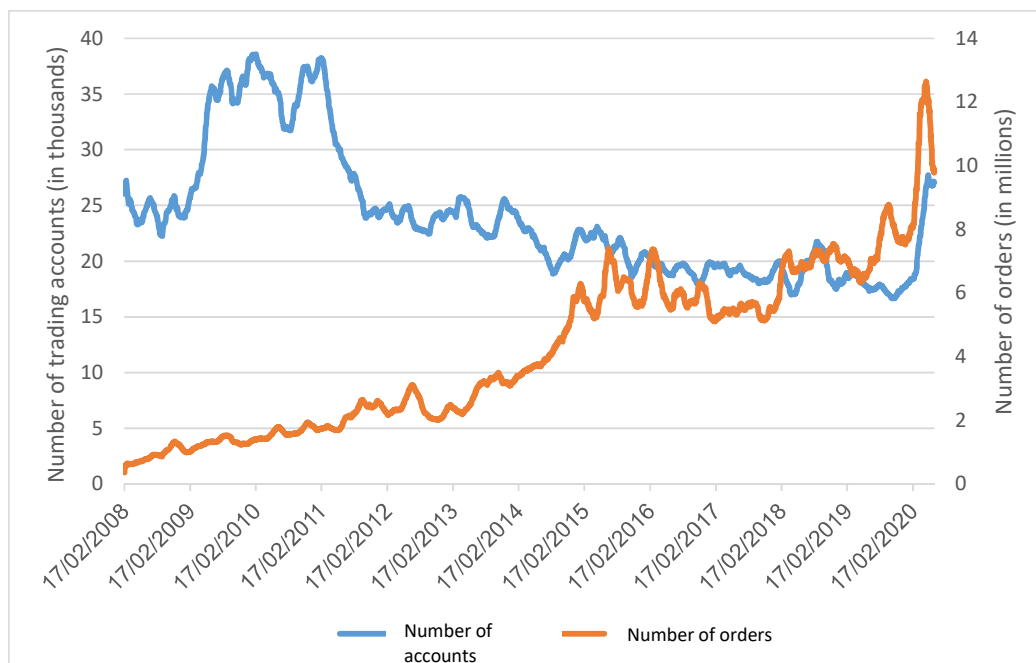
Diagram 1.1: Trade turnovers on TASE (ILS in billions), 40-trading day moving average



An additional indicator of the sharp rise in trading activity is the number of active trading accounts and the number of orders placed. Diagram 1.2 demonstrates such data (for all types of securities other than options), using a 40-trading day moving average. As demonstrated, the number of orders peaked during the crisis. Notably, the number of orders significantly grew, compared with the trade turnovers presented above since 2008. A reasonable explanation for this phenomenon is an expansion in the activity of algo traders, which will be discussed below.

The number of active accounts dropped since the period of recovery from the 2008 crisis, but here too a significant increase is apparent around the current crisis.

Diagram 1.2: Number of active trading accounts and number of orders placed, 40-trading day moving average



Analysis of aggregate buys

Methodology

For each type of entity, we aggregated the net buys (buys minus asks) in each day from the beginning of the year until the end of May 2020.

The types of entities are: pension funds, provident funds, insurance companies, mutual funds, portfolio managers, market makers, nostro accounts of TASE members, foreign residents, and others (“**Public**”).

In addition, the Public, which includes sophisticated players whose main occupation is trading (nostro companies, algo traders, etc.), was broken-down into three categories according to their trading volumes in the three months under examination, such that **each group makes-up one third of the Public’s total trading volume in absolute terms**. Such groups are specified below:

Table 1.1: Breakdown of the Public into groups

Group	Number of entities	Average daily trading volume, in ILS
“Small” Public	300,335	10,000
“Medium” Public	208	14,000,000
“Large” Public	38	80,000,000

In government bonds, market makers are appointed by the Ministry of Finance and are not identified as market makers by TASE. Market making in government bonds is performed by most of the local and foreign banks that are TASE members, through their nostro accounts, and are therefore, also included in the "nostro accounts of TASE members" group. This group also includes the Bank of Israel, which started buying government bonds according to the program that was published during the crisis.

Before presenting the findings, it is stressed that this analysis was performed on an aggregate basis, in order to identify general trends, without examining the specific activity of the different players. Therefore, no uniform activity by such groups may be assumed.

In addition, the information regarding account attribution may be incomplete and inaccurate. As aforesaid, **the analysis of these data is solely designed to assess general trends.**

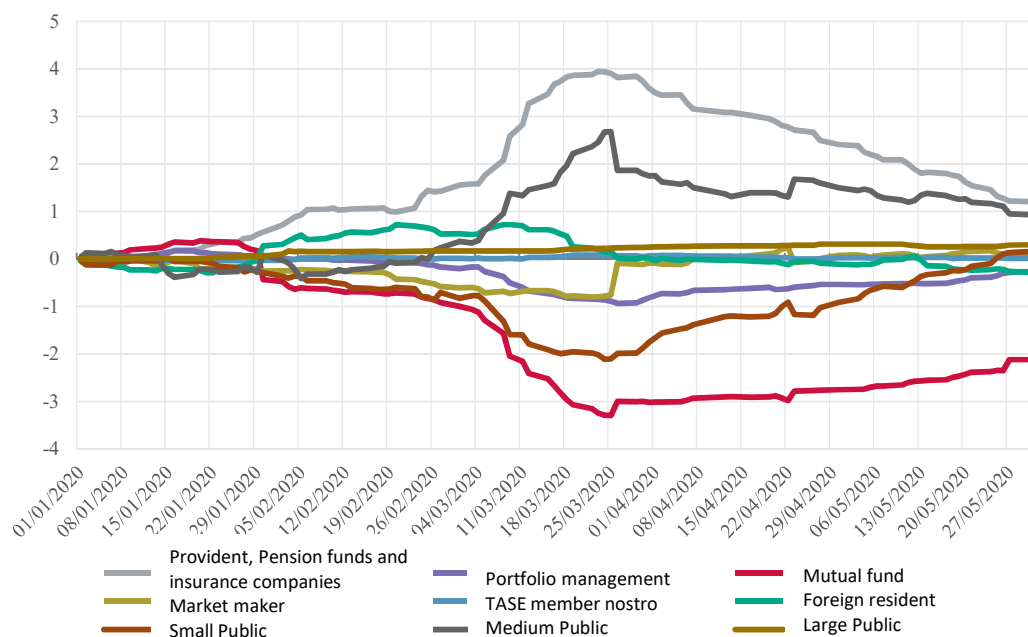
Findings

Below is a description of the findings, broken-down by type of security.

Diagram 1.3 describes the net buys of shares and participation units by type of entity. The diagram demonstrates that the main sellers during the crisis were mutual funds, due to the irregular redemption volumes described in the previous chapter. An additional group is the small public accounts. A reasonable explanation therefor is that they are characterized as "weak hands", who rush to sell during periods of declines in view of the panic in the markets.

However, **the supply was generally absorbed by the institutional bodies (pension, provident funds and insurance companies) and medium-size "Public" accounts,** which are often more sophisticated players with a greater capacity to absorb loss and seize buying opportunities at relatively low prices.

Diagram 1.3: Aggregate net buys (ILS billions) of shares and participation units, by type of entity, January-May 2020

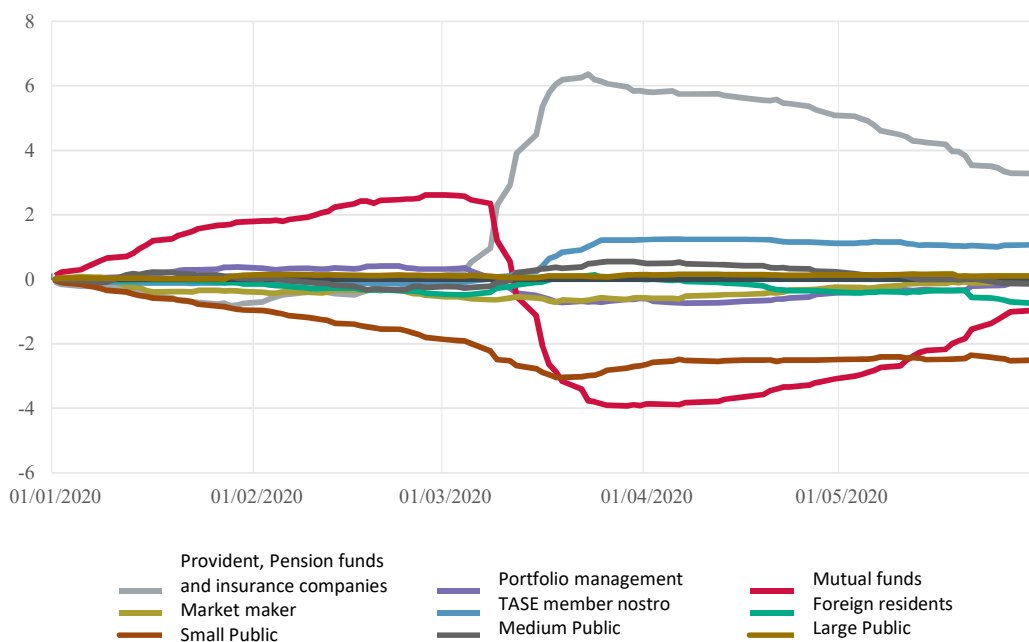


Notably, the larger accounts did not significantly change their position. A reasonable explanation for this phenomenon is that this group includes also traders and players whose activity is characterized by non-formal market making strategies. It is further apparent that the formal market makers were actually inclined towards selling at the beginning of the period, but balanced out their position towards the end of March 2020 (a more thorough analysis of the formal and non-formal market makers is presented in Chapter 4).

Commencing from the recovery stage (end of March 2020) the small and medium public accounts have been simultaneously reversing the trend: the small account buy and the medium accounts sell, while those transactions are apparently made at higher prices.

A similar picture emerges in corporate bonds, as demonstrated in Diagram 1.4, in which the mutual funds and small public accounts were the main sellers. An in-depth examination of the small public group reveals that its members were net selling corporate bonds before the crisis (at least since the beginning of 2020). However, in mid-March they changed the trend and began buying the bonds. Such trends may have been affected by the historically low yields before the crisis.

Diagram 1.4: Aggregate net buys (ILS in billions) of corporate bonds, by type of entity, January-May 2020

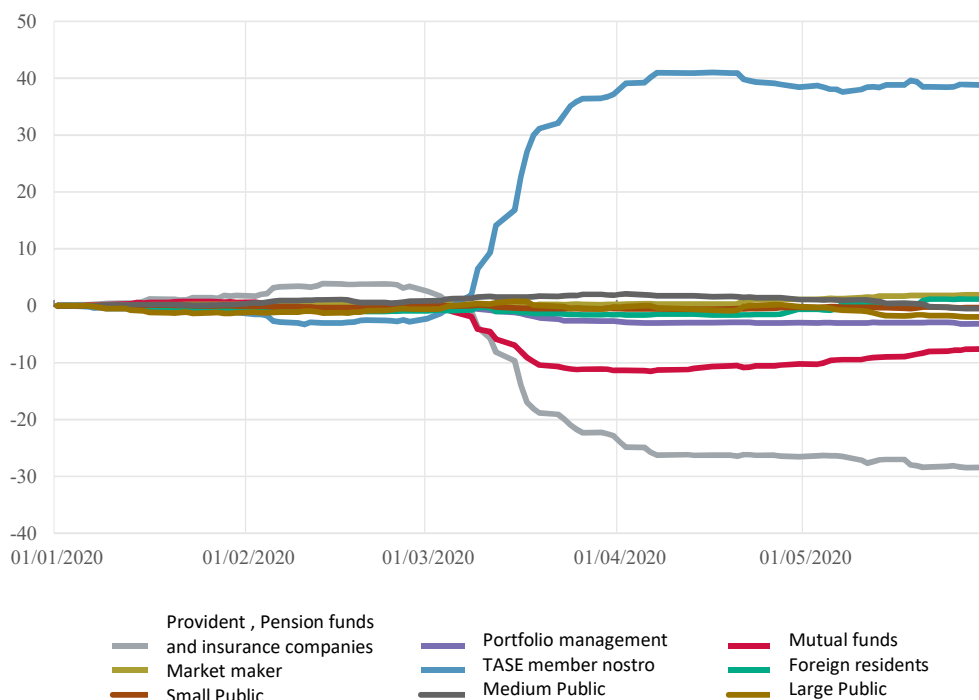


Here too, it seems that the institutional bodies acted on the opposite side, buying the corporate bonds, and that they were joined, to a certain degree, by TASE member nostro accounts. This difference may derive from the considerable increase in spreads that took place in this period and from an attempt to seize opportunities.

The recovery period actually saw sales of corporate bonds by institutional bodies, against the return of mutual funds to the buying side.

The picture is different in government bonds (Diagram 1.5). Here, the institutional bodies joined the mutual funds in the large sale volume. Conversely, the market makers, which are appointed by the Ministry of Finance to provide liquidity in those securities, together with the Bank of Israel that announced a buying program during the crisis, absorbed most of the supply (included under the “TASE member nostro” group in the diagram below).

Diagram 1.5: Aggregate net buys (ILS in billions) of government bonds, by type of entity, January-May 2020 (ILS in billions)



It is noteworthy that the extensive redemptions from mutual funds, and to a certain extent, also from some institutional accounts, brought about substantial selling pressure on the government bonds, which are a major source of liquidity at times of crisis. As described in the previous chapter, it appears that this pressure, *inter alia*, led to a substantial rise in the yields of government bonds at the beginning of the crisis, contrary to the trend in most countries of the world, and contrary to the theory whereby government bonds are a safe haven in times of crisis (“run to safety”). This trend later changed, *inter alia*, due to the Bank of Israel’s intervention in the market and a decrease in redemptions.

Algorithmic trading

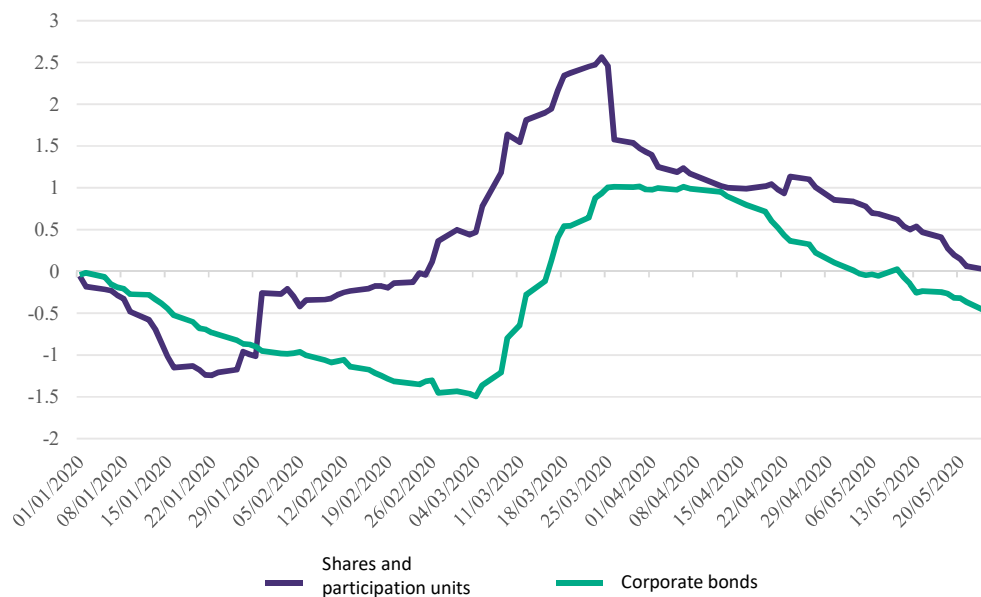
Algorithmic trading is trading executed by computers that send orders to the stock exchange according to a preprogrammed software code. There are various types of algorithmic traders, and they differ from one another according to their response capabilities, software usage purposes and trade strategies¹¹. For the purpose of this review, we treat such traders as a single group, defined by the submission of a large number of orders in a short time span.

An analysis of the trading volumes of such traders in the examined period (January-March 2020) revealed that they made-up approx. 30% of the stock turnover and approx. 20% of the corporate bond turnover, with no significant change throughout the period. Importantly, in the diagrams presented above, such traders belong to the “Public”. They represent a negligible share of the number of small accounts, and comprise around 50% of each one of the two other groups.

Diagram 1.6 presents the aggregate volume of stock and corporate bond buying by this group. The diagram demonstrates that during the crisis, the algo traders were mainly buyers of shares and bonds. This trend is ever more prominent in the corporate bond market, in which the trade activity of this group was characterized before the crisis by net selling. **This finding reinforces the concept whereby these players provide liquidity to the market at times of crisis.** Since the beginning of the recovery phase, the algorithmic trader group sold their aggregate holdings.

¹¹ For further details, see the following article on the ISA website, an updated and expanded version of which is expected to be published in the near future:
http://www.isa.gov.il/GeneralResearch/179/Documents/IsaFile_8229.pdf

Diagram 1.6: Algorithmic traders: aggregate net buys of shares and corporate bonds, January-May 2020 (ILS in billions)



In conclusion, sales in the shares and corporate bond markets during the crisis were mainly performed by small investors, whether directly or through mutual funds, while sophisticated investors, including the algo traders and the long-term institutionals, fueled liquidity and took the opposite side. In the government bond market, institutionals participated on the selling side and market makers were the main source of liquidity.

Chapter 2 – Herd behavior, risk components and security correlations

Investor responses to the COVID-19 crisis were the most dominant factor to impact market dynamics since the start of the year. The unprecedented dominance of this impact is exemplified by **peak correlation values between securities and the leading indices** (Diagram 2.1 below) and between the various securities among themselves (diagrams 2.7 and 2.8 below). Low correlation values may indicate the efficiency of the market in terms of the pricing of various assets, whereas the peak values found may indicate herd behavior in the markets. In situations like this, market trends are dictated by one factor (the reaction to the crisis), and pricing efficiency is expected to be compromised.

