**Bank of Israel** **Research Department**

# "Much Ado about Nothing"? The Effect of Print Media Tone on Stock Indices

**Mosi Rosenboim,[a] Yossi Saadon,[b] and Ben Z. Schreiber[c]**

Discussion Paper No. 2018.10

October 2018

---

Bank of Israel; http://www.boi.org.il
[a] Ben-Gurion University, Faculty of Management, mmm@som.bgu.ac.il
[b] Bank of Israel Research Department and Sapir College, yosis@boi.org.il
[c] (corresponding author) Bank of Israel Information and Statistics Department and Bar-Ilan University, ben.schreiber58@gmail.com

The authors thank Alon Eizenberg, Ron Kaniel, Doron Kliger, Ilan Kremer, Nathan Sussman, and the participants at the Bank of Israel Research Department seminar, the Bar-Ilan University AMCB forum, and the Ben-Gurion University research seminar, for their helpful comments and suggestions. We specially thank 'Ifat Media Research' company for providing us a unique database and the tone classifications. We also thank Yonatan Schreiber for technical assistance.



**חטיבת המחקר, בנק ישראל ת"ד 780 ירושלים 91007**

**Research Department, Bank of Israel. POB 780, 91007 Jerusalem, Israel**

## Abstract

We translate print media coverage into a gauge of human sentiment and the equivalent advertisement value, and find that the tone of media coverage substantially impacts stock markets. The tone has a positive effect on both overnight and daily stock returns but not on intraday returns, while conditional variance and daily price gaps are negatively influenced. This effect is significant on days of sharp price declines. The coverage of negative events in the capital market is about double the coverage of positive events. This asymmetry is greater when distinguishing between professional and unprofessional financial print media.

## תקציר

עבודה זו בוחנת את השפעת התקשורת הכלכלית המודפסת על שוק המניות בשנים 2011–2017. כל הכתבות העוסקות בשוק המניות שפורסמו בעיתונות המודפסת בישראל נותחו וסווגו בהתאם לסנטימנט שלהן ביחס לשוק זה – חיובי, שלילי או ניטרלי. הובא בחשבון גם השווי הכלכלי של כל כתבה, דהיינו עלות הפרסומת במקומה ובגודלה; (למשל: שוויה של כתבה המפורסמת בעמוד הראשון גבוה יותר מזה של כתבה באותו גודל בעמוד פנימי). בכך ניתן משקל למידת החשיפה של הכתבה לקוראים. המחקרים הבוחנים את סוגיית הקשר בין התקשורת לשוקי ההון מתבססים בדרך כלל על ניתוח באמצעות רובוטים (text mining) ועושים שימוש במספר הכתבות (בלי לשקלל את היקף החשיפה של כל אחת מהן). השימוש בשווי הכלכלי של הכתבות אפשר לנו לנכות גורמים שבעצמם יכולים להשפיע על שוק ההון (השינוי במדדי המניות בימים האחרונים, השינוי במדד הנאסד"ק וכו'), ובכך "לזקק" את השווי הכלכלי ולהתמקד בהשפעה של התקשורת בלבד.

את השפעת היקף הסיקור והסנטימנט (להלן האווירה) אנו בוחנים על התשואות היומיות, על התשואות התוך-יומיות ועל התשואות הליליות (בין מחיר הפתיחה היום למחיר הסגירה אתמול). בעזרת הבחנה זו אנו קושרים למעשה בין שני סוגי ספרות: זו העוסקת בהשפעת התקשורת על מחירי המניות וזו העוסקת באנומליית ההבדל בין התשואות התוך-יומיות לתשואות הליליות. מהתוצאות עולה כי: (א) להיקפי הסיקור והאווירה השפעה חיובית ומובהקת על תשואות המניות היום, ובעיקר על התשואות הליליות; (ב) ההשפעה מובהקת בימים של תנודות חדות, ובעיקר בימי ירידות שערים חדות; (ג) השפעת היקפי הסיקור והאווירה על השונות המותנית היא שלילית; (ד) התקשורת מסקרת באופן לא סימטרי אירועים חיוביים ושליליים בשוק ההון. האסימטריות בולטת במיוחד בתקשורת הכלכלית הכללית ("ידיעות אחרונות", "ישראל היום", "מעריב"). אירוע שלילי בשוק ההון יקבל בתקשורת הכלכלית המקצועית ("דמרקר", "גלובס", "כלכליסט"), בממוצע, סיקור כפול מאשר אירוע חיובי באותו סדר גודל (לדוגמה – ירידה של אחוז בשוק המניות לעומת עלייה של אחוז), וזאת לעומת סיקור גבוה פי שישה בערך בתקשורת הכלכלית הכללית. תוצאות (א) עד (ג) מתיישבות עם מאפייני התנהגותם של משקיעים פרטיים "נאיביים", אשר מושפעים מהתקשורת המודפסת מחד גיסא, ופועלים כ"עדר", בייחוד בימים של ירידות חדות, מאידך.



Keywords: Media coverage, Market sentiment, Overnight returns
JEL classification: G10, G11, G14

## 1. Introduction

Efficient stock markets price in relevant new information rapidly and efficiently. The new information is transmitted through various media channels, the oldest of which is the print media. Moreover, for people who are generally not among the group of professional investors, general rather than business newspapers are the main, if not the only, channel for transmitting economic information (Peress, 2014). In particular, newspapers not only report, they also influence the decisions of individuals by emphasizing or downplaying relevant economic events. Thus, the tone of their reporting influences investors and creates a public atmosphere that is not necessarily a direct result of economic developments (Shiller, 2005). Because tone is a latent variable, the current literature has usually examined the effect of the media on the prices of financial assets, including stock prices, without controlling for other intermediary variables. Tone in financial reporting is important to policy makers and those responsible for the stability of the financial markets, since its effect on investors, mainly naïve ones, is very significant in periods of sharp changes in asset prices. In particular, the literature reports on asymmetry in the effect, which for the most part is clearly reflected in sharp price declines (Soroka, 2006; Tetlock, 2007).

Another issue that has attracted the attention of researchers of financial anomalies in recent years is the gap between intraday returns (the difference between the closing price and the opening price on the same trading day) and overnight returns (the difference between the opening price today and the closing price yesterday). Such gaps in returns, where intraday returns are negative while the overnight returns are positive, were found in many stock markets and in various sample periods, and can reach dozens of percent in annual terms (Tompkins and Wiener (2007); Lou et al. (2015); Liu and Tse (2017)).

This study examines the effect of the tone residual (adjusted for relevant economic variables) on daily stock prices on the Tel Aviv Stock Exchange and on other market variables (trading volumes, return variance, and the daily gap between high and low prices), from January 1, 2011 to October 30, 2017. We analyze the effect of press coverage on the stock market through the use of a unique database built by the "Ifat Media Research" company.[1] In this database, thousands of financial news articles that appeared in the newspapers are priced and classified into positive, negative, or neutral tone from the standpoint of the domestic stock market.

[1] The company sells analyses on the local media for decades. Particularly, we use their database that covers the entire Israeli print media with regard to the local stock market, on a daily basis.

In contrast with the relevant literature, we examine the extent of an article's impact by the newspaper in which it is published, by its location in the newspaper (first page in a weekend supplement compared with an inside page on a weekday), and by its size (number of square inches). Then, the relevant newspaper articles are translated into equivalent monetary terms as if they had been commercial advertisements. This new methodology is justified both theoretically and empirically, compared to the practice in which the number of positive less the number of negative articles or words is taken into consideration. For instance, a dramatic economic development described laconically and briefly in the newspapers will apparently have less impact on readers than a case where the exact same development is given broad media coverage accompanied by commentary, newspaper headlines, and so forth. This approach is particularly reasonable these days, when newspapers do not convey real-time (objective) news such as the web news sites or social networks do. Thus, we are looking for the net influence of newspapers on stock market variables, controlling for other market variables.

To the best of our knowledge, we are the first to make use of a monetary equivalent of coverage based on the articles of all newspapers in the country. In addition, we examine the effect of the tone residual on intraday returns; on overnight returns, which measure today's opening price against yesterday's closing price; and on common daily returns, which measure today's closing price against yesterday's closing price. In this way, we examine the effect of the tone residual presented by newspapers (the newspapers are published in the morning before the market opens) on returns, and distinguish between returns beyond trading hours (overnight) and returns during trading hours (intraday). We relate to this anomaly through the effect of the tone residual on the three aforementioned returns, on trading volumes, on daily gaps, and on daily and intraday volatility in stock prices.

Essentially, this study connects two strands of literature: one that deals with the effect of the media on stock prices (Tetlock (2007); Barber and Odean (2008); Boudoukh et al. (2013); Garcia (2013); Peress (2014); Garz (2014); and Larsen and Thorsrud (2017)), and one that deals with the anomaly of overnight returns (Tompkins and Wiener (2007); Riedel and Wagner (2015); Lou et al. (2015); Liu and Tse (2017); and Basdekidou (2017)). This study makes a double contribution. First, it offers an equivalent monetary index of the tone residual, adjusted for the effect of other relevant economic variables. This index is preferable, from theoretical and empirical standpoints, since the index that is currently used in the literature usually does not take into account the monetary value of the articles, meaning that it does not consider the size or placement of the article or the distribution of the newspaper. Second, it uses the effect of the tone

residual rather than the tone itself, thus assessing the net effect of newspaper articles on stock market indices. Additionally, we examine the asymmetry of press coverage, using non-linear statistic procedures, and the existence of sharp price fluctuations to partially explain the anomaly of the gap between intraday and overnight returns. The main results of the study are:

(1) The effect of the tone residual derived from the newspapers on stock prices is significantly positive on both overnight and daily returns but not on intraday returns.

(2) The effect is highly significant on days of sharp fluctuations (mainly price declines) in the lowest deciles of the distribution of stock indices. This asymmetry in the print media is revealed mainly in non-business (general) newspapers and is mostly influenced by sharp price declines where the tone residual (net effect) turns very negative (see Kearney and Liu (2014)).

(3) The effect on the conditional variance of all return types is negatively significant i.e., if the tone residual declines the conditional variance increases.

(4) The effect of the tone residual on daily gap prices (high-low or [high-low]/[high+low]/2) is negatively significant.

(5) The findings are robust to the type of newspaper (business: TheMarker, Globes, Calcalist or general: Yedioth Ahronoth, Israel Hayom, Ma'ariv), the various stock indices, and the statistical procedure through which they are tested.

The rest of the study is organized as follows. Section 2 provides a brief review of the literature. Section 3 presents the methodology. Section 4 presents the data and the results of the estimation and discusses the results. In Section 5 we perform robustness checks and present alternatives to the examined variables, while Section 6 concludes.

## 2. Review of the literature

A number of studies examine the effect of the print and electronic media, as well as of forums such as discussion groups, opinion columns, and blogs, on the stock market. This literature shows that the media may have an effect, inter alia, through economic expectations created by media consumers. These expectations are sensitive to the manner in which the articles are presented, and not just to their content. Pruitt et al. (1988) found that the same economic article had a different effect in accordance with the way in which it was presented. They attributed the differences in the effect, inter alia, to the length of the article. Ferguson et al. (2015) examined the effect of media coverage on the returns of individual stocks, using a dataset

between 1981 and 2010 in the UK. They used a methodology of textual analysis, where media tone was considered positive or negative based on the ratio between the quantity of positive and negative words, and by the number of words written on a particular company in the media. Using complementary economic information on the parent company, they found that this tone has a good ability to forecast the behavior of the company's stock prices, in both positive and negative directions.

The effect of the media is not reflected only in future expectations. The very fact of the coverage itself may influence the return on assets traded on the stock market in a wide variety of ways. First, the fact that a company name appears in the media may lead to the purchase of its shares by retail investors who pay limited attention to the variety of purchase possibilities. This is due to time restrictions or due to other cognitive limitations that cause them to focus on stocks that attract their attention—a phenomenon called "limited attention bias" (see, for instance, Kahneman and Riepe, 1998). Limited attention bias has been identified by Barber and Odean (2008) who, based on a database of news updates from the Dow Jones News Service (1994 to 1999), found that retail investors tend to purchase stocks that are at the focus of media attention. They found that this tendency is stronger in the purchase of stocks than in the sale of them, because stocks are sold from a given investment portfolio, which includes a limited number of stocks, whereas the quantity of stocks that can be bought is essentially unlimited. This tendency is not solely the domain of retail investors. Fang et al. (2014) examined the effect of media coverage of individual stocks on the volume of purchases of those stocks by mutual fund managers. They found that mutual fund managers have a tendency to purchase stocks that attract broader coverage, despite the fact that this tendency is negatively correlated with the future performance of the purchased stocks. Thus, their finding reflects the fact that even "professional" investors pay limited attention to the assets they are buying. They based their research on an analysis of daily news articles between 1993 and 2002, where the tone was determined by the number of articles, without taking into account the size or cost of the article.

The media's effect on the stock market has been studied over the years in a variety of ways. Tetlock (2007) examined articles that appeared between 1984 and 1999 in the daily column "Abreast of the Market," which appears in a fixed size in the Wall Street Journal. The research question was whether media tone affects the return on stocks when tone is measured by a textual analysis of negative and positive words. He found that continued declines in the stock market lead to an increase in media pessimism. Similar findings regarding the media's response to the behavior of stocks were obtained by Loughran and McDonald (2011), Garcia (2013), and Das

and Chen (2007). It was found that price increases (declines) yesterday lead to positive (negative) tone today. It is worth noting that the behavior of tone according to these studies therefore reflects adaptive (ex-post), rather than rational (ex-ante), investment characteristics. Antweiler and Frank (2004) characterized sentences where the recommendations "buy," "sell," and "hold" appear in Internet chats that deal with the stock market. Even though they found a statistically significant correlation between buy and sell recommendations and positive and negative returns, respectively, they also found that the level of chat activity is correlated with trading volume and volatility. Coval and Shumway (2001) reported similar findings.

Other studies have tried to isolate the media effect on stock performances from variables that do not reflect media coverage. Peress (2014) examined the media effect on various variables in the stock market by comparing their behavior on days when there was a strike in the media and on regular days. He examined significant newspaper strikes that took place between 1989 and 2010, and found 52 such strikes. According to his findings, trading volume on strike days was 12 percent lower than on regular days, with a stronger effect on the trading volume of stocks with a lower market value (a decline of 18 percent in volume in the lower three quintiles). The explanation for this was that there are investors whose sole channel of information is the newspapers, and when that medium disappears, they have no source of information on which to rely in making investment decisions. However, the study did not find an effect on stock prices. In other words, there was no difference in the price change between the closing price at the end of the day prior to the strike and the closing price on the day of the strike and those prices under normal conditions. However, the intraday volatility was lower on strike days than on regular days. Specifically, the average price range, the ratio between intraday high and low prices, and the broad standard deviation in the market were 7 percent lower on strike days.

The studies examining the media effect on the stock market have shown that there is an asymmetrical effect. Kearney and Liu (2014), for instance, argued that textual tone has an effect, but text that is perceived as negative to the stock market (such as "sell") is found to have a stronger effect than positive text (such as "buy"). Kothari et al. (2009) also found such asymmetry regarding the volatility of stock returns, where negative text preceded an increase in the volatility of returns. Boudoukh et al. (2013) indicated the importance of a precise identification of the tone found in a textual analysis of newspapers. They found that the overall explanatory level (Adj. $R^2$) of market models (CAPM and four-factor model) increased twofold after a model with precise textual analysis ability was applied.

Generally, people pay more attention to negative news than to positive news (Muddiman and Stroud, 2017). The media's tendency to emphasize negative events has been shown in a number of studies in various fields, including in economics literature. For instance, Soroka (2006) found a statistically significant greater tendency to cover negative changes in economic indicators and negative events compared with positive changes and events in the UK. He also found that negative coverage influenced expectations more than positive coverage did. There was also found to be over-reporting of negative events regarding unemployment data in Germany. According to Garz (2014), such a tendency is not due to a lack of understanding of the data on the part of the journalists, but due to structural effects in the process of producing the news. He enumerates three main reasons for this tendency. The first is a cognitive limitation on the part of the correspondents, who, similar to news consumers, tend to emphasize negative events over positive ones. The second reasonable assessment of newspaper editors, publishers, and owners is that negative news "sells" newspapers more than positive news does. The third reason is the role of the press as a watchdog in democratic countries.

Larsen and Thoursund (2017) recently tried to quantify the effect of the newspapers in Norway on daily stock prices there, between 1996 and 2014. They argued that the effect of a standard press report may influence a stock's return (cumulative, measured as the closing price compared to the opening price) by about 4 percent after 15 trading days. Moreover, between 20 and 40 percent of the ability to forecast a stock's return can be attributed to the direct media effect (adjusted for other variables).

The literature dealing with the anomaly between intraday returns and overnight returns does not examine the media effect on these returns. The findings obtained for various assets (stocks, ETFs, futures contracts, commodities) on several markets during different trading periods show that intraday returns are characterized by lower mean returns and higher volatilities than overnight returns (see Tompkins and Wiener (2007); Riedel and Wagner (2015); Lou et al. (2015); Liu and Tse (2017); and Basdekidou (2017)). This anomaly poses a challenge to popular asset pricing models (such as the four-factor model) and performance indices (such as the Sharpe ratio), in which a higher expected return is required as compensation for greater exposure to risk. There are those who attempt to explain the anomaly through the higher crash risk or downside risk in overnight returns than in intraday returns (Lou et al., 2015; Riedel and Wagner, 2015). According to these explanations, which rely on procedures for examining extreme price volatility (Extreme Value Theory (EVT) or Value at Risk (VaR)), the crash risk is greater in overnight returns, and hence the positive overnight returns are compensation for this risk. However, Liu

and Tse (2017) examined a wide variety of ETFs and futures contracts traded on American exchanges, and found that in addition to the positive returns and low volatility of overnight returns, the crash risk is also lower than intraday returns. This finding necessitates a new explanation to the old anomaly. One possible explanation of the anomaly, which concerns institutional activity was provided by Lou et al. (2015), who argued that institutional and professional investors usually act during the trading day, and mainly toward the end of trading when liquidity is high, while retail investors assess their investment portfolio after business hours and therefore tend to act when trading begins the following day. They also found that financial institutions act contrary to the trend, while retail investors act in accordance with the trend (particularly when there are sharp price fluctuations, where they act as a "herd"). While Lou et al. (2015) did not analyze the reasons for these differences in behavior, their finding that retail investors (who are influenced by the press) affect the opening price of the stock indices may connect the media effect and the overnight return anomaly, as we do in this study.

## 3. The Methodology

In an efficient stock market (semi-strong efficiency), stock prices take into account all of the relevant information, including media coverage. Coverage of the stock market is comprised of two main factors: reporting on actual developments; and analysis, commentary, and assessments. However, the way in which the media presents the information and analyses is not uniform, nor does it objectively reflect what is happening in the stock market. There may be many reasons for the lack of congruence between an economic event and the media coverage it receives, such as other events on the public agenda (which may take up newspaper space at the expense of coverage of what is happening in the stock market), editorial decisions (which may be dependent, for instance, on the newspaper's editorial line or on the availability of other interesting topics[2]), the public atmosphere, and so forth. The newspapers almost never provide *new information* that should affect the stock market in real time, at least in Israel where they are printed at night (general newspapers: Yedioth Ahronoth, Ma'ariv, Israel Hayom) or in the evening (business newspapers: Globes, TheMarker, Calcalist).[3]

[2] The pages in the newspaper are generally fixed according to the day of the week, such that a "lack" of interesting topics makes it possible to expand on other topics.

[3] The other newspapers are not significant in Israel, but in cases where an article with significant economic value was published in another newspaper, it was included in the sample. There is a difference in stock market coverage between the "professional" business media and the (non-business) general media. While the business media tends to maintain a fixed framework, with changes in the composition and location of coverage in the newspaper according to the aforementioned factors (which may change the economic value of the coverage), the general media is more

In contrast with the newspapers, the Internet media is currently the main channel conveying new information to the public, and an analysis of its effect may be more complex. In order to examine the media as a news tool that influences the stock market, the Internet media and social networks must be analyzed, with a different methodology. Such an analysis is beyond the scope of this study, but appearances in the print media also represent appearances in the electronic media[4], so that the use of print media data is similar in essence to the use of electronic media, albeit at a lag.