Developing on the above mentioned, this sub-chapter will present several analyses of correlation values and risk components in equity and corporate bonds (“**Bonds**”) in Israel since 2008.

Stocks and bonds versus the leading indices

This sub-chapter analyses the values of correlation coefficients ρ_i between the returns of stocks and bonds and the returns of the TA-125 and Tel Bond 60 indices (each category with its respective index). The ρ_i correlation coefficient of security i , the values of which range between -1 and +1, describes the extent to which an increase (or decrease) in a security's value corresponds to an increase (or decrease) in its respective index. A correlation coefficient of value 1 represents a security that rises and declines in parallel to the index. A correlation coefficient value of -1 represents a security that rises when the index declines, and declines when the index rises. In other words, the correlation coefficient describes the **direction** of the response to the index.

In addition, this sub-chapter reviews the Beta values β_i for securities. Beta values are calculated by multiplying the correlation coefficient ρ_i by the ratio between the standard deviation of security σ_i and the standard deviation of the index σ_{index} , i.e.:

$$\beta_i = \frac{\sigma_i}{\sigma_{index}} \cdot \rho_i$$

The Beta values originate from calculating the regression of the security returns (r_i) with respect to the index returns

$$r_i = \alpha_i + \beta_i r_{index} + \epsilon_i$$

with α_i being the excess return for the security. Beta values greater than 1 describe a security that rises and declines together with the index, but at a sharper rate than the index. Positive values smaller than 1 describe a security that rises and declines in parallel with its respective index, but at a more moderate rate. A similar interpretation (*mutatis mutandis*) applies to negative values of Beta. The term $\frac{\sigma_i}{\sigma_{index}}$ therefore describes the **magnitude** of the response to the index.

For each day in the period, correlation coefficient values and Beta values were

calculated for all shares and bonds on the Israeli stock exchange, using the returns of the preceding 100 trading days (including the day of the outcome). The graphs below present the median value of each day¹².

Diagram 2.1 presents the values of the median correlation coefficient throughout the period. Evidently, the median coefficient reached its peak for the period during the COVID-19 crisis.

Diagram 2.1: median correlation coefficient (across securities) with respect to the leading indices, 2008-2020

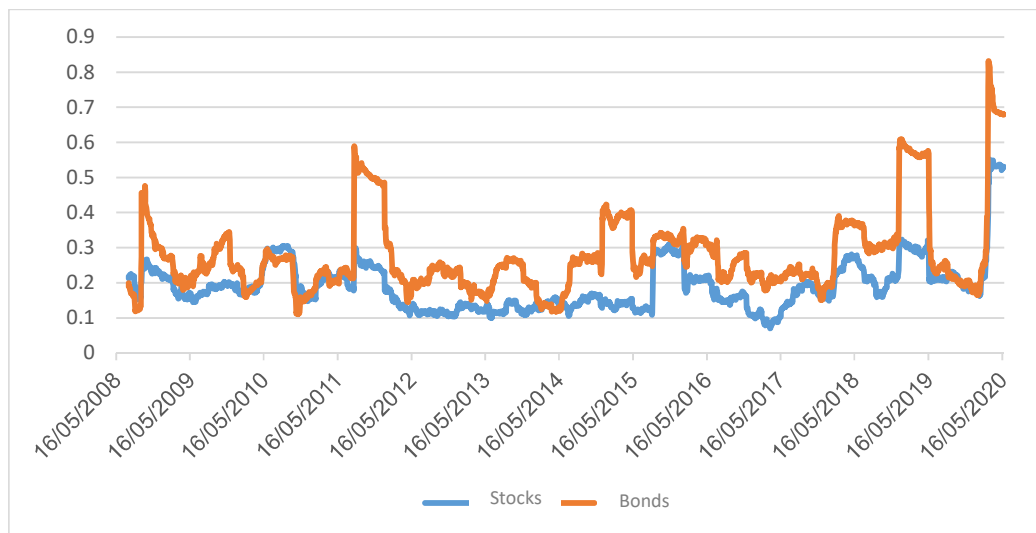
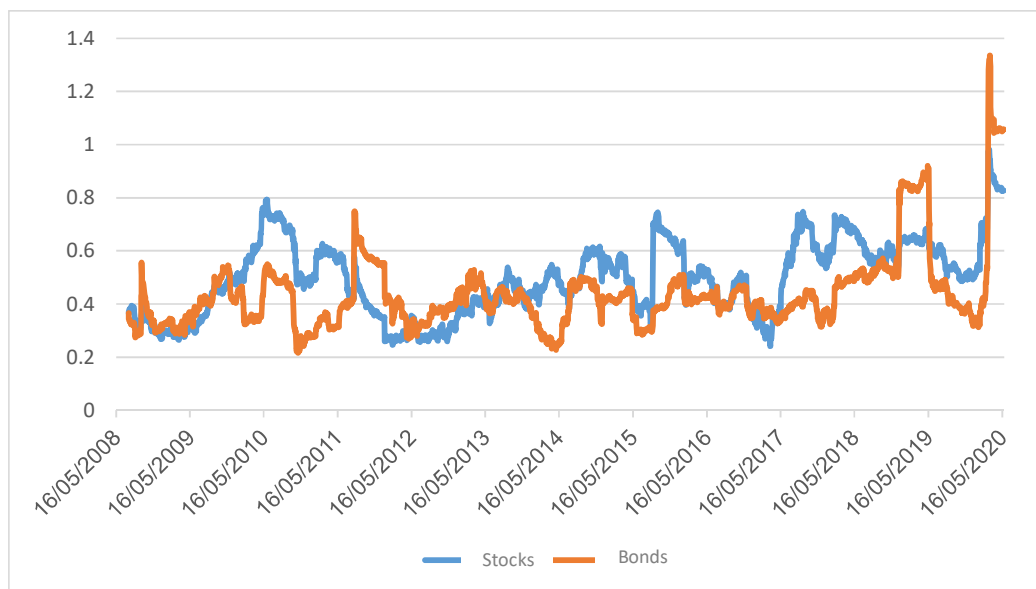


Diagram 2.2 similarly presents the values of the median Beta.

¹² The median was selected as a characteristic measure, since in comparison to the average, it is less sensitive to extreme fluctuations. Similar trends were also found for the average.

Diagram 2.2: median Beta (across securities) with respect to the leading indices, 2008-2020

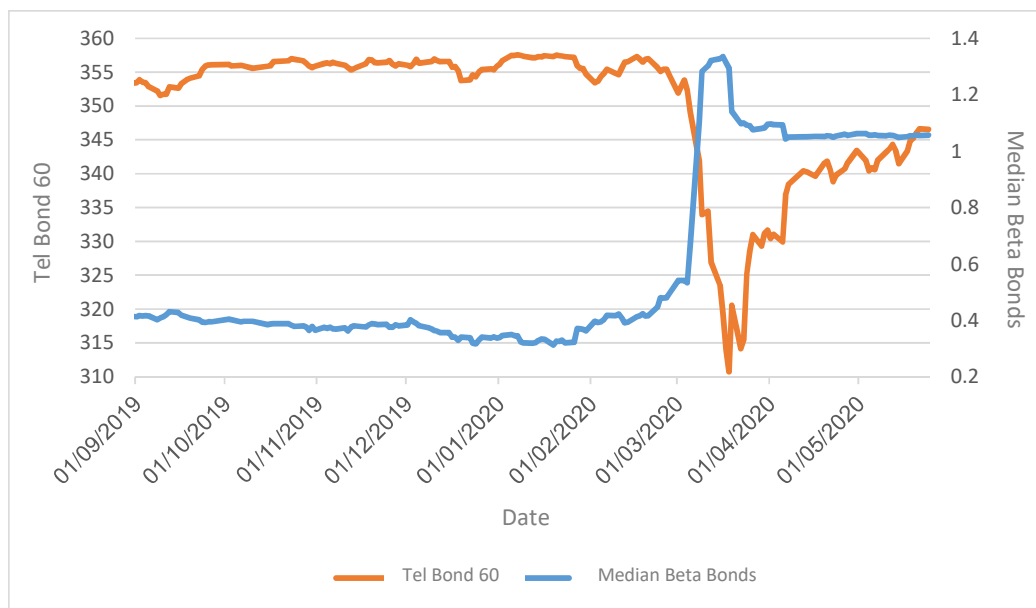


The values of the median Beta also reached historic peaks, such that the median Beta for corporate bonds crossed the threshold value 1¹³. As mentioned earlier, securities with Beta values exceeding 1 respond to index fluctuations by a fluctuation higher than the index itself. The increase in Beta values **indicates a decreased ability to reduce market risk by employing active portfolio management during the crisis.**

It is of particular interest to focus on Beta values during the end of the period (Diagram 2.3, beginning September 2019). It is noticeable that notwithstanding index recovery, high Beta values persisted. This finding can be interpreted as an indication that the response to the crisis continued to be the sole factor that dictated recovery across securities, rather than the specific pricing of any particular security.

¹³ We remind that the entire group of corporate bonds is included, not just those on the Tel Bond 60 index.

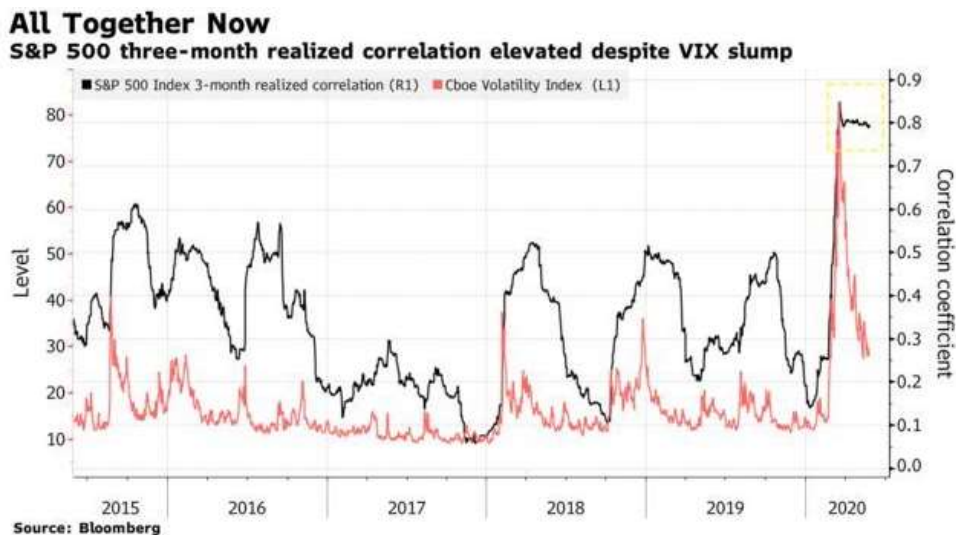
Diagram 2.3: median Beta (across securities) with respect to the leading indices, 9/2019-5/2020



A similar picture is found also in foreign markets. An analysis from the Bloomberg News website indicates an unprecedented increase in the correlation coefficients between the shares on the S&P 500 index¹⁴, notwithstanding the recovery in the VIX index (obviously, the first is retrospective and the second prospective). The website attributes this too to investor activity, driven almost exclusively by reactions to the COVID-19 crisis.

¹⁴ <https://www.bloomberg.com/news/newsletters/2020-05-28/stock-markets-today-covid-19-european-stimulus-hong-kong>.

Diagram 2.4: retrospective 3-month correlation coefficient of S&P 500 shares versus the VIX index, 2015-2020



Risk components

A second perspective divides the overall risk embodied in the security into market risk and idiosyncratic (specific) risk:

$$\sigma_i^2 = \beta_i^2 \cdot \sigma_{index}^2 + \sigma_{\epsilon,i}^2$$

where σ_i^2 is the variance in security returns, $\beta_i^2 \cdot \sigma_{index}^2$ is the market risk and $\sigma_{\epsilon,i}^2$ is the idiosyncratic risk¹⁵.

The market risk component cannot be minimized by asset diversification in investments, whereas the idiosyncratic risk is theoretically minimized by diversification.

In the Diagrams below, each one of the components is calculated in a 100 days backwards time frame, similarly to the above. Diagrams 2.5 and 2.6 present the median market risk and idiosyncratic risk for the share and bond categories, respectively¹⁶. These diagrams indicate the following developments:

- The median market risk reached peak values in both groups, hence narrowing the ability to minimize the risk by asset diversification.
- The median idiosyncratic risk also grew significantly, but to much lower values as compared with the 2008 crisis.

¹⁵ William Sharpe & Gordon J. Alexander, *Investments* (6th ed.), Jeffrey W Bailey, 1999.

¹⁶ Clearly, these values do not necessarily derive from the same security on each day. However, the purpose of these charts is to demonstrate market trends, and in this respect, values of different securities also suffice for the sake of illustration.

Diagram 2.5: Risk components – shares, 2008-2020

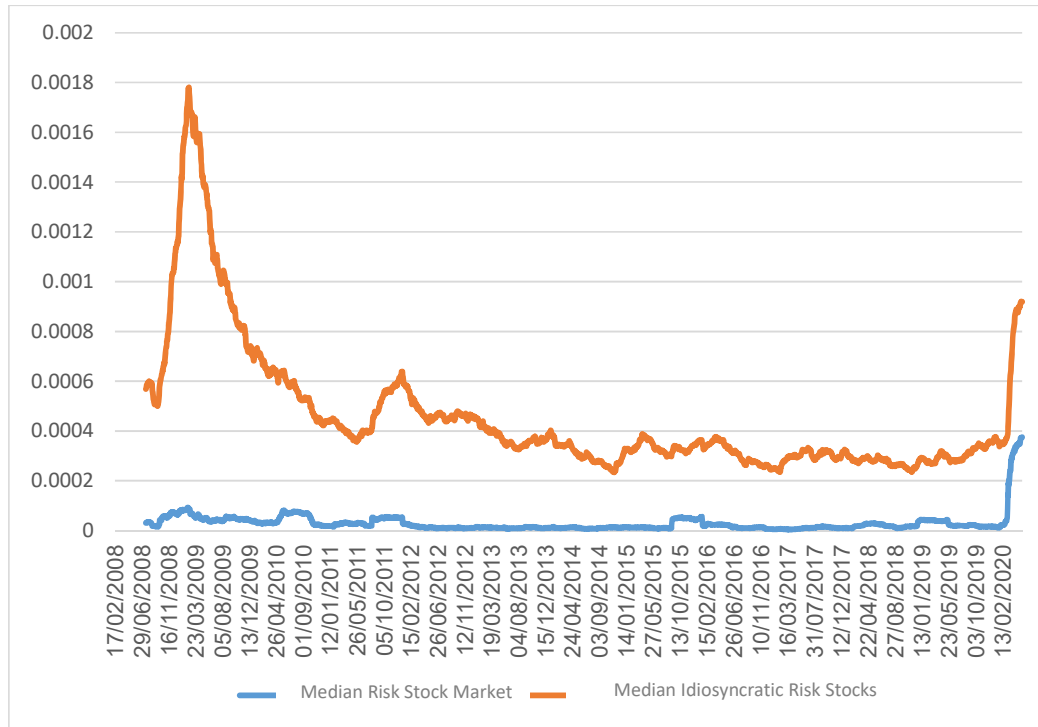
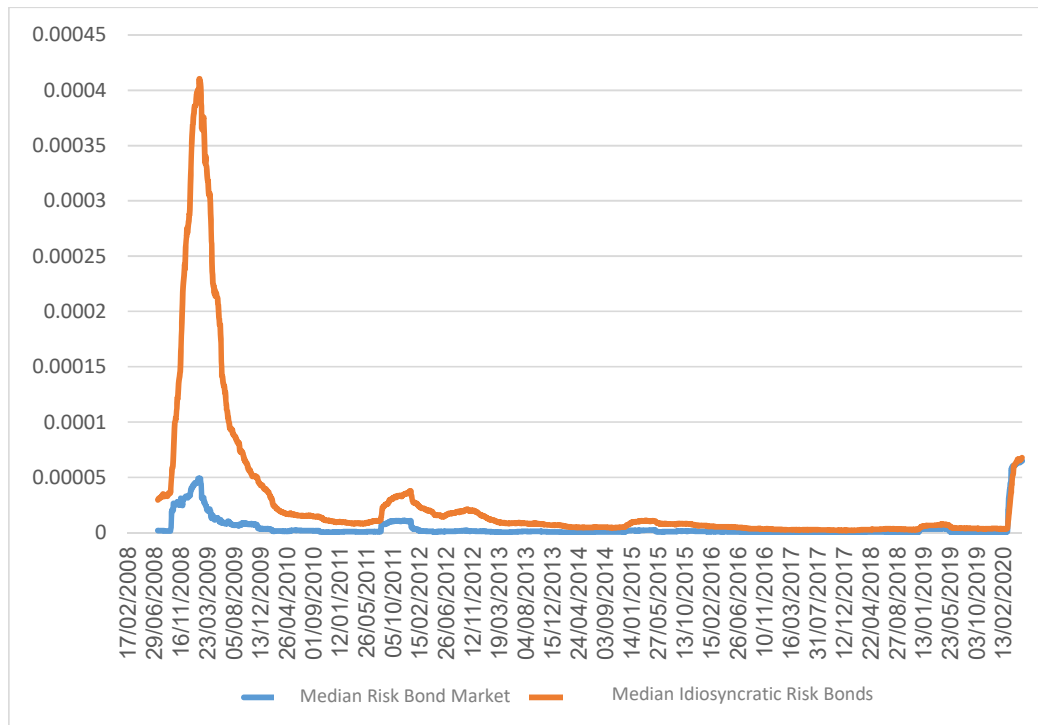


Diagram 2.6: Risk components – bonds, 2008-2020



Share – share correlations; bond – bond correlations

Yet another perspective abandons the index and examines correlation coefficient values in pairs – each share every other share, and each bond with every other bond. In this way, no particular importance is attributed to the index securities.

Diagrams 2.7 and 2.8 present, per day, the probability density function of share-share correlations and bond-bond correlations. The density function describes the probability that a certain correlation coefficient value will be observed on a certain day, such that the area below the graph, for each day, equals 1.

It is evident that extreme and unprecedented changes occurred in the distribution of coefficients during the crisis, with an average increase (higher correlations) and higher standard deviation between the correlations (larger range of values for correlations).

Diagram 2.7: daily distribution of share-share correlation coefficients, 2008-2020

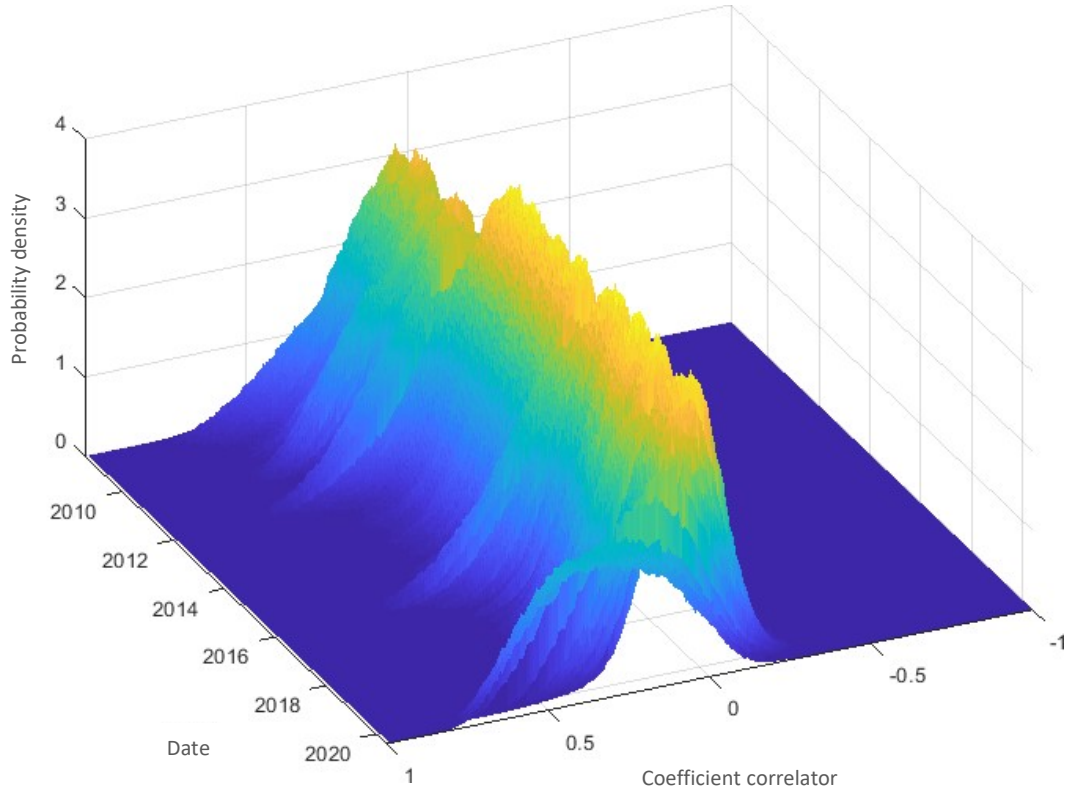
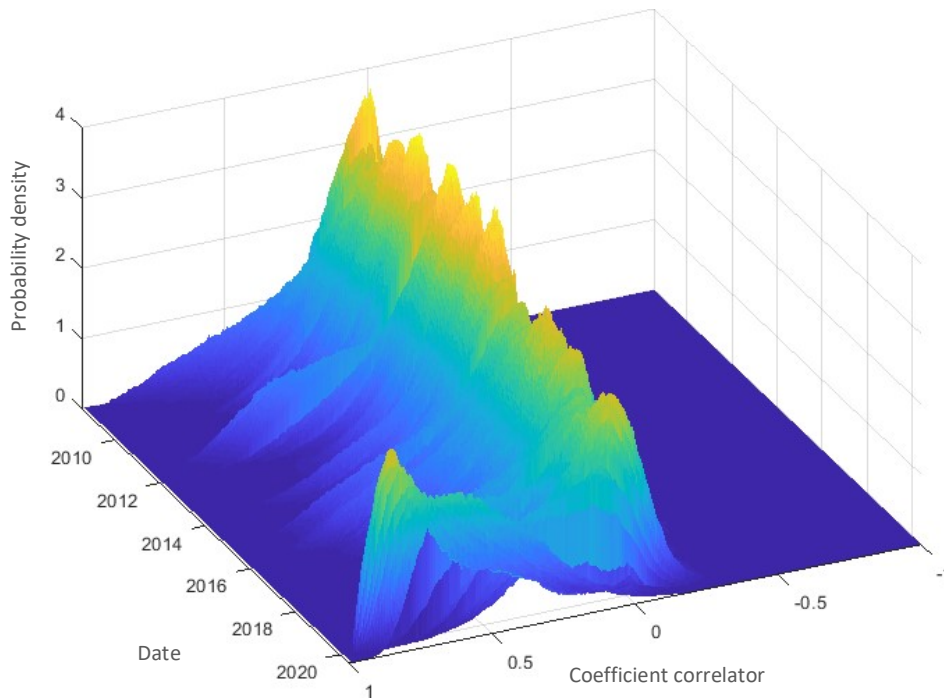


Diagram 2.8: daily distribution of bond-bond correlation coefficients, 2008-2020



Discussion and summary of findings

It is a truism that crisis periods are accompanied by an increase in correlation values, as illustrated in Diagram 2.1 during the market drops of 2008, 2011 and 2018. Nevertheless, **the peak values recorded during the COVID-19 crisis are unprecedented.**

One possible explanation for such values, which is often offered by the research literature, is the increase in passive investments along the past decade. Significant passive activity at times of crisis may create downward price pressure uniformly across securities. An illustrative study¹⁷ that examined this assumption through the prism of American stocks between 1979-2010 found a significant direct proportionality between the relative share passive investments and the values of the correlation coefficients and Beta values across securities. Accordingly, the study identified an increase in market risk throughout the period that was examined, corresponding to the increase in passive investments.

However, in concurrence with the writing of this chapter, an analysis was made of trading volumes which derive from the activity of managers of passive instruments (mutual funds, ETNs and ETFs) in Israel throughout the period. Such analysis did not indicate a significant increase in the volumes of passive trading, relative to the overall trading volumes, also during the COVID-19 crisis. Therefore, **the peak values that were observed cannot be attributed solely to passive trading activity.** The persistence of the relative portion of passive trading volume during the crisis indicates that the high correlation values resulted from the **similar reactions** of investors who in routine times employ **different trading strategies.**

The main findings:

- a. The median correlation coefficients in the stock and bond categories reached a peak for the period (2008-2020) during the COVID-19 crisis.
- b. The median Beta values also reached peak values. The median Beta value in the bond category is higher than 1, indicating a sharper response of the security to the index than of the index itself. The increase in Beta values indicates a decreased ability to reduce market risk by employing active portfolio management.
- c. The median market risk (across securities) reached peak values in the stock and bond markets, thus reducing the ability to minimize the risk by asset diversification.
- d. The median idiosyncratic risk also grew significantly, but to much lower values as compared with the 2008 crisis.

¹⁷ Rodney N. Sullivan & James X. Xiong (2012), How Index Trading Increases Market Vulnerability, *Financial Analysts Journal*, 68:2, 70-84, DOI: 10.2469/faj.v68.n2.7.

Chapter 3 – Analysis of liquidity indicators during the COVID-19 crisis

Liquidity indicators estimate the ability to trade an asset without affecting its price. Different liquidity indicators measure different dimensions of liquidity: bid-ask spread, depth of market (DOM) and time.

In times of greater uncertainty, the level of market agreement on the price of an asset is reduced, demand and supply grow further apart and liquidity is impaired in terms of the spread; at times of a need for disposal of large trading volumes (relative to the norm) liquidity is impaired in terms of DOM; at times when asymmetrical pressure is applied by one side of the market, the other side may not allow for an immediate transaction, thus impairing liquidity in terms of time.

The COVID-19 crisis was accompanied by all the aforementioned characteristics (uncertainty, a need for disposal of large trading volumes, asymmetric pressure), and as we shall demonstrate below, the implications thereof materialized as well. In particular, we stress the following findings:

- During the COVID-19 crisis, a **sharp** decline occurred in the TASE liquidity indicators, in almost all types of securities. Some of the indicators demonstrated a sharp decline compared to both historic performance (the 2008 crisis) and to foreign exchanges (the leading U.S. index S&P 500).
- Some of the liquidity indicators showed increased gaps between securities on the leading indices and other assets.

Liquidity indicators – definitions

The following liquidity indicators were calculated for the various securities, from September 2019 to mid-April 2020. Values were sampled every five minutes, and such samples were averaged per day per security. Following is a concise description of the indicators, according to the above mentioned liquidity dimensions.

Spread indicators:

- a. Bid-ask spread: the difference between the **first** layer of supply and the **first** layer of demand, relative to the mid-price.
- b. Cost of Round Trip (CRT) 5%¹⁸: the spread weighted by the quantities in **all layers of the order book**. Simply stated, this indicator estimates how much it will cost to buy and sell at a given moment, a given quantity q , relative to the mid-price. In this case, the quantity q is determined as 5% of the daily trade in the security.
- c. CRT min side: as in the previous definition, with the quantity q being

¹⁸ Irvine, Paul J., Benston, George J., & Kandel, Eugene, Liquidity Beyond the Inside Spread: Measuring and Using Information in the Limit Order Book, *SSRN Electronic Journal*, May 2000.

determined as the sum of quantities in all layers on the “emptier” side of the order book (hence, “min side”).

DOM (value) indicators:

d. First layer of demand – in terms of value.

First layer of supply – in terms of value.

Time indicator:

e. Empty time – the time, in minutes, during which one side of the book has no orders.

The aforesaid indicators shall be analyzed according to the following breakdown (types of leading securities and indices with a characteristic degree of liquidity in routine times):

- TA 35
- TA 90
- Other shares
- Equity ETF
- Foreign equity ETF
- Tel Bond 20
- Tel Bond 40
- Other bonds
- Bond ETF
- Foreign bond ETF
- Government bonds
- Treasury security
- Other securities

The “other shares” and “other bonds” represent the shares and corporate bonds which are not part of the Tel Aviv 125 and Tel Bond 60 asset types and indices, respectively. The “other securities” tag includes warrants and options for purchase.

Daily trends throughout the period

The daily trends throughout the period are compatible with the dynamics that might have been anticipated:

- I. Routine (September 2019 to February 2020) – relatively high liquidity, low spread indicator (bid-ask and CRT) values and high value indicators.
- II. Panic (beginning of March 2020) – sharp decline in liquidity.
- III. Crisis (March 2020) – low liquidity values fixed in time.
- IV. Recovery (April 2020) – moderate increase in liquidity values (decline in the spread indicators, increase in the value indicators), but still no reversion to routine values.

Diagrams 3.1 and 3.2 below illustrate those trends, and are typical of the period under discussion for the various securities and indices (as presented in detail in the next sub-chapter). Diagram 3.1 presents the spread indicators (bid-ask and CRT) for the bonds in Tel Bond 40. Diagram 3.2 presents the value indicators in the first layers of the order book for the bond ETFs.

Diagram 3.1: spread indicators for Tel Bond 40, September 2019 – April 2020

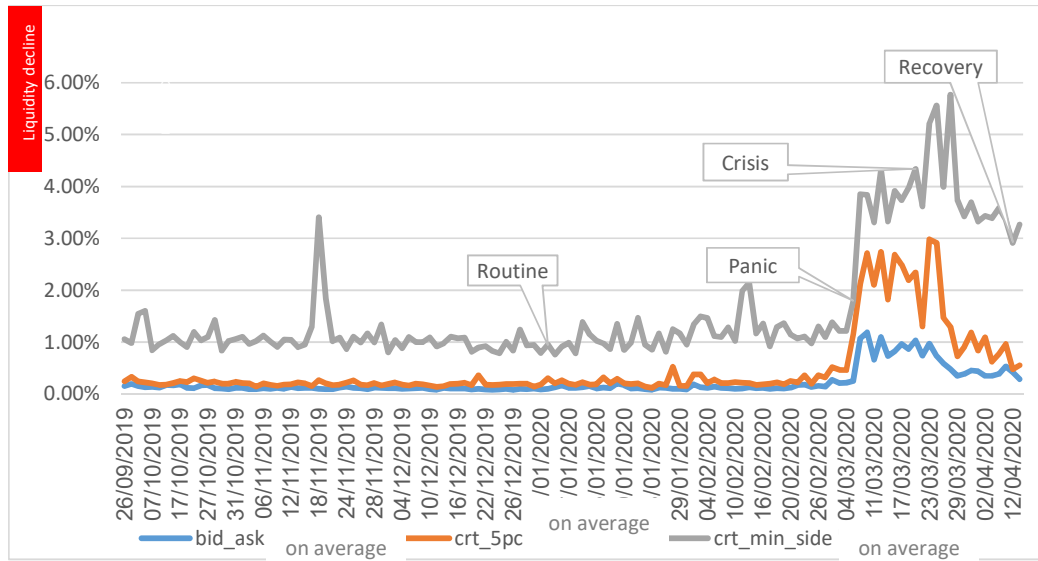
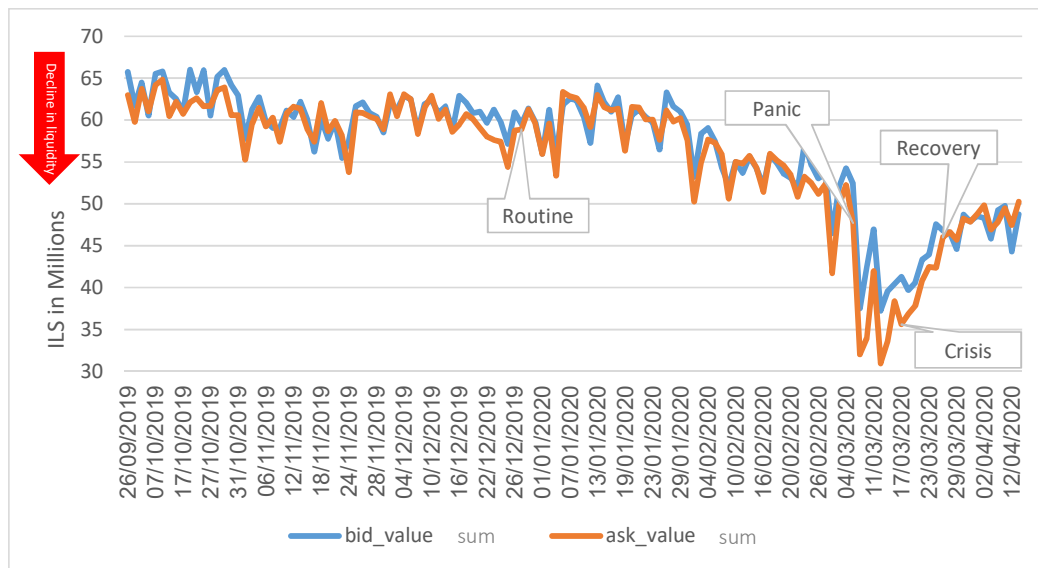


Diagram 3.2: value indicators for bond ETFs, September 2019 – April 2020



Changes by asset types and indices

The following diagrams describe the change in liquidity indicators, **broken down by** asset types and indices (types of leading securities and indices), compared between three periods:

- a. Routine: September 2019 – February 2020.
- b. Crisis: March 2020.
- c. 2008 crisis: mid-September until December 2008.

The following discussion touches on two different perspectives:

- a. The change of **each** asset type and index **compared with itself** between the periods (e.g. how much the TA-35 bid-ask spread changed between the routine and crisis periods).
- b. The change in the **gap between** asset types and indices between the periods (e.g. how much did the gap change between TA-35 values and TA-90 values between the routine and crisis periods).

In general it can be stated that all asset types and indices demonstrated a significant decline in liquidity (further detail below), and that **the more the asset types and indices include assets that are less liquid in times of routine, the more significant is the increase in the spread indicator** (which represents a decline in liquidity), mainly in absolute terms. Accordingly, **the liquidity gaps between the various asset types and indices grew significantly in March.**

Diagram 3 presents the bid-ask spread (the average spread between the bid price and the ask price as a percentage of the mid-price).