The print media is expected to influence mostly naïve ("unprofessional") investors in two ways: (a) creating pessimism, optimism, fear, euphoria, and so forth, and (b) making information on the stock market accessible to those who have not been exposed to it through other media outlets (Peress, 2014). It is precisely due to the relative paucity of print media sources and the relatively wide circulation of these sources that the "professional" investors may be influenced by the print media mainly in the extreme cases of negative tone that it creates, through their understanding that such tone may later influence the stock market through ill-considered activities by the naïve investors (Ranyard et al., 2008). For instance, a wide-ranging article in a widely distributed newspaper may create a reverberation that may influence media and public discourse and lead to a "herd mentality" of selling on the part of naïve investors, which may in turn lead to follow-up articles and, in some cases, to actions on the part of the government and the regulators entrusted with the supervision of the stock market.

We use monetary equivalents to represent media tone rather than the number of positive or negative articles, as is customary in the literature. Let us assume, using an illustration model of the cost of publication as an index of exposure, that newspaper $i \in \{1,\ldots,6\}$ (TheMarker, Calcalist, Globes, Yedioth Ahronoth, Israel Hayom, and Ma'ariv) offers publication area of type $j \in \{1,\ldots,3\}$ (front page, internal page, back page) at a price per area unit of $P_{ij}$. For example, a 200-word article published on the front page is more significant than an article twice that size on an internal page; an internal article with a reference to it on the front page is more important than an article that is larger in size but does not have a reference to it on the front page. The circulation of the newspaper as a share of total print circulation is also taken into account. These considerations, and many others, are used when calculating the equivalent economic value

affected by those factors when it comes to covering what happens in the stock market, and may frequently not publish such coverage at all, or publish it in significantly different locations and sizes from one day to the next. The difference between the business media and the general media in the effect of sentiment on the stock indices is examined in Section 5 on robustness checks.

[4] This assessment is supported by analyses conducted by "Ifat Media Research."

(shadow price) of each article. The publication price list is set, as stated, according to the newspaper's popularity, $i$, and according to the article's location, $j$, within the newspaper. In order to simplify the model, let us assume that in the short term, advertisers refer to a newspaper's price list as an exogenous variable from their standpoint. In other words, they are "price takers" with a given budget available to them. The problem for the advertisers is to maximize the product's exposure, subject to budgetary limitations, as follows:

(1)

$$\max_{Space_{ij}} Exposure \equiv \sum_{ij} Space_{ij} \cdot Impact_{ij}$$

$$\text{s.t. } \sum_{ij} Space_{ij} \cdot P_{ij} \leq Budget$$

where, $Exposure$ is the exposure of the product that the advertiser wants to maximize, $Space_{ij}$ is the advertiser's decision variable on which newspaper to advertise in $(i)$, where the advertisement will be placed within the newspaper $(j)$, and what the size of the advertisement will be (in square inches). The illustration model assumes that the advertised product's exposure is a linear multiplication of advertising space ($Space$) and influence ($Impact$). The Lagrangian ($L$) of (1) is:

$$L = \sum_{ij} Space_{ij} \cdot Impact_{ij} - \lambda(\sum_{ij} Space_{ij} \cdot P_{ij} - Budget)$$

Taking the derivative of $L$ with regard to both the $Space_{ij}$ decision variable and $\lambda$ and comparing it to zero, yield:

(2) $$\sum_{ij} Space_{ij} \cdot P_{ij} = Budget <= Impact_{ij} = \lambda P_{ij}$$

Equation (2) shows that in order to maximize exposure, the advertiser must use his entire budget at the relative price per area unit ($P_{ij}$), which in turn reflects the advertising impact ($Impact_{ij}$).

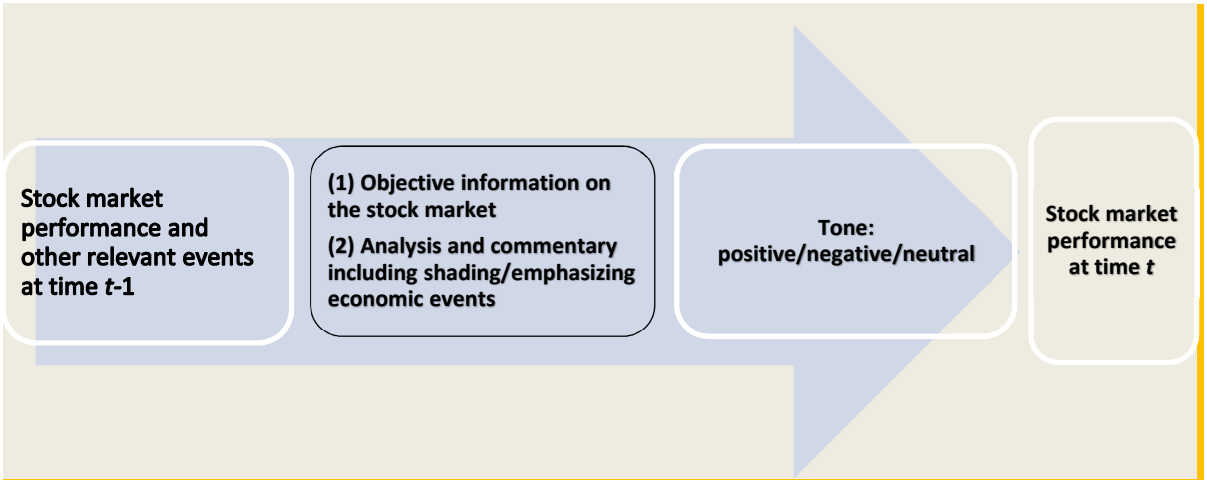
We use tone calculations from the "Ifat Media Research" company, which analyzed for us *all* stock market press coverage in *all* major newspapers in Israel[5] between January 2011 and September 2017 (a total of 1,650 daily observations), while measuring the equivalent monetary value of each article. The monetary value is, as stated, set according to the cost of advertising in the article's location, with this cost used as an indicator of the volume of readers' exposure to the article. Each print media article that related to the stock market was analyzed according to its tone in relation to the stock market (positive, negative, or neutral), its equivalent monetary value,

[5] We generally ignore local and sectoral newspapers and those that are not published on a daily basis. In the vast majority of cases, the value of coverage in those papers is near-zero (see FN 3). However, we included magazine articles in cases where the economic value and relevance justified it.

and the extent of its relevance to the stock indices, at values ranging from 5 percent to 100 percent (100 percent being the maximum relevance). The sample contained only articles with more than 50 percent of their area devoted to the stock market in general (and to specific stocks), such that the reasonable reader encountering these articles would "absorb" the tone from them on only a superficial reading. In total, about 19,200 articles were analyzed, among which 6,456 dealt with the stock market ("stock exchange performance") and answered all the criteria we set in this study (2,749 were defined as having positive tone, 2,393 as having negative tone, and 1,314 as being neutral). The team that analyzed the articles and evaluated their tone represented "the average person." Therefore, the people chosen to make the classification were generally high school graduates or university students in communications tracks, who are not economists, and whose understanding of the stock market is obtained from reading newspapers. (We implement an alternative categorization method—Google Trends—in the robustness checks section.)

In order to evaluate the tone as reflected by the newspapers (hereinafter 'env'), we calculate the difference in shekels between the monetary value of total positive media and total negative media each day. It is worth noting that there were almost no cases in which both negative and positive coverage was found in the same newspaper on the same day. In contrast, there were cases where negative and neutral coverage or positive and neutral coverage were found in the same newspaper on the same day, and opposite coverage was found among different newspapers, but opposite coverage with a high monetary value was rare during the sample period. These facts make it easy to use the difference as a variable representing tone. Coverage in the morning of day $t$ generally relates to events that took place in the stock market on $t$-1, and is therefore influenced by past developments. The volume of coverage and the tone presented by the media (both business and general) are in line with past market events. It is therefore the case that tone on day $t$ is influenced by the stock indices on day $t$-1, and it may influence the indices on day $t$ through investor behavior. In other words, the media's effect on the stock market includes an auto-regressive component of the stock market itself, as Figure 1 shows.

**Figure 1: The relations of the tone and stock market indices**




In Figure 1, we separate the economic value of objective information coverage that is dependent on events that took place in the stock market on day $t$-1 from the economic value of actual coverage, including analyses, commentary, and the relative prominence given to events. In other words, there may be days with identical changes in the stock market but with differing scopes of coverage. Only this gap—and *not* the overall value of coverage, which is currently the common measurement in the relevant literature—will be entered into the estimation equations of stock market returns at $t$+1. There are two main reasons for this:

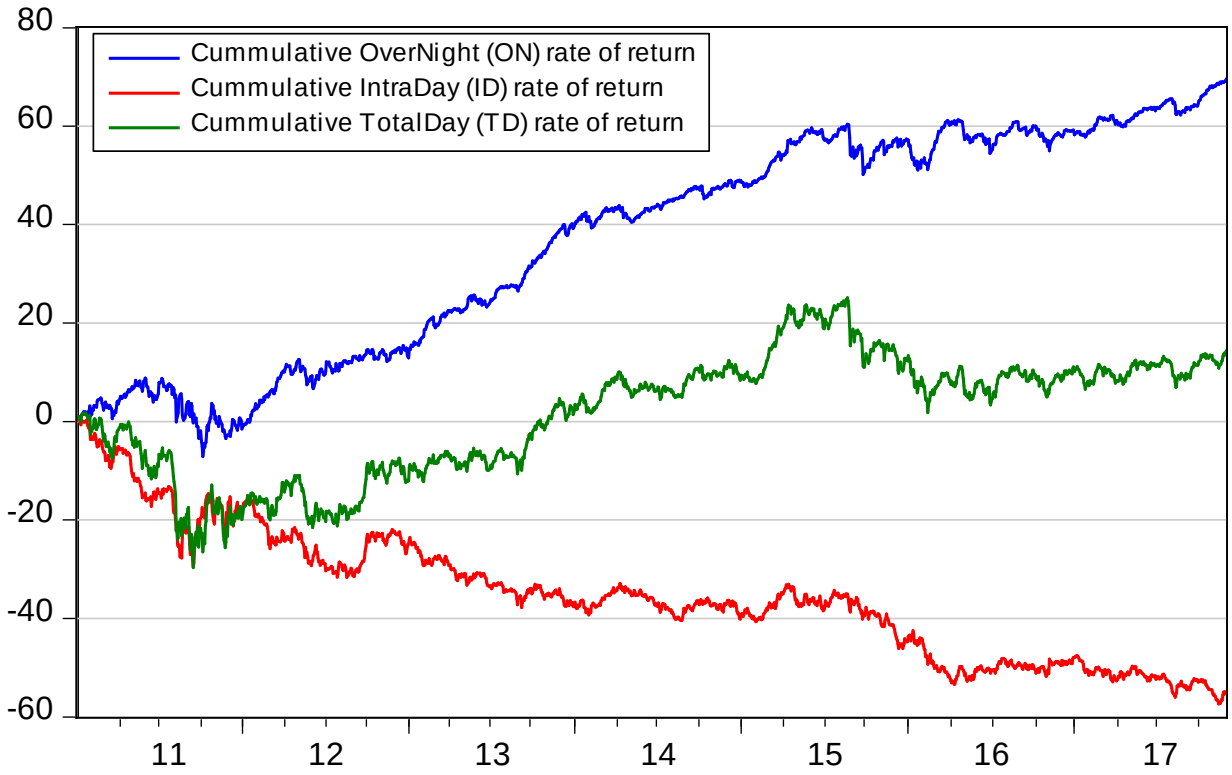
a. We are interested in adjusting the scope of media coverage today for the effect of changes in the stock indices in earlier days, so that the explanatory variable is not correlated with the dependent variable through an auto-regressive process between the daily changes in the stock indices.
b. We are interested in identifying the net print media effect, while neutralizing intermediary variables as much as possible. It is reasonable to assume that the public is not surprised when the scope of coverage changes in accordance with changes in the stock indices. This is the result of other up to date communication channels such as online financial TV or radio stations, or social media networks. Moreover, some of the news was received by the markets during yesterday's trading hours, and is thus already embedded in yesterday's closing prices. To control for these effects we isolate media tone from the effects of relevant economic variables including the objective plain news and are left with the net media tone (tone residual) assuming that outlier coverage would be a surprise, and could influence tone in relation to the stock market, particularly on the part of naïve investors.