The stock indices demonstrated an increase of approx. 100% in the bid-ask spread *between the routine period and the crisis period*. Inspection of the gap *between the various equity* asset types and indices indicates that the gap in the spread between TA-35 and TA-90 grew from 0.33% to 0.7%. The gap between TA-35 and the other shares index grew from 2.6% to approx. 6%, the latter representing a ratio of **approx. x19 between the two.**

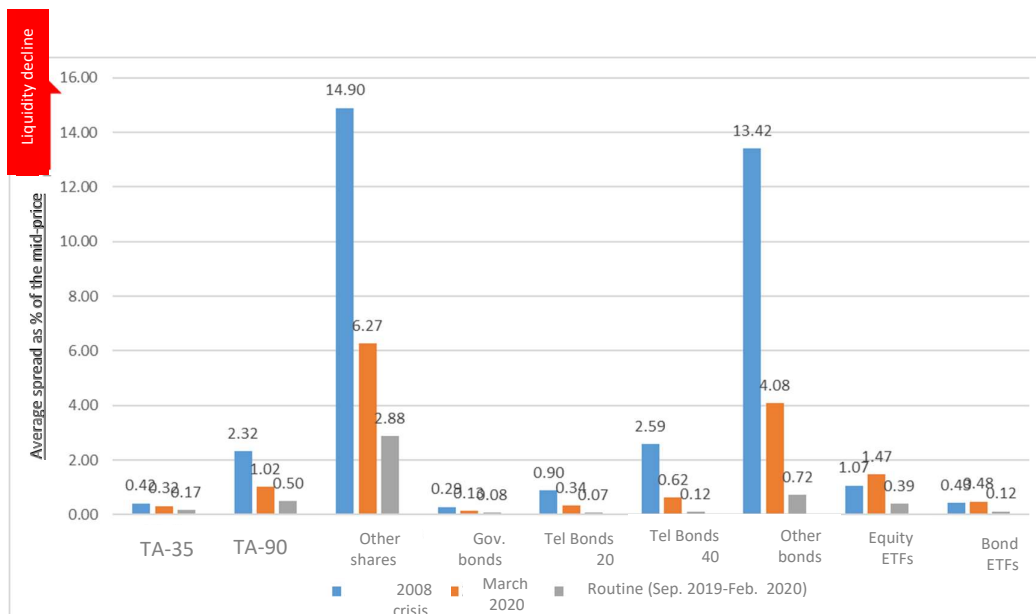
In corporate bonds, the rate of increase in the spread *between the routine period and the crisis period* was even greater than the corresponding increase in stocks, around 400%. Inspection of the gap *between the various bond* asset types and indices indicates that the gap between the bonds in the Tel Bond indices and bonds which are not in the Tel Bond indices grew significantly – from around 0.6% to around 4% (representing a ratio of approx. x8). Contrarily, government bonds maintained high liquidity (low spread) also during this period.

It is evident that also for ETFs, in which most of the trading is with official market makers, spreads grew significantly. Of course, increased spreads in the ETFs'

underlying assets directly affect ETF market making.¹⁹

In comparison with the 2008 crisis, it can be seen that the spread maintains a lower level in all asset types and indices.

Diagram 3.3: comparison of the bid-ask spread indicator between times of routine and crisis periods, broken down by track



* In 2008, the main stock index was TA-25/75, which was replaced by TA-35/90, and ETFs were ETNs.

Diagrams 3.4 and 3.5 present the CRT indicator, which measures quantity weighted spreads (the cost for an immediate buy and sell of a defined quantity, as a percentage of the mid-price). It is reminded that this indicator was calculated relatively to the security turnover (5%) or the maximum quantity in one of the book sides (min side), therefore each security is measured by a different quantity which is compatible with its characteristics.

Relative to the bid-ask spread that was presented above, the CRT indicator **demonstrate an even greater decline in liquidity between routine and crisis times, in all asset types and indices** (each asset types and indices compared with itself).

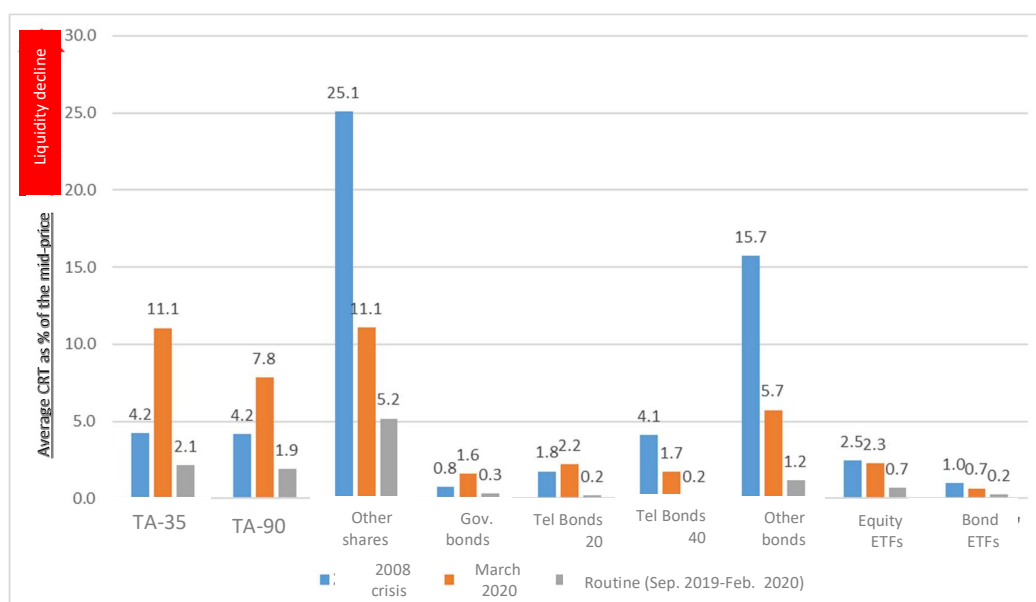
Contrarily, the gaps that were created between the asset types and indices (e.g. TA-35 versus TA-90) are slightly lower, and in some cases even opposite to the trend that was described above. For example, in the TA-35 index, CRT for a DOM of 5% of the turnover grew from 2% in the period preceding the crisis, to 11% in March: similar to the level of the other shares index, and higher than the TA-90 index. As aforesaid, this phenomenon is explained by the fact that turnovers in TA-35 are much higher, and increased considerably during the crisis, such that the impact on the level of liquidity

¹⁹ Detailed analysis of the TASE market makers activity (*inter alia* in ETFs) is provided in Chapter 4 hereof, which also analyzes ETF activity relative to the underlying assets.

in the book's DOM, relative to the daily turnover, was greater (the greater the turnover, the greater the depth against which CRT is measured).

In comparison to the 2008 crisis, the picture is also opposite to the picture of the bid-ask spread. The CRT indicator for the leading stock and bond indices is significantly higher during the current crisis, i.e. indicating lower liquidity for the book's DOM. The gap in results can be attributed to the increase in the use of algorithmic trading tools (also among low frequency traders). Such tools led to a consistent decline in the bid-ask spreads over the last decade, but they have lesser effect on the book's DOM.

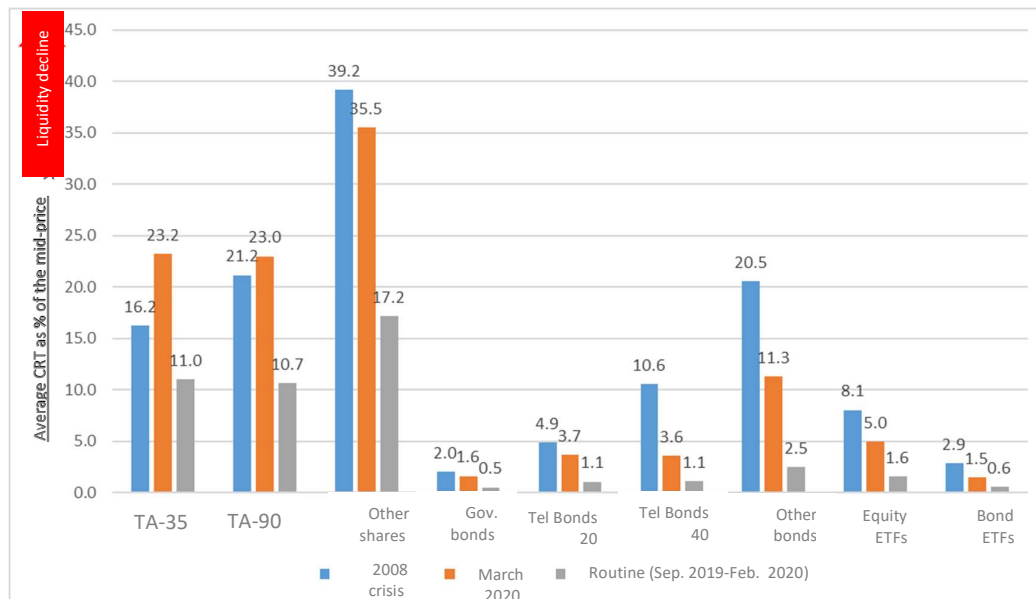
Diagram 3.4: comparison of CRT 5% indicator between routine and crisis periods, broken down by asset types and indices



* In 2008, the main stock index was TA-25/75, which was replaced by TA-35/90, and ETFs were ETNs.

Review of the indicator by the existing quantity in the order book presents a picture which is closer to the bid-ask spread, but here too, the gaps between the various asset types and indices are smaller, and almost non-existent between TA-35 and TA-90, as well as between the Tel Bond indices.

Diagram 3.5: comparison of CRT min side indicator between routine and crisis periods, broken down by asset types and indices



* In 2008, the main stock index was TA-25/75, which was replaced by TA-35/90, and ETFs were ETNs.

Table 3.1 below gives more details on the figures of March 2020, broken down by asset types and indices, in comparison with the preceding 6 months. The main findings arising from the table are the following:

- An increase of more than 95% in the bid-ask spread in all types of securities other than government bonds and treasury securities (which maintained high liquidity) and other securities (in which the spreads are large also in times of routine). Corporate bonds suffered the greatest impact.
- The leading indices (shares and bonds) demonstrate an increase in the CRT 5% indicator, which is more than double than in the bid-ask spread. Since the CRT indicator describes the cost of trading for large trading volumes, it can be said that the impairment to liquidity as described in the previous bullet, is also greater when large volume trading is required. This fact may incentivize a shift of large-scale traders to OTC transactions.
- In most asset types and indices there is a decline of approx. 10-30% in the quantity in the first layers of the order book. Exceptions are: an increase of approx. 80% in demand for government bonds and treasury securities.
- Significant increases in the time frames at which one side of the book is empty (on average) in some types of securities.

Table 3.2 presents a comparison of liquidity indicators versus the peak of the 2008 crisis.

Table 3.1: liquidity indicators in March 2020 compared with the period September 2019 - February 2020; the change rate presented in parentheses

Type of security	Bid-ask spread	CRT 5%	CRT min side	First layer demand	First layer supply	Empty time (in minutes)
TA-35	0.32% (95%)	11.06% (417%)	23.22% (110%)	1.16 (-32%)	1.17 (-30%)	0.00 (0%)
TA-90	1.02% (108%)	7.85% (313%)	23.00% (116%)	1.44 (-13%)	1.26 (-25%)	0.04 (69%)
Other shares	6.27% (118%)	11.07% (113%)	35.52% (107%)	1.80 (0%)	2.44 (-2%)	1.90 (132%)
Government bonds	0.13% (63%)	1.63% (387%)	1.62% (212%)	425.58 (70%)	102.34 (-13%)	0.72 (-72%)
Tel Bond 20	0.34% (373%)	2.21% (960%)	3.67% (240%)	1.38 (-61%)	1.00 (-66%)	0.07 (2927%)
Tel Bond 40	0.62% (435%)	1.74% (720%)	3.59% (224%)	1.97 (-12%)	1.62 (-21%)	0.45 (608%)
Other bonds	4.08% (472%)	5.73% (388%)	11.29% (358%)	37.29 (5%)	28.68 (-2%)	6.15 (729%)
Treasury securities	0.03% (42%)	0.05% (-48%)	0.06% (-40%)	761.38 (95%)	171.02 (-55%)	1.30 (-71%)
Equity ETF	1.47% (281%)	2.30% (243%)	4.97% (220%)	50.97 (-26%)	49.76 (-25%)	4.27 (4083%)
Bond ETF	0.48% (291%)	0.66% (175%)	1.49% (158%)	44.78 (-25%)	41.56 (-30%)	2.60 (1166%)
Foreign equity ETF	1.20% (146%)	1.41% (150%)	2.19% (202%)	1.56 (-39%)	1.97 (-33%)	26.49 (285%)
Foreign bond ETF	1.39% (352%)	1.43% (350%)	1.53% (360%)	2.49 (-1%)	2.22 (-16%)	38.88 (2441%)
Other securities	41.81% (33%)	59.21% (31%)	81.00% (26%)	0.53 (-13%)	0.62 (-26%)	2.91 (20%)

Table 3.2: liquidity indicators in March 2020 compared with the period September 18, 2008 – end of December 2008; the change rate presented in the parentheses

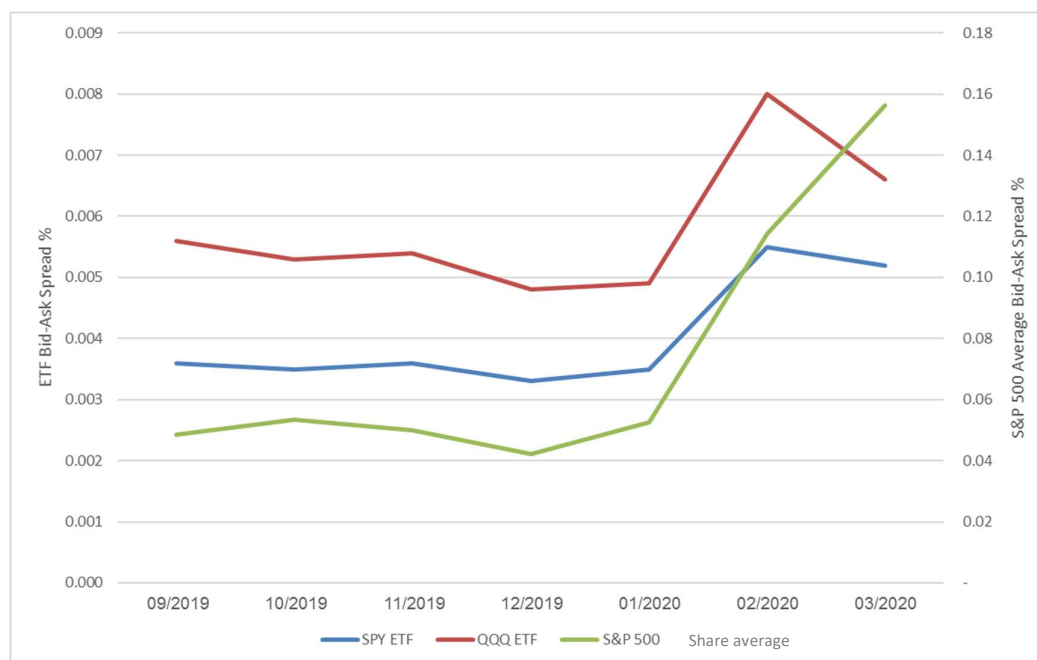
Type of security	Bid-ask spread	CRT 5%	CRT min side	First layer demand	First layer supply	Empty time (in minutes)
TA-35	0.32% (-23%)	11.06% (162%)	23.22% (43%)	1.16 (-15%)	1.17 (-15%)	0.00 (0%)
TA-90	1.02% (-56%)	7.85% (89%)	23.00% (9%)	1.44 (24%)	1.26 (2%)	0.04 (4093%)
Other shares	6.27% (-58%)	11.07% (-56%)	35.52% (-9%)	1.80 (-41%)	2.44 (-64%)	1.90 (-27%)
Government bonds	0.13% (-55%)	1.63% (111%)	1.62% (-20%)	425.58 (397%)	102.34 (115%)	0.72 (77%)
Tel Bond 20	0.34% (-62%)	2.21% (26%)	3.67% (-25%)	1.38 (-43%)	1.00 (-54%)	0.07 (-43%)
Tel Bond 40	0.62% (-76%)	1.74% (-58%)	3.59% (-66%)	1.97 (-37%)	1.62 (-45%)	0.45 (235%)
Other bonds	4.08% (-70%)	5.73% (-64%)	11.29% (-45%)	37.29 (-36%)	28.68 (-55%)	6.15 (-73%)
Treasury securities	0.03% (65%)	0.05% (-20%)	0.06% (-88%)	761.38 (268%)	171.02 (33%)	1.30 (Inf%)
Other securities	41.81% (-44%)	59.21% (-7%)	81.00% (13%)	0.53 (-90%)	0.62-91%	2.91 (-58%)

Bid-ask spreads in the U.S.

For comparison purposes, the bid-ask spreads were also calculated for the shares in the S&P 500 index, and for the two leading ETFs for this index (SPY) and for the NASDAQ index (QQQ) over the past 6 months, according to Bloomberg figures.

Here too, it is evident that the spreads rose significantly, mostly in the index shares (almost 4 times more). Such spreads are considerably lower in comparison with domestic indices – approx. 0.04% on average in times of routine, compared with 0.17% on the TA-35 index and 0.5% on the TA-90 index – although the relative increase therein was greater: x4 compared with approx. x2 in Israel.

Diagram 3.6: average bid-ask spread in S&P 500 shares and leading ETFs, 2019-2020



Summary of findings

This chapter presents a snapshot of the changes in liquidity indicators and trading trends on the TASE during the COVID-19 crisis. Following are the main findings:

- Bid-ask spreads demonstrated a sharp increase (decline in liquidity) during the crisis, in all types of securities, excluding government bonds and treasury securities. Values for equity asset types and indices increased by approx. 100%, whereas the values for corporate bonds asset types and indices (which experienced the sharpest liquidity decline among the asset types and indices) increased by approx. 400%. Consequently, the average spread in Tel Bond 20, which in times of routine is a 1/3 lower than the spread of TA-35, increased during the crisis and surpassed the latter.
- An analysis made using the CRT indicator, which describes the cost of trading

for large trading volumes, revealed that the impairment to liquidity in respect of such volumes, is even greater (approx. twice as much).