In order to examine the effect of the tone residual on the various returns, we break the daily rate of return of the stock index (by closing prices, as is customary - $TD_t$) on day $t$ into two separate returns:

$$(3) \qquad TD_t = log\left(\frac{PC_t}{PC_{t-1}}\right) = \log\left(\frac{PC_t}{PO_t} \cdot \frac{PO_t}{PC_{t-1}}\right) = \log\left(\frac{PC_t}{PO_t}\right) + \log\left(\frac{PO_t}{PC_{t-1}}\right) = ID_t + ON_t$$

where, $ID_t$ is the intraday rate of return from the closing price ($PC_t$) to the opening price on day $t$ ($PO_t$), and $ON_t$ is the rate of return from the opening price on day $t$ to the closing price on day $t$-1 ($PC_{t-1}$). According to the literature, the "overnight returns anomaly" is characterized by negative ID returns compared to positive ON returns. This anomaly can be exploited to obtain significant profits (see, for instance, Basedkidou, 2017), as shown in Figure 2.[6]

**Figure 2: Cumulative return (arithmetic, %) on ON, ID, and TD**




This figure presents the arithmetic cumulative rate of return (in percent) of overnight (ON), intraday (ID), and total day (TD) investment strategies. For a definition of these strategies see equation (3).

[6] Calculating a trading strategy is beyond the scope of this paper. However, the following can be a simple 24-hour strategy: Buy the index (namely an ETF that tracks the TA-125) at the closing price and sell it at the opening price tomorrow (ON). Then, sell short at the opening price and close the position at the closing price tomorrow (ID). We calculated this strategy using the Kesem TA-125 tracking ETF from 1/1/2004 to 31/12/2017 and gained a gross annual rate of return of 24.8% (17% on ON and 7.8% on ID). As the ETF charges a commission of 0.115% on each buy and sell and the typical Bid-Ask spread is 15 points (0.15% for the average ETF index of 10,000 over the sample period) we could gain on average a net annual rate of return of 22.2% on that trading strategy.

Given the anomaly in overnight returns globally and in Tel Aviv (Figure 2), we estimated the print media effect separately on each of the three rates of return at time $t$: overnight ($ON_t$), intraday ($ID_t$), and common daily ($TD_t$). Our hypothesis is that the tone residual mainly affects the overnight returns (through the opening prices), due to the characteristics of naïve investors (see, for instance, Berkman et al. (2012) and Lou et al. (2015)), who are substantially influenced by the media coverage. In practice, we run the estimation equations in two stages. In the first stage, we estimate the tone effect in time t (isolated from the effect of other variables that influenced the stock indices before time t) through the following regression:

(4) $$env_t = \alpha_0 + \sum_{j=1}^{n}(\alpha_j ON_{t-j} + \beta_j ID_{t-j} + \delta_{jk} Other_{t-j} + \theta_j env_{t-j}) + \varepsilon_t$$

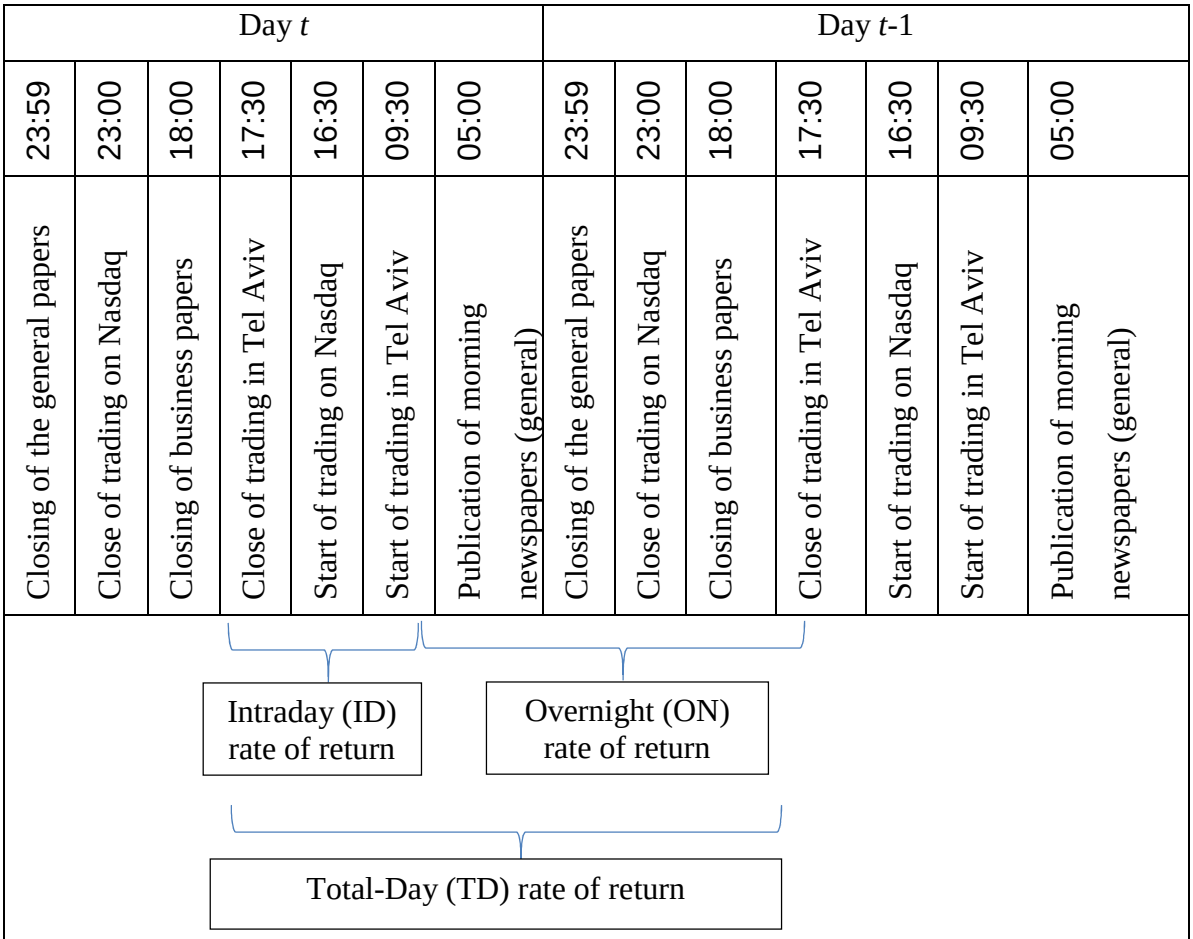
where $env_t$ is the tone (the equivalent monetary value of positive articles minus the respective negative articles) in time $t$ as calculated based on the business and general newspapers, and is supposed to mainly affect the opening prices ($ON_{t-j}$); $ID_{t-j}$ are the overnight and intraday returns in the past $n$ days, respectively; $env_{t-j}$ is the dependent variable with n lags; and $Other_{t-j}$ is a vector of other relevant variables included in order to "isolate" the tone as much as possible from variables that do not reflect only media coverage. In particular, we include the following in the vector of these variables:

a. The average return on the Nasdaq composite index in the hours following trading in Tel Aviv (which reflects global developments; see Figure 3);
b. The return on Israeli stocks traded in New York in the hours following trading in Tel Aviv (the median of all dual-listed shares; see Figure 3);
c. The return on the shekel/dollar exchange rate in the hours following trading in Tel Aviv (which reflects last economic developments that are not reflected in the stock market);
d. Dummy variables for days on which there were prominent geopolitical events (which reflect newspaper editors' interest in other matters, leading to a potential negative impact on economic coverage of the print media); and
e. The Israeli volatility index (Israeli VIX based on the TA-35 index).

We chose the number of lags $n$=3 because there was no statistically significant effect beyond that. For the tone residual (hereinafter *env_res*), we use the residual of the regression ($\varepsilon_t$), which is orthogonal to all of the explanatory variables in Equation (4). Therefore, positive (negative) values reflect a positive (negative) tone residual. In contrast with the tone itself (*env*), including as many explanatory variables as possible, even if they are not all statistically significant, in Equation (4) refines and reduces the definition of tone residual (env_res) to the minimum possible. For instance, adding three lags of the dependent variable reduces the effect of the tone

residual to today only, because the residual (env_res) is orthogonal to those lags. Particularly, we control for news received by the markets during trading hours of previous days and that are incorporated in prices. Figure 3 shows the timetable for publication of the business and general newspapers and the three types of return.