- An increase was noted in the absolute gap in the spreads between the leading indices for each type of securities (TA-35 and Tel Bond 20) and the ‘other’ groups (other shares and other bonds). Securities that are illiquid in times of routine, deteriorated more also in absolute terms.
- A comparison of the current crisis with the 2008 crisis is multifaceted. The bid-ask spreads are approx. 50% lower in comparison to 2008, in all types of securities, while on the other hand, the leading share indices demonstrate an increase in the CRT indicator. Such contradicting findings can be attributed to the increased use of algorithmic trading tools (also among low frequency traders). Such tools led to a consistent decline in the bid-ask spreads over the last decade, but they have a lesser effect on the book’s DOM.
- Review of the bid-ask spreads of the leading indices in the U.S. also indicates a sharp decline in liquidity – sharper than Israel in relative terms, and more moderate in absolute terms.
- Most asset types and indices demonstrate a value decline in the first layers of the book, of approx. 10-30%. Exceptions are: an increase of approx. 80% in demand for government bonds and treasury securities.

Chapter 4 – Market making on the TASE during the COVID-19 crisis

This chapter reviews the activity of market makers on the TASE, in all types of securities, during the routine period preceding the COVID-19 crisis, the height of the crisis and the recovery period that followed. The importance of effective market making increases, naturally, at times of crisis.

Market makers on TASE are subject to a number of rules that dictate their presence in the order book. Two of the main rules are the following:

- a. Setting the bid-ask spread at a lower value than the threshold which is set by the TASE board of directors (the value of the threshold varies according to the characteristics of the security).
- b. Offering the said spread in the order book through the entire continuous trading stage, with a possible absence of no more than 100 minutes per day²⁰.

As will be shown, at times of routine market makers demonstrate much higher effectiveness than the mere threshold conditions, whereas during the crisis their activity deteriorated to levels close to the thresholds.

1. Definitions, database and structure of the chapter

For all securities, the spreads offered by market makers were measured on a minute-by-minute basis, in the period from September 2019 to the first week of May 2020. A minute during which the market maker does not offer orders on both sides of the book is counted as a minute of absence. In some of the analyses below, we look at three sub-periods:

- a. Routine: September 2019 – February 2020.
- b. Crisis: March 2020.
- c. Recovery: April – the first week of May 2020.

In addition to formal market makers, this chapter further reviews the activity of “non-formal” market makers, traders who effectively meet the threshold conditions ‘a’ and ‘b’ above, but are not bound by a market making agreement. A plausible assumption is that many of them are algorithmic traders, for whom market making is a common strategy.

The following analyses present daily averages of the spread values (Section 2) and times of absence (Section 3), broken down by liquidity category (see reference in

²⁰ TASE Trading Guide, Resolutions of the Board of Directors and the General Manager. A number of additional rules apply to the market makers (e.g. a minimum quantity offered in the book), which are detailed in the resolutions of the board of directors. A sample test of the market makers' activity indicated that these additional rules generate less than 1% of the violations, whereas 99% of the violations are due to the two rules noted in the text.

footnote 21) and the type of the market maker – formal or non-formal. It is emphasized that **only securities in which formal market makers are active** are weighted in these analyses. Non-formal market making also occurs in other securities, but for the purpose of data standardization such activity is excluded from this analysis.

Section 4 below defines two additional indicators for measuring the activity of market makers. The first indicator is **ineffectiveness**, which examines the degree to which the market maker is responsible for the leading quotes in the order book. The second is a **symmetry** indicator which examines the position of the market maker's quotes relative to the market spread – whether the market maker tends to the ask side or to the bid side.

Section 5 reviews the breakdown of market makers' transactions in the continuous phase into taker transactions (initiated by the market maker) and maker transactions (initiated by the counterparty).

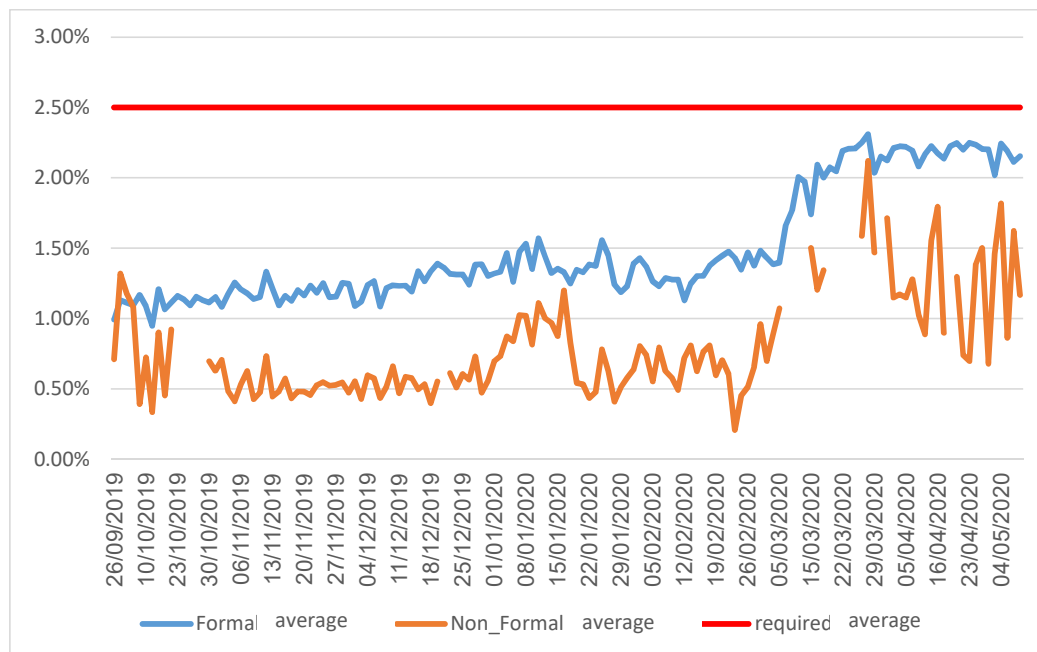
Section 6 focuses on ETFs market making and reviews the activity of market makers with respect to the spreads of the fund's underlying index.

The chapter is concluded by a summary of the main findings and points for further consideration.

2. Market making on TASE – spreads

The diagrams in Annex 1 present the average daily spread offered by market makers, by type of security and liquidity category. Diagram 4.1 below illustrates the results for corporate bonds with maturities of 0-3 years.

Diagram 4.1: Average bid-ask spread of market makers for corporate bonds, 0-3 year maturity, September 2019 – May 2020



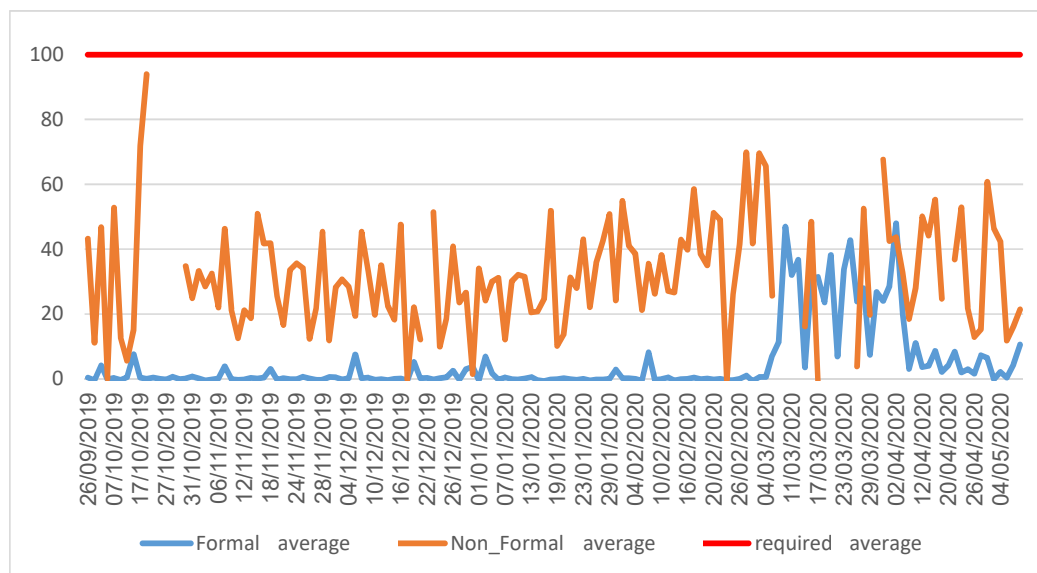
Main findings:

- During the crisis, formal market makers increased their offered spreads. This increase is most significant in corporate bonds.
- Excluding the ETF category, at routine times non-formal market makers provide superior spreads as compared with those of formal market makers.
- As could have been expected, during the crisis, non-formal market makers ceased their activity in a large part of securities (as demonstrated by the gaps in the graph above).

3. Market making on TASE – times of absence from the book during the continuous phase

The diagrams in Annex 2 present the average time (in minutes) of market makers' absence from the book during the continuous phase, by type of security and liquidity category. Diagram 4.2 below illustrates the results for corporate bonds whose maturity is within 0-3 years.

Diagram 4.2: Average time (minutes) of market makers' absence from the book during the continuous phase, for corporate bonds, 0-3 years maturity, September 2019 – May 2020

**Main findings:**

- Formal market makers increased their time of absence from the book during the crisis. While at times of routine, formal market makers quote almost throughout the day (with absence times close to zero) in most types of securities, during the crisis, average values neared 40 minutes and up.

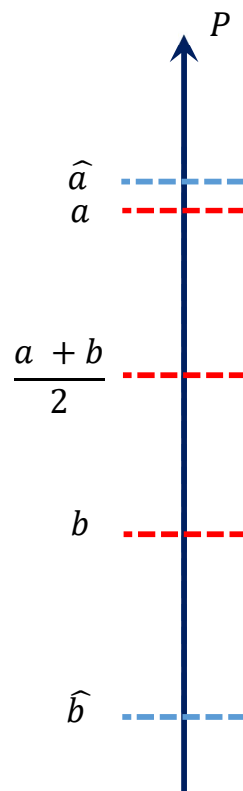
- Non-formal market makers are absent from the book for longer periods of time in routine times, and during the crisis have effectively ceased their activity as market makers.

4. Market makers' position with respect to the leading quote

Quoting obligations do not force market makers to position themselves at **layer 1** of the order book, which may be quoted by other traders. In particular, the “market maker spread” may be situated asymmetrically around the actual “market spread”.

Diagram 4.3 illustrates the various components that comprise the market spread $[b, a]$ and the market maker spread $[\hat{b}, \hat{a}]$. At any moment during continuous trading $\hat{a} \geq a$, $\hat{b} \leq b$ obviously apply, but the distances between the quotes of the market maker and the market quotes do not have to be identical on both sides of the book. For example, Diagram 4.3 describes a market maker who is more effective on the ask side, because her quote is closer to the market quote on that side.

Diagram 4.3: The market spread $[b, a]$ and the market maker spread $[\hat{b}, \hat{a}]$



Therefore, the comparison of the market maker spread with the market spread may indicate both the effectiveness of the market maker (proximity to the first layers) and the policy of the market maker on a particular day – which side he chooses to “protect”. Two indicators are defined in order to analyze these two aspects of market maker activity – ineffectiveness and symmetry. The averages in the definition of the formulas are based on minute by minute samples during continuous trading.

- a. **Ineffectiveness:** for each market maker m on a particular day, the following ineffectiveness indicator (E) was calculated:

$$E_{m,t} = \left(\frac{\hat{a}}{a} / \frac{\hat{b}}{b} \right)_{m,t} - 1 \geq 0$$

Market makers who are positioned in the leading layers of the book (highly effective) are scored with a value of $E_{m,t} = 0$. **High values indicate ineffectiveness of the market maker.** It is emphasized that low values of the ineffectiveness indicator do not point to a *low spread*, but rather to the presence of the market maker's quotes in proximity to the actual spread (whether low or high in value).

- b. **Symmetry:** for each market maker m on a particular day, a symmetry measure (S) was calculated:

$$S_{m,t} = \left(\frac{\hat{a}}{a} \cdot \frac{\hat{b}}{b} \right)_{m,t} - 1$$

Positive $S_{m,t}$ values point to a larger distance from the market quote on the ask side (the market maker is **more effective on the bid side**; hereinafter – “bid inclined”). **Negative** $S_{m,t}$ values point to a larger distance from the market quote on the bid side (the market maker is **more effective on the ask side**; hereinafter – “ask inclined”).

As illustrated below (Tables 4.1, 4.2), the findings relating to the ineffectiveness and symmetry indicators as defined above vary greatly by type of security. Before we present the full findings, Diagrams 4.4, 4.5 shall detail the results in the stocks category.

Diagram 4.4 presents average $E_{m,t}$ values across all stocks. It is evident that throughout the period, non-formal market makers demonstrate greater effectiveness. In addition, the gap between the two groups of market makers grew since mid-March.

It is further interesting to note that up to mid-March, at the height of the crisis, the effectiveness of formal market makers in the stock market actually improved, whereas later, when recovery began, the level of effectiveness decreased. It is emphasized that this finding does not suggest that they provided smaller spreads during the crisis (quite the contrary, as described in Section 2 of this chapter), but rather that relative to the other players in the market, their quote was more effective, and that later they maintained relatively high spreads. Conversely, in the corporate bonds and ETF categories an increase was identified in the ineffectiveness of formal market makers all through the month of March.

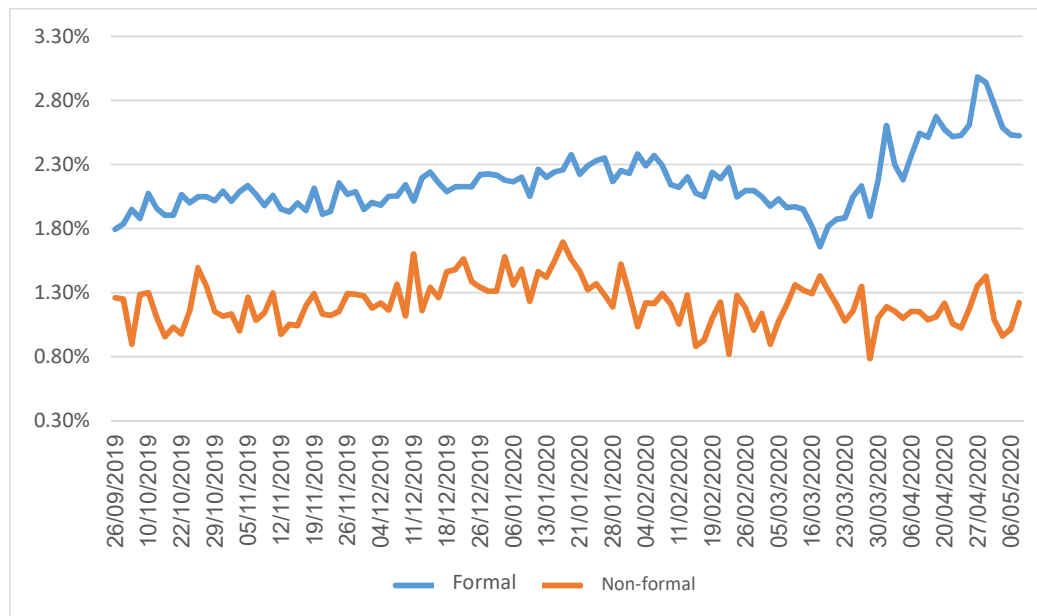
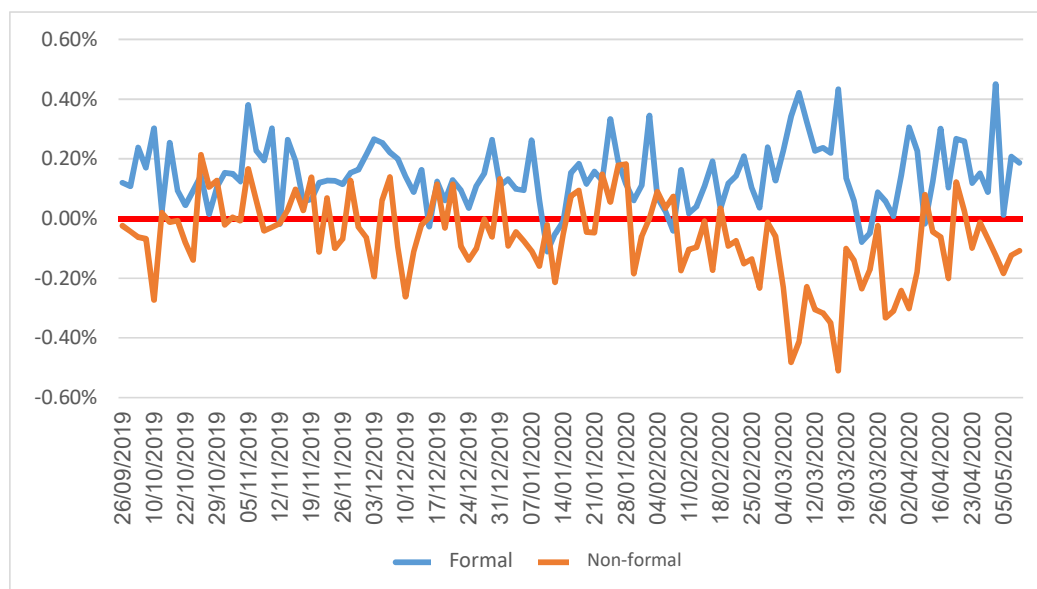
Diagram 4.4: The ineffectiveness indicator $E_{m,t}$ – Stocks, September 2019 – May 2020

Diagram 4.5 presents the other side of the coin – average $S_{m,t}$ values across all stocks. It is evident that during the crisis, formal market makers “carried” the bid side, whereas non-formal market makers, as expected, moved downward in values. Evidently, formal market makers tend to the bid side also in times of routine, whereas non-formals mostly operate around the mid-price. During the crisis, the two groups of market makers effectively played complementary roles.

Diagram 4.5: The symmetry indicator $S_{m,t}$ – Stocks, September 2019 – May 2020

Detailed findings by type of security and period (routine: September 2019 – February 2020, crisis: March 2020, recovery: April 2020- May 2020) are provided in Tables 4.1

and 4.2 below.