**Figure 3: Timing of newspaper publication and returns on the Tel Aviv and Nasdaq indices (including dual-listed shares, local time)**




1. The timetable may differ among newspapers and over time (for instance standard/daylight savings time). The main business newspapers are TheMarker, Globes, and Calcalist. The main general newspapers are Yedioth Ahronoth, Israel Hayom, and Ma'ariv.

2. Regarding the timetable of the business newspapers, TheMarker and Calcalist close around 19:00, while Globes, which is published that evening, closes at 16:00. Articles submitted after closing time are not published.

3. Information is gathered around the clock by reporters and photographers, but whether it is published depends on its importance and the time it arrives at the newspaper. As the time of arrival gets later, only important information is published, at the editors' discretion. The business newspapers are more flexible about accepting articles around the time of closure. Particularly important economic information can be inserted on the news pages until they are closed.

## 4. Data and estimation results

We divide the data used in the study into two types. The first includes the classification by "Ifat Media Research" of newspaper articles into positive, neutral, and negative tone/sentiment. This proprietary information includes the equivalent value of the article by newspaper and day. The second type includes public data on prices (opening, closing, daily high, daily low) and trading volumes of the stock indices in Tel Aviv. Table 1 presents basic statistics of the main variables.

**Table 1: Basic statistics of the main variables**

| (a) All Sample | env | ON | ID | TD | NAS |
|---|---|---|---|---|---|
| Mean | 0.0014 | 0.0085 | -0.0325 | 0.0412 | 0.0830 |
| Median | 0.0000 | 0.0425 | -0.0291 | 0.0686 | 0.0468 |
| Maximum | 0.3322 | 4.1766 | 4.0813 | 3.2117 | 9.6414 |
| Minimum | -1.2339 | -7.1986 | -3.5804 | -5.4557 | -13.5913 |
| Std. Dev. | 0.0781 | 0.8651 | 0.6468 | 0.5731 | 1.5278 |
| Skewness | -5.4856 | -0.7143 | 0.2108 | -1.2394 | -0.1376 |
| Kurtosis | 79.5239 | 8.9103 | 7.8430 | 14.4902 | 11.6147 |
| Observations | 1692 | 1692 | 1692 | 1692 | 1692 |
| | | | | | |
| (b) Year = 2011 | env | ON | ID | TD | NAS |
| Mean | -0.0174 | -0.0820 | -0.0749 | -0.0062 | 0.0478 |
| Median | -0.0042 | -0.0437 | -0.0658 | 0.0387 | 0.0714 |
| Maximum | 0.2575 | 4.1766 | 4.0813 | 3.2117 | 9.6414 |
| Minimum | -1.2339 | -7.1986 | -3.5804 | -5.4557 | -10.4871 |
| Std. Dev. | 0.1134 | 1.4793 | 1.1076 | 0.9713 | 2.5581 |
| Skewness | -5.5958 | -0.4910 | 0.3257 | -0.6758 | 0.2778 |
| Kurtosis | 57.6689 | 5.2881 | 4.9112 | 8.0550 | 5.4240 |
| Observations | 244 | 243 | 244 | 243 | 243 |
| | | | | | |
| (c) Year = 2013 | env | ON | ID | TD | NAS |
| Mean | 0.0138 | 0.0598 | -0.0502 | 0.1099 | 0.2031 |
| Median | 0.0116 | 0.0839 | -0.0297 | 0.1121 | 0.1660 |
| Maximum | 0.2708 | 2.6004 | 1.3296 | 1.7625 | 5.8070 |
| Minimum | -0.2917 | -2.0202 | -1.7144 | -1.7202 | -13.5913 |
| Std. Dev. | 0.0746 | 0.6441 | 0.4898 | 0.3886 | 1.5412 |
| Skewness | -0.0519 | -0.0890 | -0.2165 | -0.2786 | -2.7295 |
| Kurtosis | 4.5966 | 3.9258 | 3.3918 | 7.2867 | 28.7249 |
| Observations | 244 | 244 | 244 | 244 | 244 |

'env' is the equivalent value of positive-negative newspaper articles compared with ads (in millions of shekels). ON, ID, and TD are daily rate of return (in percent) of today's opening relative to yesterday's closing, intraday, and today's closing relative to yesterday's closing, respectively, of the Tel Aviv 125 stock index. NAS is the daily Nasdaq's rate of return.

All of the data are daily, from Jan 1, 2011 to Nov 30, 2017 (a total of 1692 observations). The upper panel (a) of the table includes all of the sample data; the middle panel (b) focuses on the year 2011, in which there were negative returns; and the lower panel (c) presents data from 2013, which was a positive year. The table shows that the average tone (env) is positive and small

throughout the period, but that it changes in accordance with returns on the stock indices. Thus, in a relatively negative year in the local stock market, like 2011, tone values became negative, while in a positive year, like 2013, they became more positive.

The table also shows that the overnight return phenomenon on the Tel Aviv 125 index is similar to what was found in other stock markets: the average return on intraday (ID) trading is significantly lower than the overnight (ON) return, whether for the entire sample or for either negative years (2011) or positive years (2013). Moreover, the distribution around the tone mean is neither symmetric nor normal. Accordingly, the skewness index is negative throughout the sample, and very negative in 2011, while the kurtosis is large as a result of extreme observations (mostly negative), on which we want to focus since they apparently influence naïve investors (see Ranyard et al., 2008; Lou et al., 2015).

### 4.1 The asymmetrical effect of trading on media coverage

The first hint of the asymmetrical effect of trading yesterday on media coverage today (env) can be found in the following regression model (OLS):

(5) $$env_t = \alpha + \beta_1 ROR_{t-1} + \beta_2 ROR_{t-1} D^+_{t-1} + \sum_{i=1}^{3} \delta_i env_{t-i} + \epsilon_t$$

where, $ROR_{t-1}$ is the ON/ID/TD return of the Tel Aviv 125 index on day *t-1*, and $D^+_{t-1}$ is a dummy variable that takes the value of 1 if the returns on the Tel Aviv 125 index are positive and 0 otherwise. According to the model, inspired by numerous studies that point to the asymmetric influence of past returns on investors (see for example Soroka, 2006), $\beta_1$ reflects the effect of negative returns of the Tel Aviv 100 index on day *t*-1 on the tone the following day, while the sum of the coefficients $\beta_2 + \beta_1$ reflects the effect of positive returns on the same tone.
It is worth noting that Tversky and Kahneman (1992) found a median risk aversion coefficient (negative to positive ratio – hereinafter NPR = $\beta_1/(\beta_2 + \beta_1)$) of 2.25 which means that the loss value is 2.25 times the profit value.

In order to assess the asymmetric impact of stock returns on the tone derived from newspaper articles, we run Equation 5 with the three different returns (ON/ID/TD) as well as newspaper types (all/general/business). We assess that the NPR impact will be larger for general newspapers than business ones (due to the former typical readers i.e., naïve investors) and for ON returns compared to other returns (ID/TD). The results of the regressions (OLS with a correction for heteroskedasticity and a serial correlation (HAC)) are presented in Table 2.

**Table 2: Asymmetrical impact of stock index returns on the tone variable**

| (A) Dep. Variable: Tone from All newspapers (env) | | ON | ID | TD |
|---|---|---|---|---|
| C | | 0.009** | 0.011*** | 0.012*** |
| ON/ID/TD(-1) | ($\beta$1) | 0.087*** | 0.070*** | 0.073*** |
| ON/ID/TD(-1)*DUM_POS(-1) | ($\beta$2) | -0.058** | -0.038*** | -0.039** |
| ALL(-1) | | 0.106 | 0.185 | 0.139* |
| ALL(-2) | | 0.020 | 0.016 | 0.011 |
| ALL(-3) | | 0.055* | 0.062*** | 0.052* |
| Adj. R-Square | | 0.27 | 0.23 | 0.44 |
| D.W. | | 1.92 | 2.07 | 2.00 |
| | | | | |
| Negative to Positive ratio (NPR) | | 2.96 | 2.15 | 2.13 |
| Wald test: NPR = 1: | | | | |
| t-stat Value | | -2.319 | -3.125 | -2.501 |
| t-stat Prob. | | 0.021 | 0.002 | 0.012 |
| Wald test: NPR = 2.25: | | | | |
| t-stat Value | | -1.563 | -1.526 | -1.244 |
| t-stat Prob. | | 0.118 | 0.127 | 0.214 |
| (B) Dep. Variable: Tone from Business newspapers (env) | | ON | ID | TD |
| C | | 0.006*** | 0.009*** | 0.007*** |
| ON/ID/TD(-1) | ($\beta$1) | 0.051*** | 0.049*** | 0.046*** |
| ON/ID/TD(-1)*DUM_POS(-1) | ($\beta$2) | -0.027** | -0.022*** | -0.017** |
| Business(-1) | | 0.117** | 0.169** | 0.137*** |
| Business(-2) | | 0.023 | 0.035 | 0.028 |
| Business(-3) | | 0.043 | 0.046** | 0.039 |
| Adj. R-Square | | 0.21 | 0.24 | 0.41 |
| D.W. | | 1.94 | 2.07 | 2.01 |
| | | | | |
| Negative to Positive ratio (NPR) | | 2.07 | 1.81 | 1.57 |
| Wald test: NPR = 1: | | | | |
| t-stat Value | | -2.349 | -3.209 | -2.568 |
| t-stat Prob. | | 0.019 | 0.001 | 0.010 |
| Wald test: NPR = 2.25: | | | | |
| t-stat Value | | -1.105 | -0.994 | -0.278 |
| t-stat Prob. | | 0.269 | 0.321 | 0.781 |
| (C) Dep. Variable: Tone from General newspapers (env) | | ON | ID | TD |
| C | | 0.004 | 0.003** | 0.006* |
| ON/ID/TD(-1) | ($\beta$1) | 0.037*** | 0.022*** | 0.028*** |
| ON/ID/TD(-1)*DUM_POS(-1) | ($\beta$2) | -0.033** | -0.017** | -0.024** |
| General(-1) | | 0.019 | 0.093 | 0.050 |
| General(-2) | | 0.038 | 0.013 | 0.007 |
| General(-3) | | 0.057 | 0.065*** | 0.058* |
| Adj. R-Square | | 0.21 | 0.09 | 0.26 |
| D.W. | | 1.97 | 2.06 | 2.04 |
| | | | | |
| Negative to Positive ratio (NPR) | | 10.27 | 4.70 | 7.06 |
| Wald test: NPR = 1: | | | | |
| t-stat Value | | -1.967 | -2.493 | -2.054 |
| t-stat Prob. | | 0.049 | 0.013 | 0.040 |
| Wald test: NPR = 2.25: | | | | |
| t-stat Value | | -1.670 | -1.938 | -1.664 |
| t-stat Prob. | | 0.095 | 0.053 | 0.096 |

The table depicts the asymmetric impact of the three returns (ON/ID/DT) on the tone variable (env) for three newspaper types (All/Business/General). DUM_POS gets the value 1 if the return (ON/ID/DT) is positive and 0 otherwise. Negative to positive ratio (NPR) is defined as $\beta_1/(\beta_1+\beta_2)$. We test whether NPR=1, i.e., there is no asymmetry or NPR=2.25, i.e., loss value is approximately twice the profit value (as in Tversky and Kahneman (1992)).

***, **, * are 0.01, 0.05, 0.1 significance levels, respectively.

As the table shows, the NPRs for ON returns are larger than both ID and TD returns and return types of 'general' are larger than the respective return of both 'business' and 'all' newspapers. For

example, the NPR for ON returns of general newspapers is 10.27 compared with TD return of 7.06 and ON returns of 2.07 and 2.96 for 'business' and 'all' newspapers, respectively. This means that ON returns reflect mostly the asymmetric coverage of the newspapers.

We test for the asymmetric reaction of the newspapers today to earlier stock market returns by implementing the Wald test with the null NPR=1, i.e., the newspapers' reactions (env) are symmetrical. It is quite clear from the figures that in all cases one can reject the null, i.e., the tone variable is asymmetric. The next test is for the null that our findings equal that of Tversky and Kahneman (1992), namely, the risk aversion coefficient (similar to the NPR in this study) equals 2.25. Interestingly, the comparable figure in the table to the Tversky and Kahneman one is for the TD return of 'all' newspapers (0.073/(0.073-0.039) = 2.13). We test the significance of this figure implementing the Wald test in which the null is NPR=2.25 as in Tversky and Kahneman. The results show that the null is rejected (at the 0.1 significance level) only for general newspapers and for all return types. This striking evidence differentiates between general and business newspapers and, to the best of our knowledge, we are the first to show such a phenomenon. Moreover, the gaps between the three newspapers' NPR teaches us that general newspapers' reaction to bad stock market returns is 3-to-5 times larger than the respective reaction of business newspapers.

The asymmetric reaction can be the result of two main non-exclusive potential reasons: (1) General newspapers' coverage of the news is more (negative) biased than the business newspapers; and (2) General newspapers cover mostly dramatic (negative) financial news while keeping silent in normal times. To discover which of the two explanations applies in our sample period, we ran the same regressions as in Table 2 except for the tone variable (*env*), in which we excluded the distribution tails (1% from each side). The results (not presented due space considerations) support the second explanation, as the calculated NPRs of the two newspapers are quite similar. For instance, for ON returns NPR(general)=1.44 and NPR(business)=1.09 compared to 10.27 and 2.07, respectively in Table 2. Moreover, the null that for general newspapers and for all return types NPR = 2.25 can no longer be rejected by the Wald test. The evidence conforms to our conjecture that general newspapers are consumed by "naïve" retail investors on the one hand, and asymmetrically react to stock market returns, mainly due to sharp price declines, on the other.

### 4.2 The effect of the media on the stock indices

We now examine the opposite direction: the effect of the tone residual (*env_res*) today on stock indices tomorrow. We first look at the level of correlation between the main variables in the study, and the potential causality between them. Such causality can hint at the non-contemporaneous tone residual's effect on the stock indices. Table 3 shows such tests.

**Table 3: Correlation coefficients and statistical causality between the main variables**

**(a) Bilateral Correlation Coefficients**

| Correlation<br>Probability | env_res | ON | ID | TD |
|---|---|---|---|---|
| **env_res** | 1.00<br>----- | | | |
| **ON** | 0.081358<br>0.0009 | 1.00<br>----- | | |
| **ID** | -0.040346<br>0.1013 | 0.004304<br>0.8613 | 1.00<br>----- | |
| **TD** | 0.022908<br>0.3523 | 0.666247<br>0.0000 | 0.748556<br>0.0000 | 1.00<br>----- |

**(b) Pairwise Granger Causality Tests**

Lags = 3 days — **H0 (lower triangle): column does not Granger cause line**

| | | env_res | ON | ID | TD |
|---|---|---|---|---|---|
| **H0 (upper triangle):** | **env_res** | --- | 0.0000 | 0.0000 | 0.0000 |
| **line does** | **ON** | 0.0012 | --- | 0.0000 | 0.0000 |
| **not Granger** | **ID** | 0.7746 | 0.0243 | --- | 0.0236 |
| **cause column** | **TD** | 0.2011 | 0.0000 | 0.0000 | --- |

Panel (a) presents the correlation coefficients of the main variables. The upper figure is the coefficient, while the lower figure represents the probability that the coefficient equals zero. Panel (b) shows P-values of the Granger causality tests between pairs of variables. The null of the upper triangle is that the variable in a line does not Granger cause the variables in a column, while the null of the lower triangle is that the variables in a column does not Granger cause the variables in a line. For figures below 0.05, the null that the first series does not Granger cause the second series is rejected, e.g., the null that ID does not Granger cause *env_res* is rejected (0.0000), while the opposite is not (0.7746).

Panel (a) shows a positive and significant correlation coefficient between the daily return (TD) and both the overnight (ON) and intraday (ID) returns. In contrast, the correlation coefficient between ON and ID is small and insignificant. The lack of correlation between ON and ID returns (0.0043) is clear, despite the fact that the opening price influences the two variables in opposite directions. For instance, a decline in the opening price increases ID returns but decreases ON returns (all other things being equal). However, it is worth noting that when

examining the correlation between ON and ID returns for daily returns higher than 0.1% or lower than -0.1%, a statistically significant negative correlation is found, as expected (see Berkman et al. (2012); Branch and Ma, (2015)). The correlation coefficient between the tone residual (*env_res*) and ON is low but significant compared to ID and TD. This result is in line with the evidence that ON is mostly influenced by the newspapers even after controlling for market and other macroeconomic variables (the tone residual - *env_res* in this study).

Panel (b) shows that *env_res* Granger causes (precedes) all return types. The causation in the opposite direction is not statistically significant, which was expected for all cases except for ON. Given the results of Table 2, and the fact that the daily rate of return of the stock indices is characterized by fat tails and conditional variance, we run EGARCH (1,1,1)[7] regressions with the three types of return as the dependent variable and with the tone residual (env_res) as the main explanatory variable, together with three lags of the dependent variable (ON/ID/TD). Table 4 shows the regression results.

**Table 4: EGARCH(1,1,1) regressions results: Returns of the Tel Aviv 125 index (TA-125) and the tone residual**

| **Dependent Variable:** | **ON** | **ID** | **TD** |
|---|---|---|---|
| **Mean Equation** | | | |
| C | 0.024 | -0.037*** | 0.062*** |
| env_res | 1.11*** | 0.026 | 0.791*** |
| ON/ID/TD(-1) | -0.014 | 0.007 | -0.050** |
| ON/ID/TD(-2) | -0.054** | -0.044* | -0.003 |
| ON/ID/TD(-3) | 0.003 | -0.010 | -0.034 |
| **Variance Equation** | | | |
| C | -0.125*** | -0.132*** | -0.152*** |
| \|RESID(-1)/GARCH(-1)^.5\| | 0.141*** | 0.140*** | 0.149*** |
| RESID(-1)/GARCH(-1)^.5 | -0.057*** | -0.070*** | -0.029** |
| Log(GARCH(-1)) | 0.974*** | 0.979*** | 0.973*** |
| env_res | -0.484** | -0.354* | -0.787*** |
| Adj. R^2 | 0.00 | 0.00 | 0.01 |
| DW | 2.06 | 2.02 | 1.99 |

This table presents the EGARCH regression results of the three rates of return (ON, ID, and TD). "env res" is the residual of Equation (4). ON/ID/TD(-*j*) where $j = \{1..3\}$ are the respective dependent variables in lag, e.g., ID(-1) for the ID equation. In the variance equation, RESID(-1)/GARCH(-1)$^{.5}$ (leverage effect) is the asymmetric component of the EGARCH model.
***, **, * are 0.01, 0.05, 0.1 significance levels, respectively.

[7] Running TGARCH(1, 1, 1) did not qualitatively change the results.

For the mean equation, the tone residual (env_res) has a positive influence on both the ON and TD returns at a significance level of 0.01, but its impact on the ID return is insignificant. For the variance equation, the leverage effect (the effect of a negative market return on conditional variance is stronger than the effect of a positive market return) is found to be statistically significant in all three regressions, as is common for daily returns. Additionally, the tone residual's impact on the conditional variance of the returns is found to be negative for all returns and insignificant (at the 0.05 level) only for the ID equation. This result means that positive tone residuals lower the conditional volatility, as expected.

### 4.3 The effect of the media on the volume and intraday volatility

There are market variables other than prices that may be influenced by the tone residual. To discover the impact of the tone residual on such market variables, we ran the same EGARCH regressions as in Table 4, where volumes, gaps and absolute gaps of Tel Aviv 125 stock index are the dependent variables, while the tone residual and other exogenous variables are the explanatory variables. The dependent variables are the daily trading volumes of the Tel Aviv 125 index (Vol - in logs), the relative (Gap), and the absolute (Agap) intraday price gaps (see Table 5 for term definitions). The explanatory variables (except for the intercept) are the tone residual (*env_res*), the explanatory variable with 3 lags (days), and a dummy variable that gets the value of 1 on Sundays and 0 otherwise.[8] The results are depicted in Table 5.

[8] The Tel Aviv Stock Exchange is active on Sunday thru Thursday. Sundays are characterized by different volumes and volatilities than other days of the week.