Following are the main findings:

- In the stocks category (and to a lesser extent in “other shares”), effective market making was due to non-formal market makers. Their ineffectiveness indicator maintained its low values also during the crisis (obviously, the spread itself concurrently grew, as presented in Chapter 3 above).
- In the ETF category, formal market makers dictated the spread, with very low ineffectiveness values (just a few basis points). However (in relative terms), their ineffectiveness indicator significantly increased during the crisis.
- In both the stocks and the corporate bonds categories, an increase in the ineffectiveness indicator of formal market makers can actually be identified **during the recovery period**. This may indicate that while the market in general is narrowing the spreads, market makers maintain the high spreads of the peak of the crisis.
- In the stocks as well as the corporate bonds categories, formal market makers tended towards the bid side during the crisis (Table 4.2 – positive or low negative values versus high negative values in the non-formal category), thus responding to the excess supply during the crisis.
- The rating of market making effectiveness (to what degree does it dictate the actual spread) by types of securities, from the most effective down: ETFs, corporate bonds, stocks. The effectiveness of ETFs is clearly dictated by the nature of the product.

Table 4.1: Market makers ineffectiveness indicator

Market maker's ineffectiveness indicator ($E_{m,t}$)	Formal			Non-formal		
	Routine	Crisis	Recovery	Routine	Crisis	Recovery
Other shares	2.03%	1.82%	2.56%	2.39%	2.35%	2.77%
TA-60 SME; TA-Growth	2.19%	2.12%	2.61%	0.98%	1.06%	1.01%
TA-90	2.01%	2.12%	2.26%	0.93%	0.95%	0.93%
TA-35	1.60%	1.66%	1.74%	0.51%	0.47%	0.47%
Time to maturity ²¹ >10	1.02%	0.00%	0.00%	0.72%		
Time to maturity 5-10	0.25%	0.42%	0.52%	0.55%	0.36%	0.79%
Time to maturity 3-5	0.47%	0.73%	0.87%	0.34%	0.63%	0.56%
Time of maturity 0-3	0.38%	0.61%	0.81%	0.30%	0.76%	0.53%
ETF in the bond market	0.01%	0.06%	0.03%	0.40%	0.38%	0.58%
Bond foreign fund	0.01%	0.03%	0.01%	0.10%	0.14%	0.22%
ETF in the stock market	0.04%	0.08%	0.07%	0.32%	0.35%	0.37%
Stock foreign fund	0.03%	0.15%	0.15%	0.14%	0.10%	0.13%

* Low values indicate proximity to the first layers of the book; high values point to distance from the first layers of the book; the color scale is independently defined for each row.

²¹ Corporate bonds are marked by the label "Time to maturity X", such that X marks the number of years to maturity. A range of years refers to a number of years larger than the bottom value and smaller than or equal to the top value.

Table 4.2: Market makers symmetry indicator

Market maker's symmetry indicator ($S_{m,t}$) Type of security	Formal			Non-formal		
	Routine	Crisis	Recovery	Routine	Crisis	Recovery
Other shares	0.25%	0.23%	0.27%	0.25%	-0.25%	0.04%
TA-60 SME; TA-Growth	0.08%	0.18%	0.10%	-0.13%	-0.29%	-0.20%
TA-90	-0.01%	-0.01%	-0.01%	0.02%	-0.05%	-0.02%
TA-35	0.00%	-0.01%	0.00%	0.04%	-0.02%	0.10%
Time to maturity >10	0.54%	0.00%	0.00%	0.50%		
Time to maturity 5-10	0.10%	0.07%	0.17%	-0.15%	-0.11%	-0.59%
Time to maturity 3-5	0.01%	0.02%	0.15%	-0.03%	-0.17%	-0.16%
Time to maturity 0-3	-0.05%	-0.06%	-0.01%	-0.03%	-0.02%	-0.22%
ETF in the bond market	0.00%	0.02%	-0.01%	0.01%	0.08%	-0.04%
Bond foreign fund	-0.01%	0.01%	0.00%	-0.04%	0.06%	0.03%
ETF in the stock market	0.01%	0.01%	-0.01%	-0.04%	-0.20%	-0.14%
Stock foreign fund	-0.01%	-0.06%	-0.04%	-0.05%	0.01%	-0.01%

* Negative values point to ask-inclination; positive values point to bid inclination; the color scale is independently defined for each row.

5. Taker-Maker ratio

Table 4.3 below presents the percentage of the taker transaction volume out of the market maker's transactions in the continuous phase. Following are the main findings (results for buy or sell transactions only are similar):

- In the stock and bond categories, formal market makers significantly reduced the ratio of taker transactions since the beginning of the crisis. This finding is consistent with a rise in the spreads and a corresponding decline in the potential profitability from taker transactions by “classic” market makers.
- The high percentage of taker transactions by formal market makers in stocks and bonds in routine times may indicate ineffectiveness of formal market making in these categories, as transpires also from previous sections.
- In ETFs (excluding foreign stock ETFs) the taker percentage of formal market makers during the crisis remained similar to times of routine. This finding corresponds with their low ineffectiveness indicator.

- *Table 4.3: Taker percentage out of the market maker's transactions in the continuous phase; the color scale is independently defined for each row*

Taker percentage	Formal			Non-formal		
Type of security	Routine	Crisis	Recovery	Crisis	Routine	Recovery
Other shares	23.62%	12.68%	11.16%	21.10%	12.70%	32.19%
TA-60 SME; TA-Growth	36.90%	18.85%	21.98%	19.58%	22.31%	20.30%
TA-90	40.28%	19.21%	22.23%	23.40%	21.04%	18.65%
TA-35	31.31%	13.78%	18.54%	23.29%	9.12%	14.09%
Time to maturity >10	50.00%			50.00%		
Time to maturity 5-10	31.53%	12.06%	18.69%	11.00%	0.00%	20.53%
Time to maturity 3-5	26.23%	21.50%	23.10%	11.11%	8.97%	6.19%
Time to maturity 0-3	32.38%	13.88%	18.29%	21.32%	26.63%	29.01%
ETF in the bond market	14.29%	18.54%	16.70%	32.67%	33.33%	50.09%
Bond foreign fund	28.53%	22.97%	28.13%	33.33%		0.00%
ETF in the stock market	21.16%	23.00%	22.54%	52.08%	75.95%	71.08%
Stock foreign fund	29.33%	37.91%	40.88%	56.53%	64.86%	50.46%

6. Liquidity indicator values for market makers in ETFs relative to the underlying index

This section analyzes the values of liquidity indicators for **ETF market makers**, relative to their value for the fund's **underlying index**. In this section, the term “fund population” refers to funds with an underlying index on TASE only. It is again emphasized that the figures pertain to the spreads of market makers (formal only in this sub-section), and not of all traders in the fund.

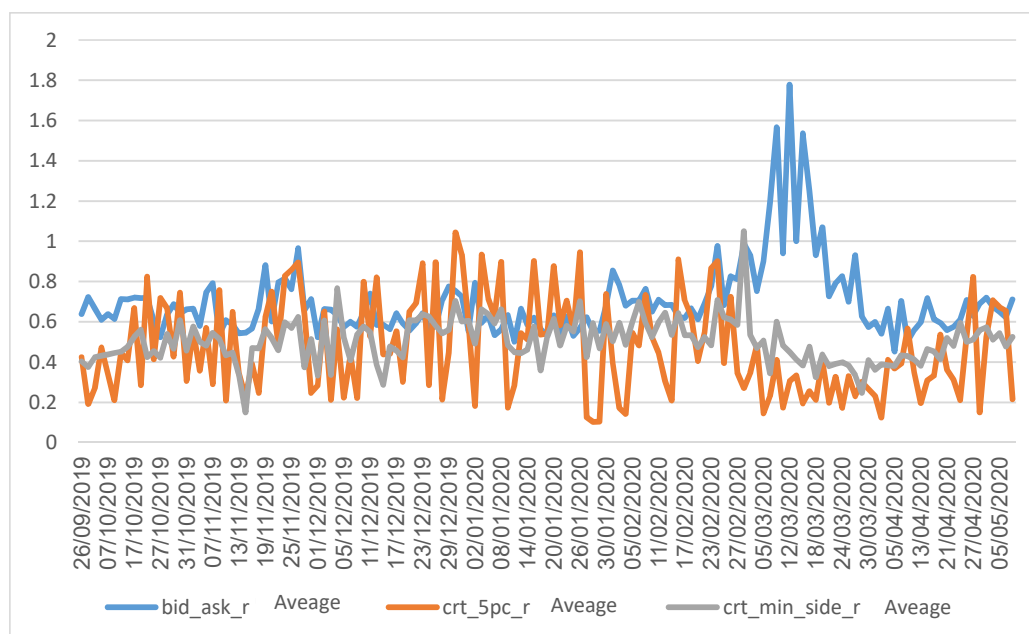
For each fund i , and each day t , the following ratio is calculated:

$$r_{i,t} = \frac{liq_{i,t}}{liq_{b(i),t}}$$

In this ratio, $liq_{i,t}$ is the market maker's relevant liquidity indicator, and $b(i)$ is the underlying index of fund i . The following diagrams present daily averages of $r_{i,t}$ by various fund populations. The market maker's liquidity indicator is calculated on the basis of minute-by-minute samples. The values of the underlying index are determined on the basis of a weighted average of the values of the liquidity indicators of the securities in the index, relative to their weight in the index.

Diagram 4.6 present the averages values of ETF market makers with respect to the underlying index. Evidently, in times of routine, all ETF spread indicators are lower than those of the underlying index ($r_{i,t} < 1$). The crisis brought about two opposite trends. On the one hand, the values of the bid-ask spread increased significantly as compared to the underlying index values (and returned to the norm values after the peak of the crisis). On the other hand, CRT values, which review the average DOM spread, improved in comparison with the underlying index.

Diagram 4.6: Daily averages of ratio r , all funds, September 2019 – May 2020



It is noted that during the crisis period, for funds tracking the TA-35, all fund managers provided spreads higher than the weighted spread of the underlying index, contrary to the routine and recovery periods.

Summary of findings

This chapter reviewed the activity of market makers on the TASE during the COVID-19 crisis and the preceding routine period.

Following are the main findings:

- During the crisis, formal market makers raised their offered spreads (in particular in corporate bonds). Concurrently, in the corporate bonds and ETF categories, the ineffectiveness indicator (as defined in this chapter), also increased. An increase in spreads is inevitable at times of crisis. However, the increase in the ineffectiveness indicator points to **an increase in market makers' spread which is not proportional to the increase in the spread which is defined by the other players**. Possibly, this created a feedback mechanism which increased the liquidity crisis.
- In relation to both the stock and the corporate bond categories, an increase in the ineffectiveness indicator of formal market makers can **actually be identified during the recovery period**. This may indicate that **while the market in general narrowed the spreads, market makers maintained the high spreads of the peak of the crisis**.
- In the pre-crisis routine period, non-formal market makers (traders who are not bound by market making agreements) provided better spreads than the formal market makers, excluding the ETF category. However, as expected, during the crisis **non-formal market makers ceased their activity** in a large part of the securities.
- In the stock as well as the corporate bond categories, formal market makers tended towards the bid side during the crisis. Thereby, despite large spreads, they responded to the excess supply.
- **Formal market makers increased their time of absence from the book during the crisis**. While at times of routine, formal market makers quote almost throughout the trading day (with absence time values close to zero) in most types of securities, during the crisis, average values neared 40 minutes and up.
- In the ETF category, formal market makers dictate the spread, with very low ineffectiveness values (a few basis points). However (in relative terms), their ineffectiveness indicator significantly increased during the crisis.
- Throughout the period, the most effective market making (the highest degree of dictating the actual spread) was in ETFs, followed by corporate bonds and lastly in stocks. The effectiveness of ETFs is clearly dictated by the nature of the product.

Following are the main findings regarding ETF market making:

- **The values of ETFs bid-ask spread increased significantly during the crisis compared with the underlying index**, contrary to the pre-crisis and the recovery period that followed it. On the other hand, CRT values (reviewing the depth of the order book) were relatively improved compared with the underlying index. This dissonance may derive from the relatively high quantity which is required of ETF market makers on the leading layer, unlike the underlying index's spread which is dictated by the minimum quantity per order. Such a requirement may cause a higher spread (Layer 1) and with respect to the DOM.
- **During the crisis**, for funds tracking the TA-35, all fund managers provided spreads higher than the weighted spread of the underlying index (sub performance), contrary to the routine and recovery periods.

Summary

The COVID-19 crisis began in January 2020 as a health crisis, first in China and later worldwide, and rapidly developed into a crisis in the real economy due to public health preventive measures taken by governments around the globe and the need for extensive behavioral change among populations. The full magnitude of the crisis hit financial markets at the end of February 2020, resulting in exceptional drops of approx. 30-40% in the leading stock indices within a single month, and sharp rises in the yields of bonds.

This paper compiles analyses performed by the Economic Department of the Israel Securities Authority (ISA), with the assistance of additional ISA departments, with the aim of monitoring the real-time implications of the crisis, identifying and preventing market failures before they materialize, and facilitating informed and data-driven decision-making. The analyses presented herein comprise but a small part of the extensive work that was done over a short time period and their publication offers a glance at the ISA's activity during this period, and allows the public to share the insights emerging from such analyses.

The background chapter detailed the implications of the crisis on the markets in Israel and globally with respect to the condition of the market immediately before the crisis.

Chapter 1 examined the day-by-day activity of the different TASE players. Sales during the crisis were mainly performed by small investors, whether directly or through redemptions of mutual funds, while sophisticated investors, including algo traders and the institutional bodies, supplied liquidity and took the side of demand. In the recovery period that followed, these trends appeared to reverse. In government bonds the picture was somewhat different, since sales were also initiated by institutional bodies and sophisticated investors, while market makers were the main source of liquidity.

Chapter 2 examined the correlation between the returns of stocks and corporate bonds versus the returns of the leading indices on TASE and within each asset type. Correlation values reached historical peaks, as did Beta values and the level of market risk. These trends point to several insights. First, the reaction to the crisis (during declines as well as rises) was the dominant driving force in the market, across all securities. Second, and accordingly, the effectiveness securities' price discovery was impaired during the crisis. Third, the ability to minimize risk by asset diversification was compromised.

Chapter 3 examined the changes in liquidity indicators on TASE during the crisis, by type of securities. Bid-ask spreads demonstrated a sharp increase (decline in liquidity) during the crisis, in all types of securities, excluding government bonds and treasury securities. Nevertheless, their values reached only to 50% of the values during the 2008 crisis. A reasonable assumption is that increased use of algorithmic trading tools moderated the rise in spreads. Conversely, it was found that the impairment in liquidity for **large trading volumes**, resembled (and even surpassed in some types of securities) the impairment which occurred during the 2008 crisis. It was further found that securities which are less liquid in times of routine experienced a more acute deterioration during the crisis.

Chapter 4 examined the activity of market makers on TASE during the crisis, with a

distinction between formal market making (which is carried out under a market making agreement and the TASE Rules) and non-formal market making (which is carried out as a trading strategy, mostly by algorithmic traders). An ineffectiveness indicator was defined and calculated, to determine the extent to which market makers dictate actual bid and ask prices. It was found that the effectiveness of formal market making declined during the crisis, and even deteriorated **after its climax**. This finding may indicate that formal market makers reduce spreads slower than the market in general. In addition, formal market makers extended the time periods in which they provided no quotes during continuous trading.

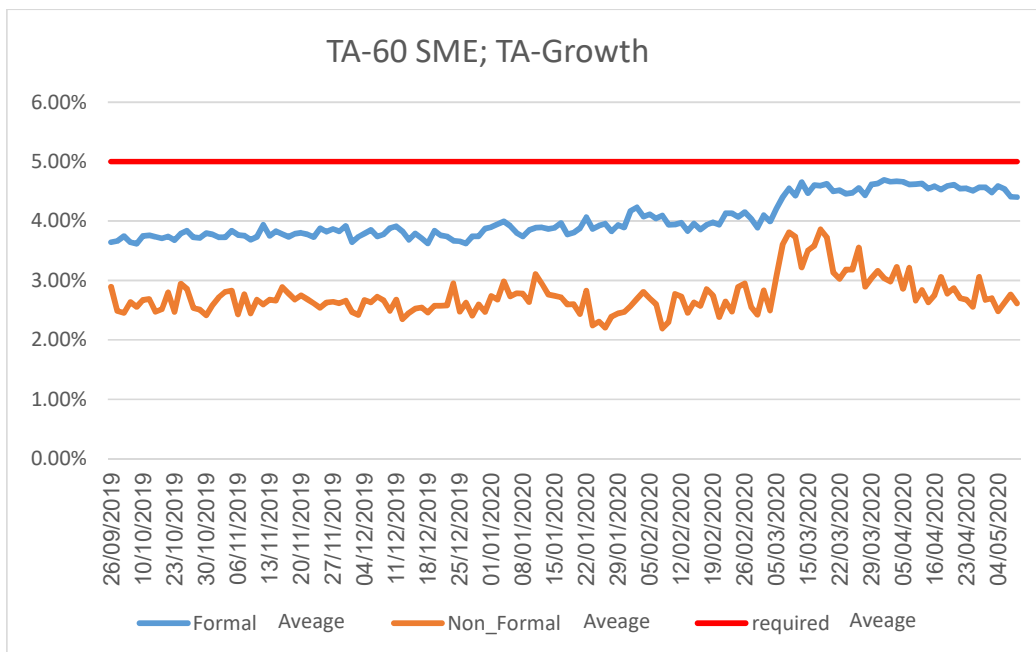
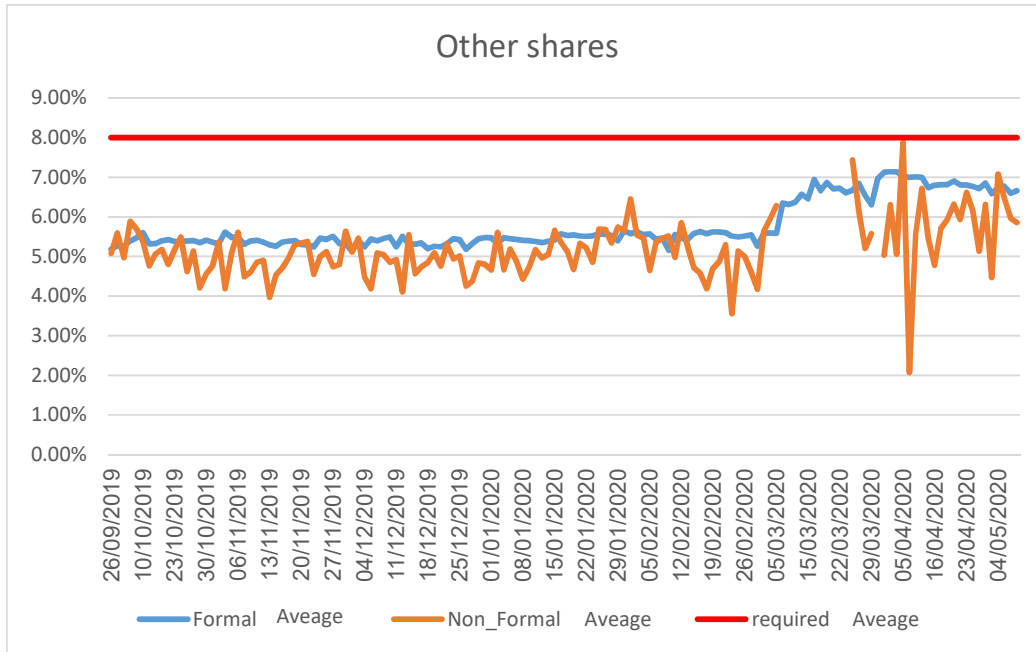
On the other hand, non-formal market makers (who in time of routine, compared with formal market makers, provide better spreads on stocks and corporate bonds) ceased their activity in a large part of the securities during the crisis.

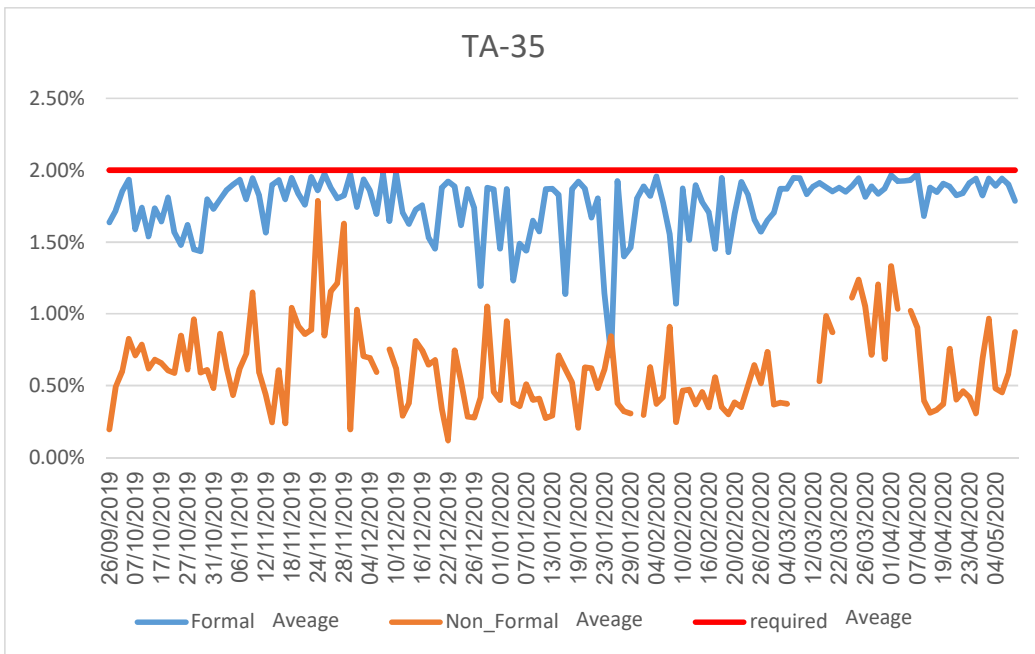
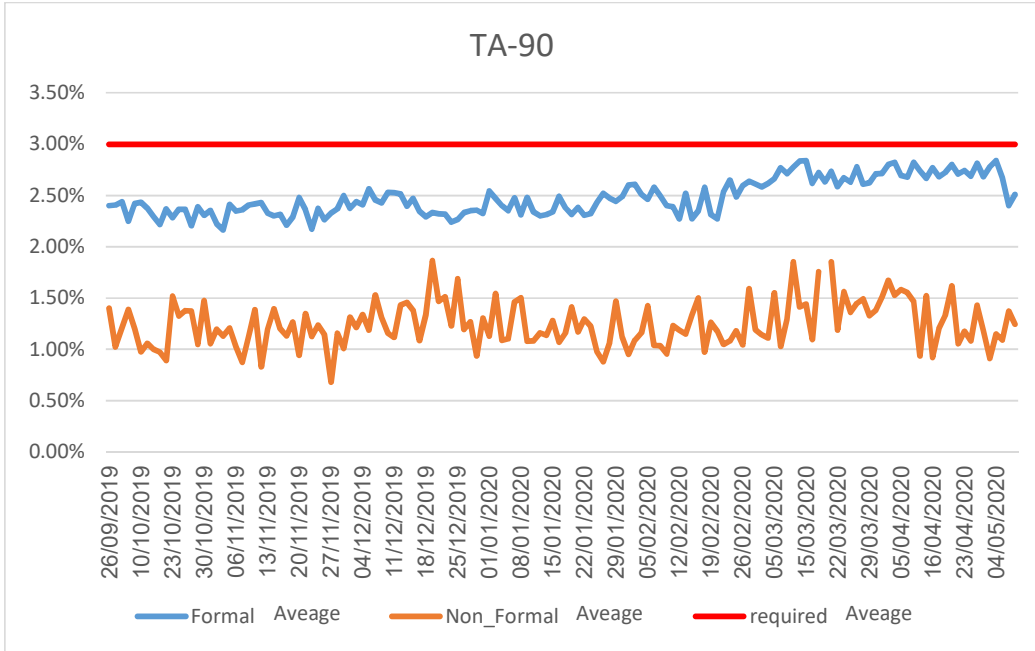
By types of securities – the most effective market making was in ETFs (although such a comparison is qualified by the different nature of the types of securities). The aforesaid notwithstanding, the increase in ETF spreads exceeded the increase in the spreads of the underlying indices of these funds.

Annexes

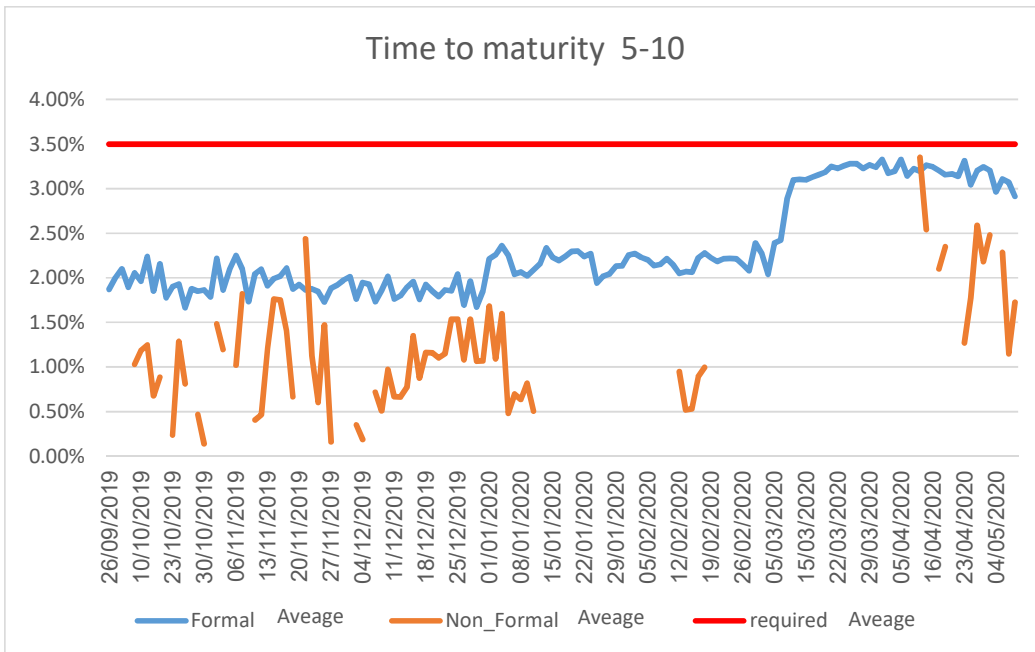
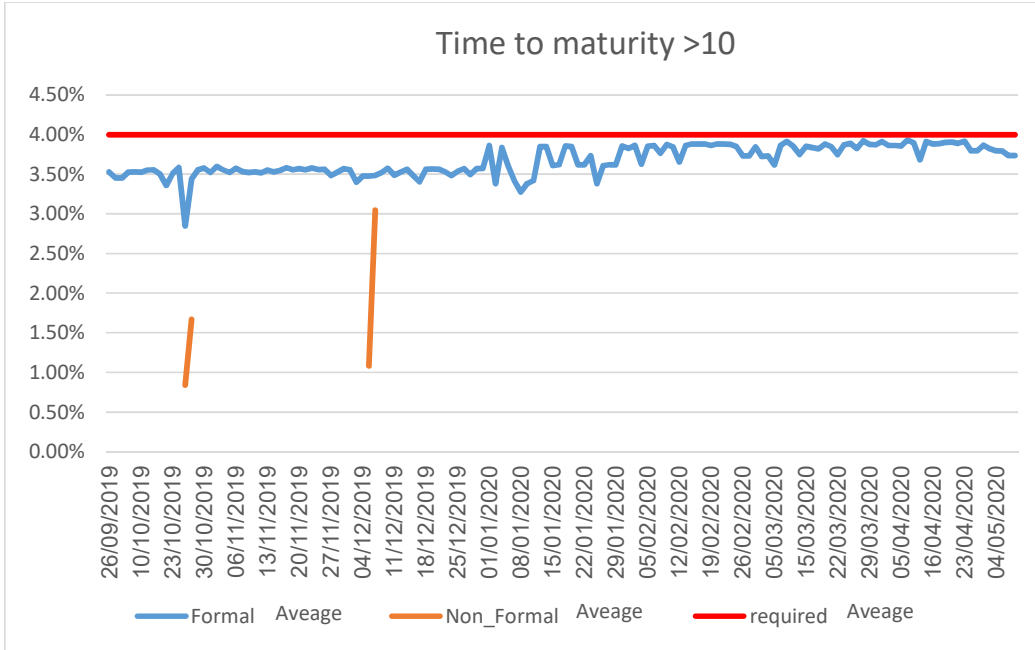
Annex 1 – Market making – bid-ask spreads throughout the period, September 2019 – May 2020

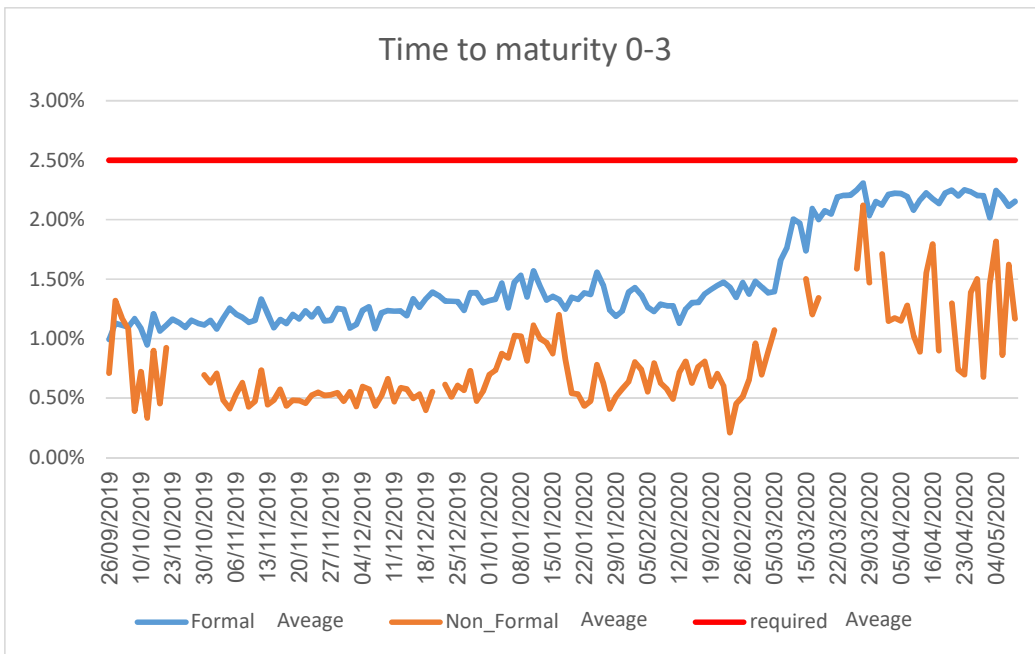
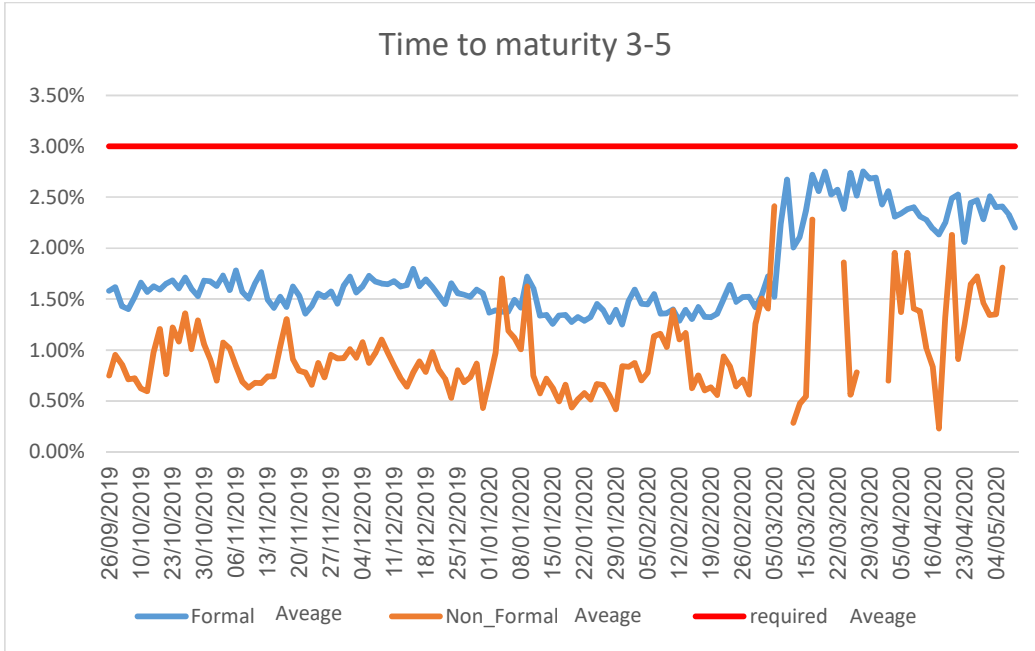
Stocks