**Table 5: EGARCH(1,1,1) regression results – Volumes, gaps, and absolute gaps in the Tel Aviv 125 stock index (TA-125) and the tone residual**

| **Dependent Variable:** | **Vol** | **Gap** | **Agap** |
|---|---|---|---|
| **Mean Equation** | | | |
| C | 10.8*** | -0.100*** | -0.157*** |
| env_res | 0.238 | -0.344** | -0.387** |
| Vol/Gap/Agap(-1) | 0.217*** | 0.297*** | 0.314*** |
| Vol/Gap/Agap(-2) | 0.127*** | 0.150*** | 0.163*** |
| Vol/Gap/Agap(-3) | 0.128*** | 0.156*** | 0.169*** |
| Sunday | 0.082*** | 0.109*** | 0.112*** |
| **Variance Equation** | | | |
| C | -1.19*** | -0.177 | -0.169 |
| \|RESID(-1)/GARCH(-1)^.5\| | -0.195*** | -0.063 | -0.059 |
| RESID(-1)/GARCH(-1)^.5 | 0.413*** | 0.010 | 0.024 |
| Log(GARCH(-1)) | 0.255*** | 0.856*** | 0.862*** |
| env_res | -2.64*** | -0.504 | -0.503 |
| Adj. R^2 | 0.06 | 0.22 | 0.28 |
| DW | 2.18 | 2.05 | 2.04 |

This table presents the EGARCH regression results of the three variables derived from Tel Aviv 125 stock index: VOL (daily volume in logs), $Gap = 100 \cdot \frac{\text{high}-low}{(\text{high}+\text{low})/2}$, and $Agap = high - low$, where, 'high' and 'low' are the daily high and low rates, respectively. "*env_res*" is the tone residual as in Table 4. Vol/Gap/Agap(-*j*), where $j$ = {1..3} are the respective dependent variables in lag, e.g., Gap(-2) for the Gap equation. In the variance equation, RESID(-1)/GARCH(-1)$^{.5}$ (leverage effect) is the asymmetric component of the EGARCH model.
***, **, * are 0.01, 0.05, 0.1 significance levels, respectively.

Table 5 presents the influence of *env_res* on trading volume, on Gap, and on Agap in both mean and variance equations, as in Table 4. The results, however, do not reflect a homogeneous influence of the tone residual on the dependent variables as in Table 4 (on returns). Particularly, in the mean equation, *env_res* positively (but insignificantly) influences trading volumes while negatively and significantly influencing both Gap and Agap variables. The results regarding Gap and Agap are expected, as larger daily gaps go hand in hand with a negative tone residual and vice-versa. In contrast, the positive coefficient (although insignificant) of *env_res* in the Vol equation is inconsistent with our prior assessment that larger volumes appear in negative periods (when the net media effect is negative). In the variance equation, all *env_res* have the negative sign, as in Table 4, but only that of the Vol equation is significant.

### 4.4 Examining the tone effect by quantile regressions

The findings thus far, in both the literature and this study, show that the negative part of the distribution of both the returns and the tone residual is more significant and influential than the positive part of the distribution. In particular, the results in Table 2 show that a significant part of the information is to be found at the ends of the distribution, and that investigating the extreme observations of both returns and tone may therefore show nonlinear links between them. This led us to examine the relations between the tone residual and the returns through a quantile regression.

The quantile regression (Basset and Koenker, 1978) expands the empirical estimation possibilities of linear models beyond the conditional mean in the OLS method. For instance, the quantile regression proposes methods for estimating the conditional median of a function (the $50^{th}$ percentile) or estimating it over every other possible conditional percentile ($0<\tau<100$). This regression is also robust to outliers and to heteroskedasticity. In the quantile regression that we ran, the explanatory and dependent variables are exactly like those presented in Table 4, but the percentiles examined are the lowest to highest deciles.

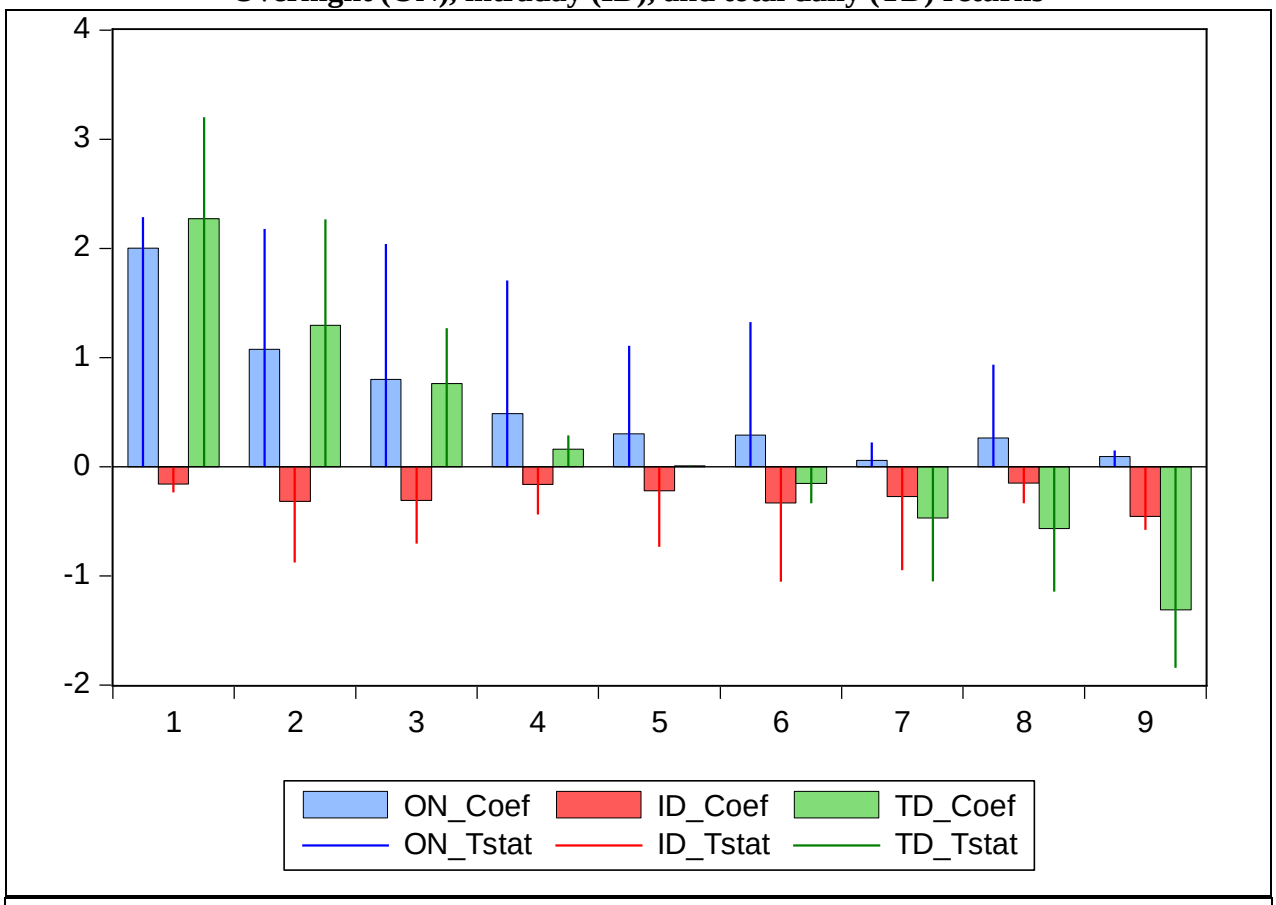
We first briefly describe the principles of the quantile regression. Let us assume, like in linear planning problems, that the target function is to find the coefficients in the regression where Y is the dependent variable, X is a vector of explanatory variables, $\beta$ are the estimated coefficients, n is the number of observations, and $\tau$ is the desired decile ($0<\tau<10$). The quantile regression model is as follows:

$$(6)\quad \widehat{\beta_n(\tau)} = \mathrm{m}argmin_{\beta(\tau)} \left\{ \sum_{i:Y_i \geq x_i'\beta} \tau |y_i - x_i'\beta| + \sum_{i:Y_i < x_i'\beta} (1-\tau)|y_i - x_i'\beta| \right\}$$

$$= \mathrm{m}\underset{\beta(\tau)}{argmin} \left\{ \sum_{i=1}^{n} \rho_\tau (y_i - x_i'\beta) \right\}$$

where, $\rho_\tau(x) = \begin{cases} \tau \cdot x & if\ x \geq 0 \\ (\tau - 1)x & if\ x < 0 \end{cases}$, referring to the check function, is an asymmetric weighting of negative values compared with positive values. For instance, for the second decile ($\tau$=2), a positive error ($y_i \geq x_i'\beta$) of observation $i$ in the regression will be multiplied by 0.2, while a negative error ($y_i < x_i'\beta$) will be multiplied by -0.8. Equation (6) can be calculated through various optimization methods, and in this test, we use the improved simplex algorithm of Koenker and D'Orey (1987). The results of the tone residual coefficients (full bars) and their t-tests (spikes) in the three regressions by deciles (1–9) are presented in Figure 4.

**Figure 4: The coefficients and t-tests of the tone residual in quantile regressions: Overnight (ON), intraday (ID), and total daily (TD) returns**