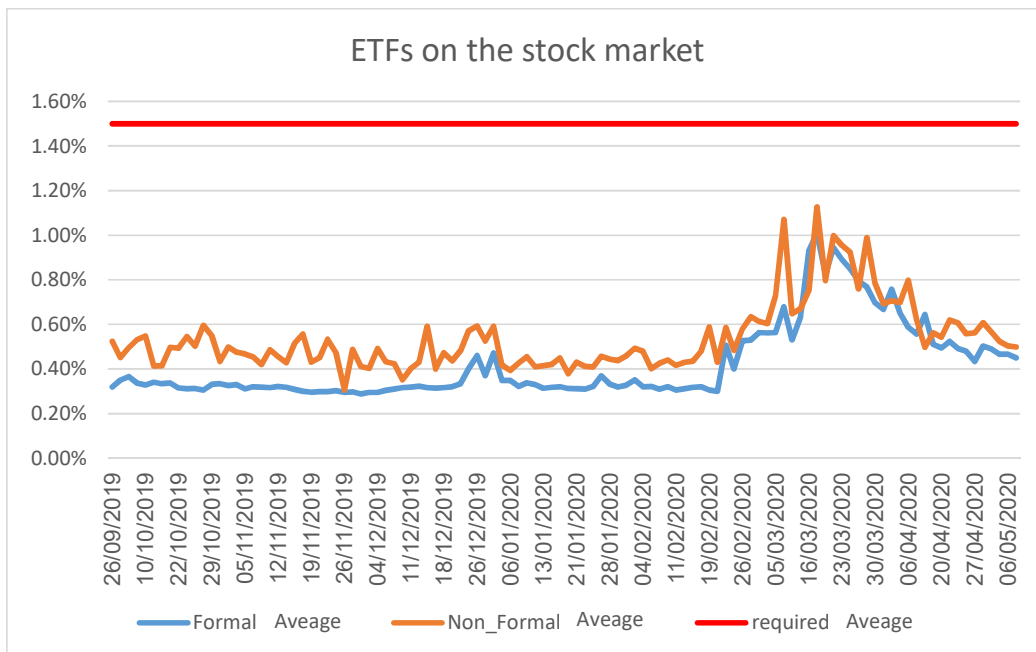
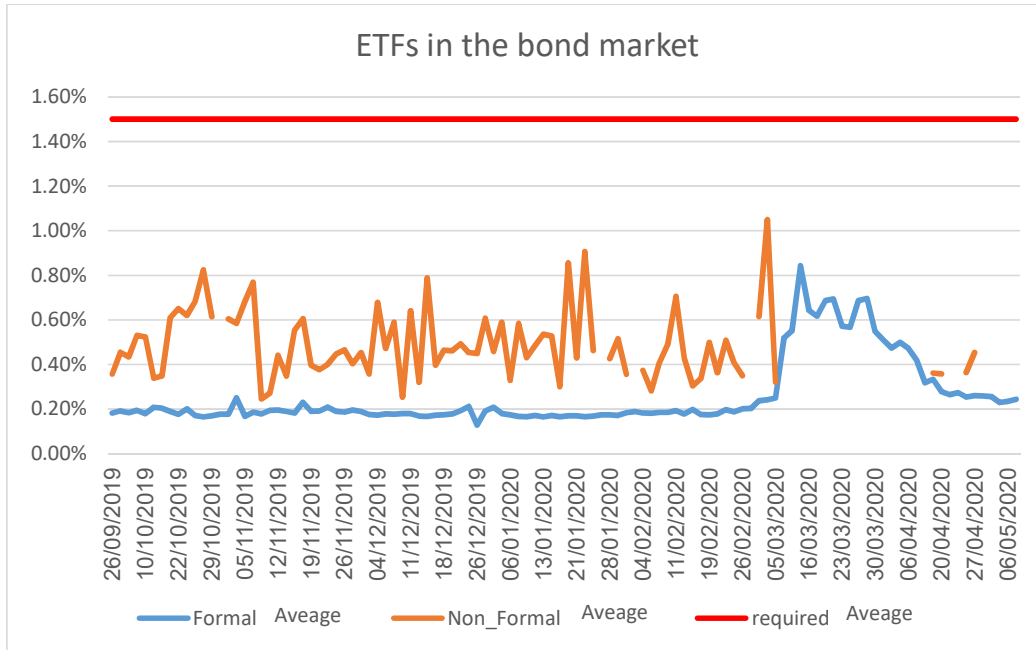




Corporate bonds

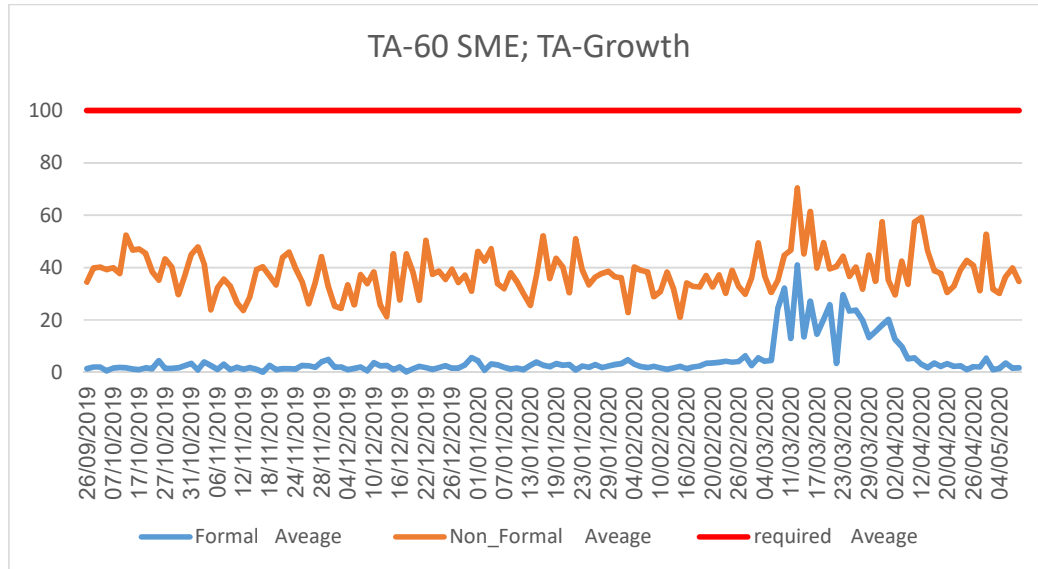
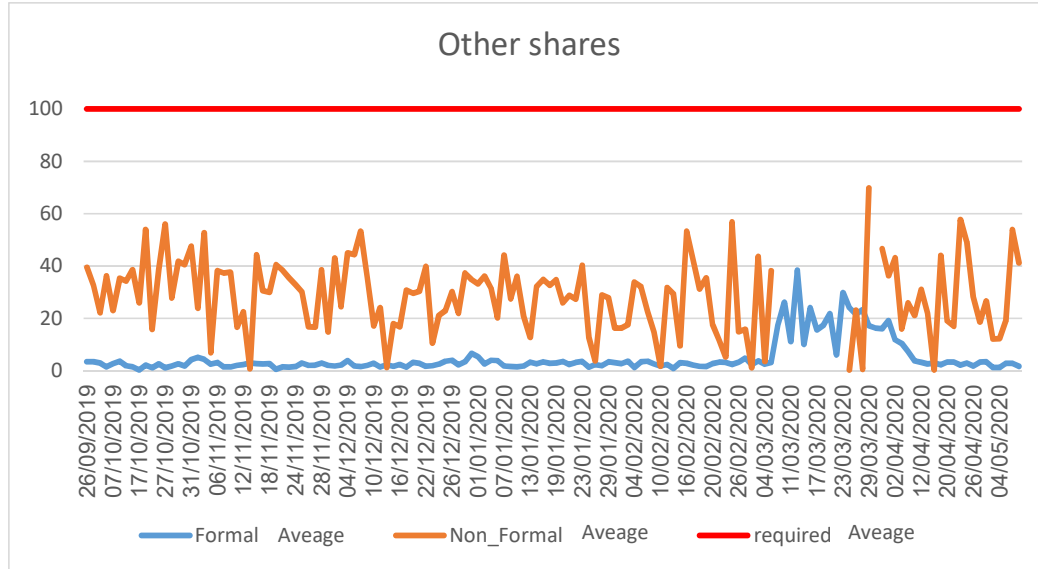


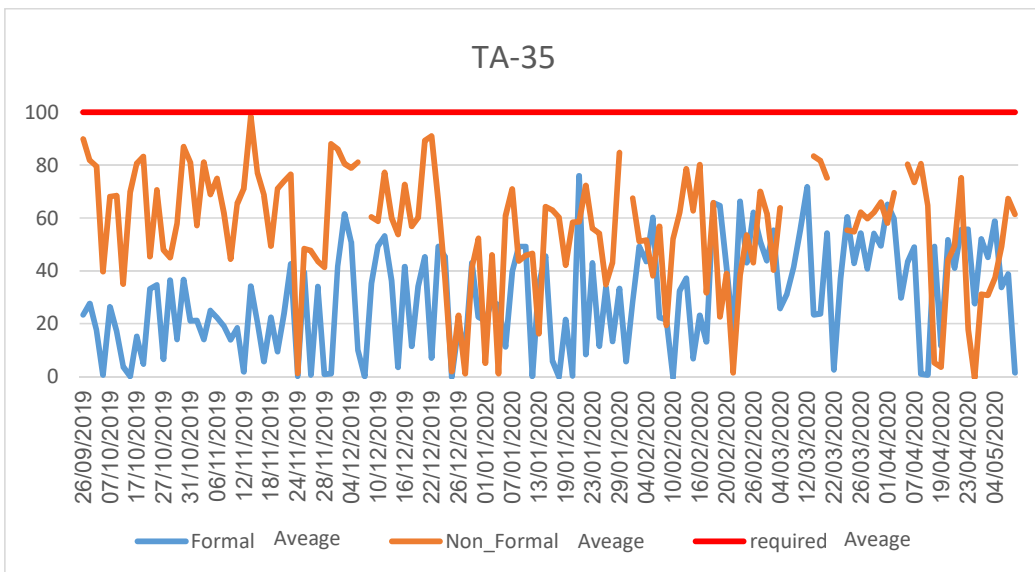
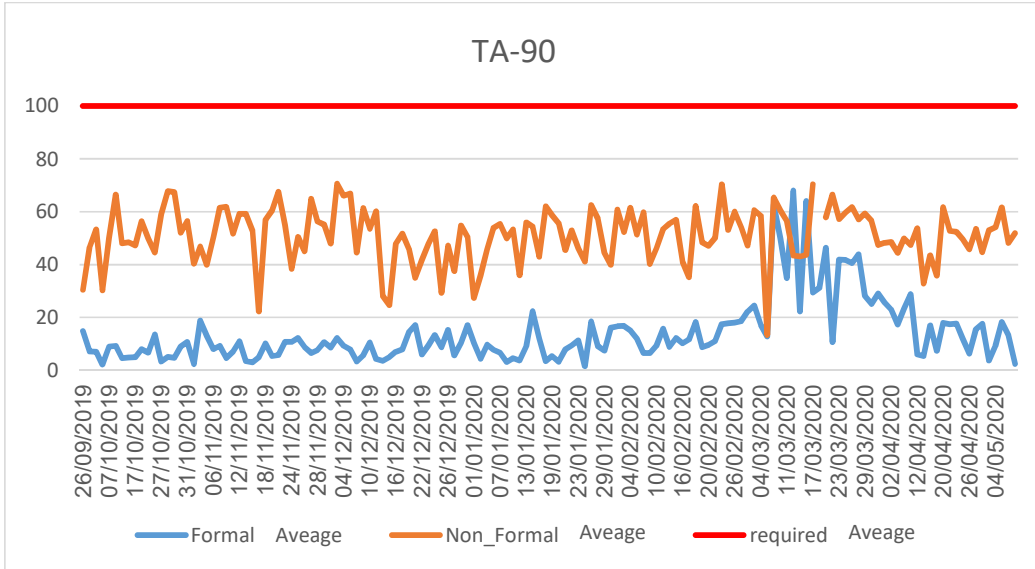


ETFs

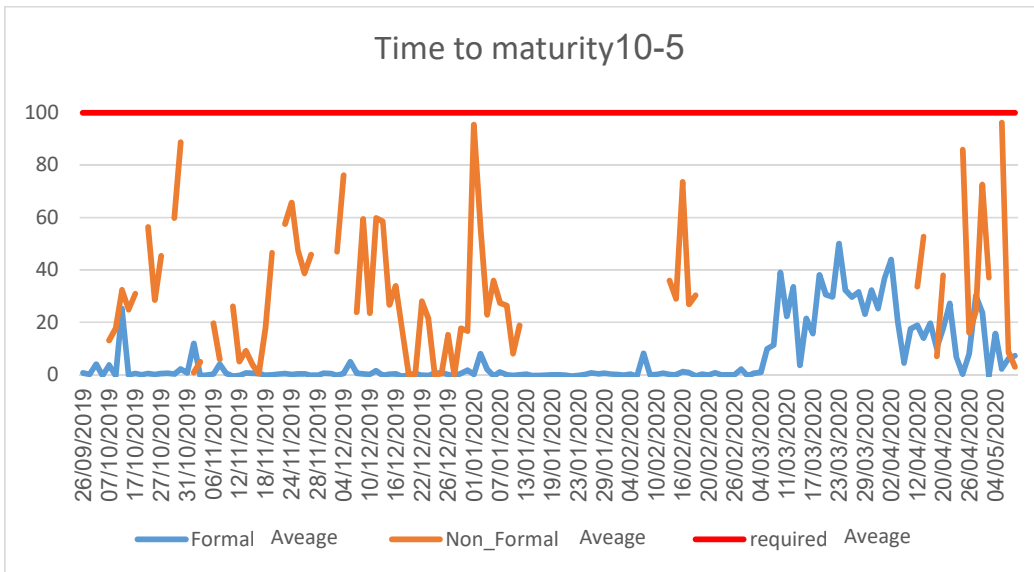
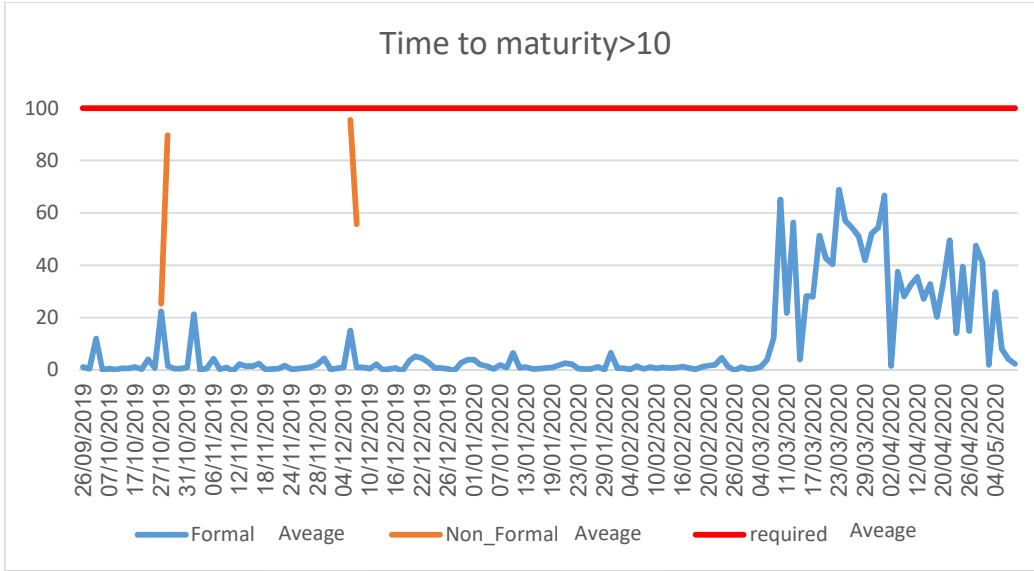
Annex 2 – Absence from the book (in minutes) throughout the period, September 2019 – May 2020

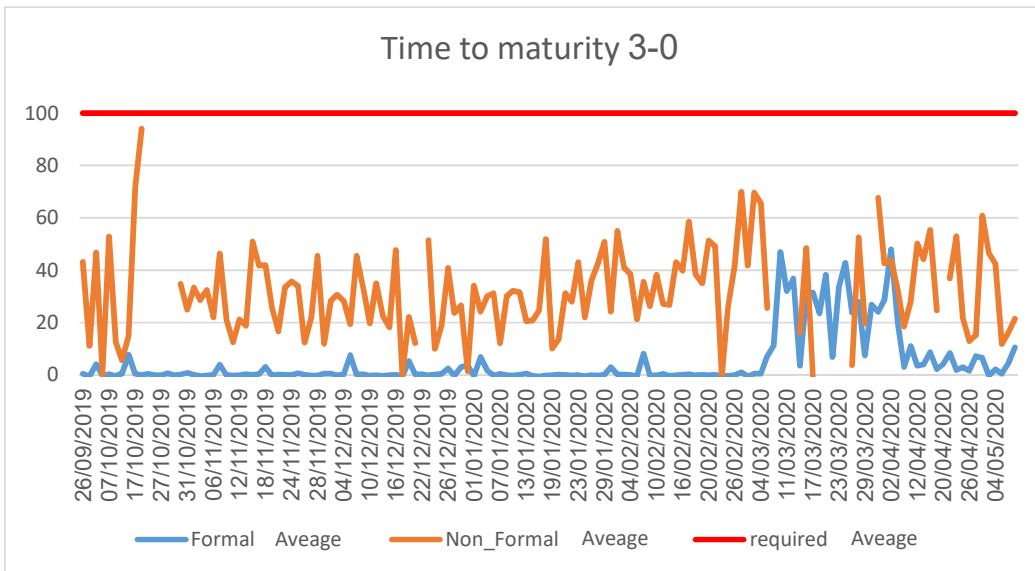
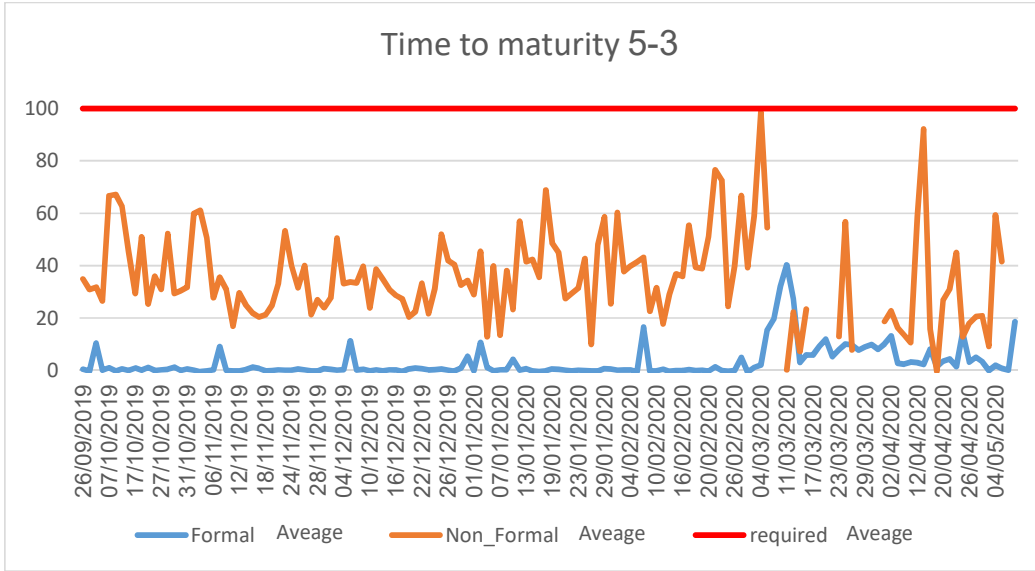
Stocks





Corporate bonds





ETFs