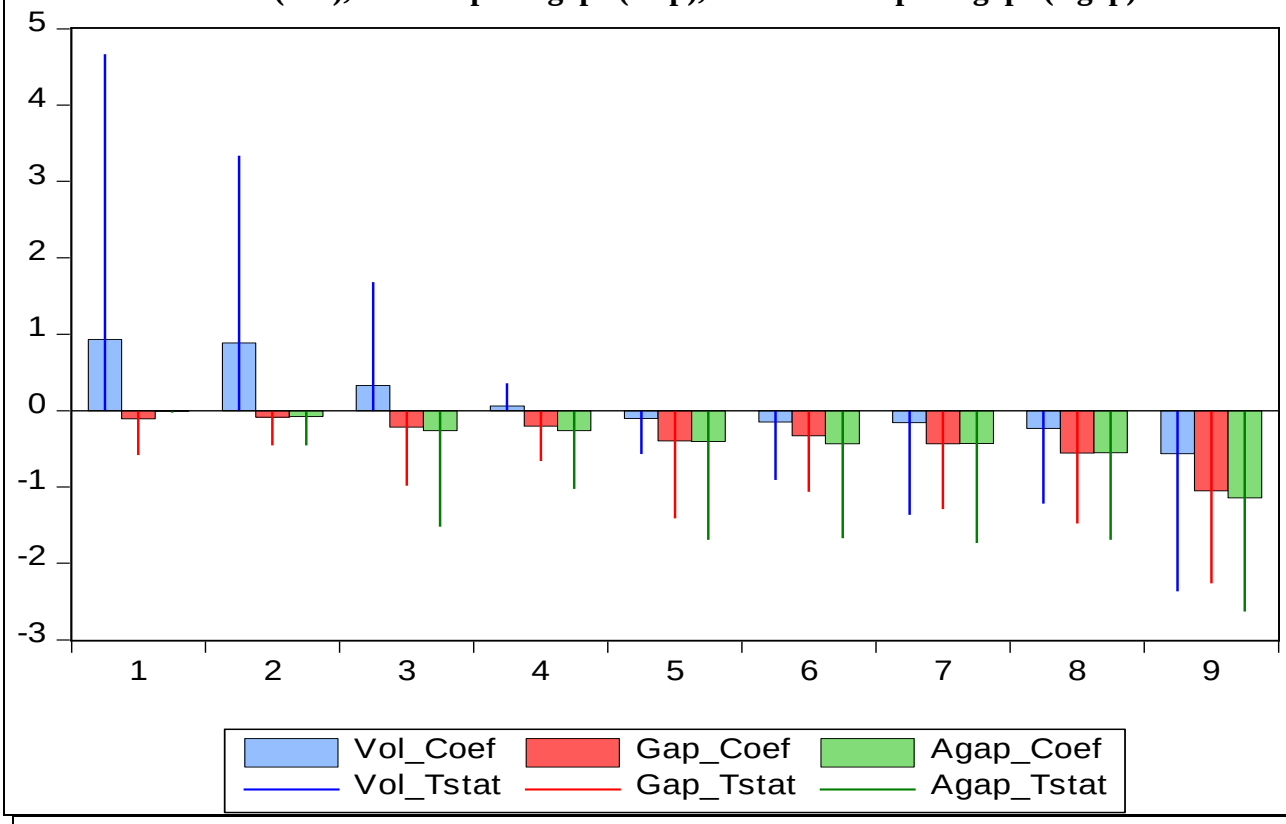

The figure presents coefficients (_Coef) and t-statistics (_Tstat) across deciles of the tone residual in ON, ID, and TD quantile regressions. The coefficients are represented by full bars and their respective t-tests by spikes.

There are two prominent results in Figure 4. First, the tone residual coefficients in the regressions of ON returns are positive over all deciles, and are significant in the three lowest deciles. Second, ID returns are negative in all deciles, but are not statistically significant in any of the deciles. At the same time, the coefficients of TD returns go from positive to negative in the transition from the lowest to the highest decile, because they are the sum of ON and ID returns. However, they are significant in the two lowest deciles. These results are consistent with those obtained in Table 4. Regarding the first prominent result, the tone residual is found to be positive and statistically significant in the overnight return regression, where the result obtained in the quantile regression may show that for the two lowest deciles its effect on the result in Table 4 is decisive. Regarding the second result, the tone residual coefficients in ID return regressions are not statistically significant though they are negative.

In parallel with returns, the intraday trading volumes and price gaps are also set in the markets. It is therefore only natural to examine the impact of the tone residual on those variables.

In order to maintain uniformity in the analysis, we ran quantile regressions (Deciles 1–9) with explanatory variables similar to those in Table 4 and Figure 4. The dependent variables are the daily trading volumes of the Tel Aviv 100 index (in logs), and the relative and absolute intraday price gaps. The explanatory variables (except for the intercept) are the tone residual (*env_res*), the explanatory variable with a lag of 3 days, and a dummy variable that gets the value of 1 for Sundays (which differs from the other days in terms of trading volume and intraday volatility) and 0 otherwise. The results are presented in Figure 5.

**Figure 5: The coefficients and t-tests of the tone residual in quantile regressions: Trading volume (Vol), relative price gaps (Gap), and absolute price gaps (Agap)**




The figure presents coefficients (_Coef) and t-statistics (_Tstat) across deciles of the tone residual in ON, ID, and TD quantile regressions. The coefficients are represented by full bars and their respective t-tests by spikes.

All of the coefficients of tone residuals were found to be negative (except for trading volumes in the three lowest deciles), as expected, and were statistically significant mainly in the extreme tails. In particular, a positive tone residual lowers trading volume and price gaps, both relative and absolute in the highest decile. In contrast, trading volumes in the three lowest deciles were positive and significant. In other words, a positive tone residual in the three lowest deciles increases trading volume, in contrast with the other deciles. Generally, there are no significant differences between the various deciles, particularly if we compare the results to those shown in

Figure 4. The main reason for this is that the lower deciles reflect days on which intraday trading volumes are small, in other words, when there is no significant activity in the stock market. In contrast, the upper deciles reflect days of intense activity and perhaps more uncertainty, when trading volumes and price gaps are larger than on "normal" days. However, unexpectedly, there is no statistically significant (at a level of 0.01) correlation between the tone residual and the trading volumes and price gaps in the upper deciles (except for the highest decile).

### 4.5 Discussion of the results

The results of the various tests of the tone residual's effect on returns on the Tel Aviv 125 index and other trading characteristics were, for the most part, in line with expectations. Thus, the tone residual's effect on ON returns, and to a lesser extent on TD returns, was positive and statistically significant in the EGARCH regressions (Table 4); namely, a positive (negative) tone residual increased (decreases) the ON and TD returns of the stock index. This result means that the local newspapers had a significant influence. Moreover, focusing on and emphasizing bad news (Garz, 2014) is a characteristic of general (rather than business) newspapers that cover dramatic changes in the financial markets and keep quiet in normal times (Table 2). This result is also consistent with the behavioral characteristics of "naïve" retail investors who make investment decisions after business hours, based *inter alia* on general newspapers, and act upon them at the start of trading (Lou et al., 2015). The fact that these investors are influenced by the newspapers (Peress, 2014), particularly by general newspapers in our case, may explain why the tone residual's effect on the overnight return is felt mainly on days of sharp declines (the lowest deciles). In contrast to ON returns, the tone residual's effect on ID returns was found to be negative and insignificant (Table 4). One of the explanations of the global anomaly of positive ON returns compared with negative ID returns, a phenomenon that was also found in the Tel Aviv stock market, is the (relatively) late, and sometimes irrational, response to news received outside of trading hours. The results we obtained in this study are in line with this explanation, since the maximal effect of the newspapers is on ON returns.

The TD returns which are the sum of ON and ID were positively influenced by the tone residual due to the ON returns. In general, the correlation coefficient of TD returns was positive until the fifth decile. The reason is the varying strength of the ON and ID returns over the deciles. We also found that the conditional variance of the returns was negatively influenced by the tone residual (Table 4) where the various coefficients were found to be statistically significant only for the overnight returns. This finding means that a positive (negative) tone residual decreases

(increases) the conditional variance of the return, as expected. In addition, asymmetry (the leverage effect) was found in the variance equations for all returns in the EGARCH regressions (Table 4).

Our hypothesis that the tone residual is mostly reflected in the extremes of the return distribution extremes is supported by the quantile regressions (Figure 4). For instance, the main effect of the tone residual on both ON and TD was statistically significant in the lowest two and the highest deciles, while there was no significance in the other deciles. This finding means that a negative tone residual is consistent with very negative returns (lowest two deciles), while at the other end of the distribution (highest decile) a negative tone residual is consistent with very positive returns (though the coefficient is insignificant).

This finding may be explained by the newspaper' characteristics that emphasize bad market news (sharp price declines), which mainly affects naïve investors. On the other extreme, a positive tone residual in the highest decile, accompanied by negative returns, may reflect a 'disposition effect' or portfolios rebalancing (see Yuan, 2015). By both hypotheses, record index prices in day t are followed by negative returns in day t+1. Yet, the coefficients in the lowest two deciles are significant while that of the highest decile is not.

Finally, the statistically significant positive effect of the tone residual on the ON and TD returns and the lack of significance of the tone residual on the ID returns are consistent with the findings of Peress (2014) concerning various stock indices, despite the differences in methodology, sample period, and geographic location of trading. We also found significant differences between the center and extremes of the distribution concerning other market variables such as trading volumes and daily gaps. However, all of the coefficients of the tone residuals in all deciles were negative, as expected (except for trading volume in the lowest three deciles).

## 5. Robustness checks

This section examines the statistical significance of the results obtained in the study through a change of parameters or of the type of estimation equation. The first examination concerns the definition of the tone residual (*env_res*). Compared with the original definition of tone (the monetary value of positive media minus the monetary value of negative media), we added the monetary value of neutral media, as follows:

(7) $$env = Pos + I \cdot Neutral - (1 - I) \cdot Neutral - Neg$$

where $Pos$, $Neg$, and $Neutral$ are the equivalent monetary values (in shekel terms) of positive, negative, and neutral articles in newspapers, respectively, and $I \in (0,1)$ is a dummy variable that gets the value of 1 if the value of the positive articles is greater than the value of the negative articles, and 0 otherwise. The reason for this calculation is that on any given day, either positive and neutral articles (positive tone) or negative and neutral articles (negative tone) were published, but it did not happen that both positive and negative articles were published in the same newspaper on the same day. Table 6 shows the results of an EGARCH regression, where the only difference between it and Table 4 is the definition of the tone residual: Table 6 includes neutral tone according to Equation (7).

**Table 6: Results of the regressions on returns of the Tel Aviv 125 and the tone residual (including neutral tone)**

| **Dependent Variable:** | **ON** | **ID** | **TD** |
|---|---|---|---|
| **Mean Equation** | | | |
| C | 0.063*** | -0.036*** | 0.027 |
| env res (Eq. 7) | -0.203 | -0.041 | -0.221 |
| ON/ID/TD(-1) | -0.038 | 0.009 | 0.020 |
| ON/ID/TD(-2) | 0.003 | -0.044* | -0.051** |
| ON/ID/TD(-3) | -0.035 | -0.011 | 0.003 |
| **Variance Equation** | | | |
| C | -0.135*** | -0.134*** | -0.134*** |
| \|RESID(-1)/GARCH(-1)^.5\| | 0.136*** | 0.142*** | 0.153*** |
| RESID(-1)/GARCH(-1)^.5 | -0.042*** | -0.078*** | -0.074*** |
| Log(GARCH(-1)) | 0.979*** | 0.979*** | 0.973*** |
| env res (Eq. 7) | 0.319*** | 0.127 | -0.048 |
| Adj. R^2 | 0.00 | 0.00 | 0.00 |
| DW | 1.99 | 2.02 | 2.06 |

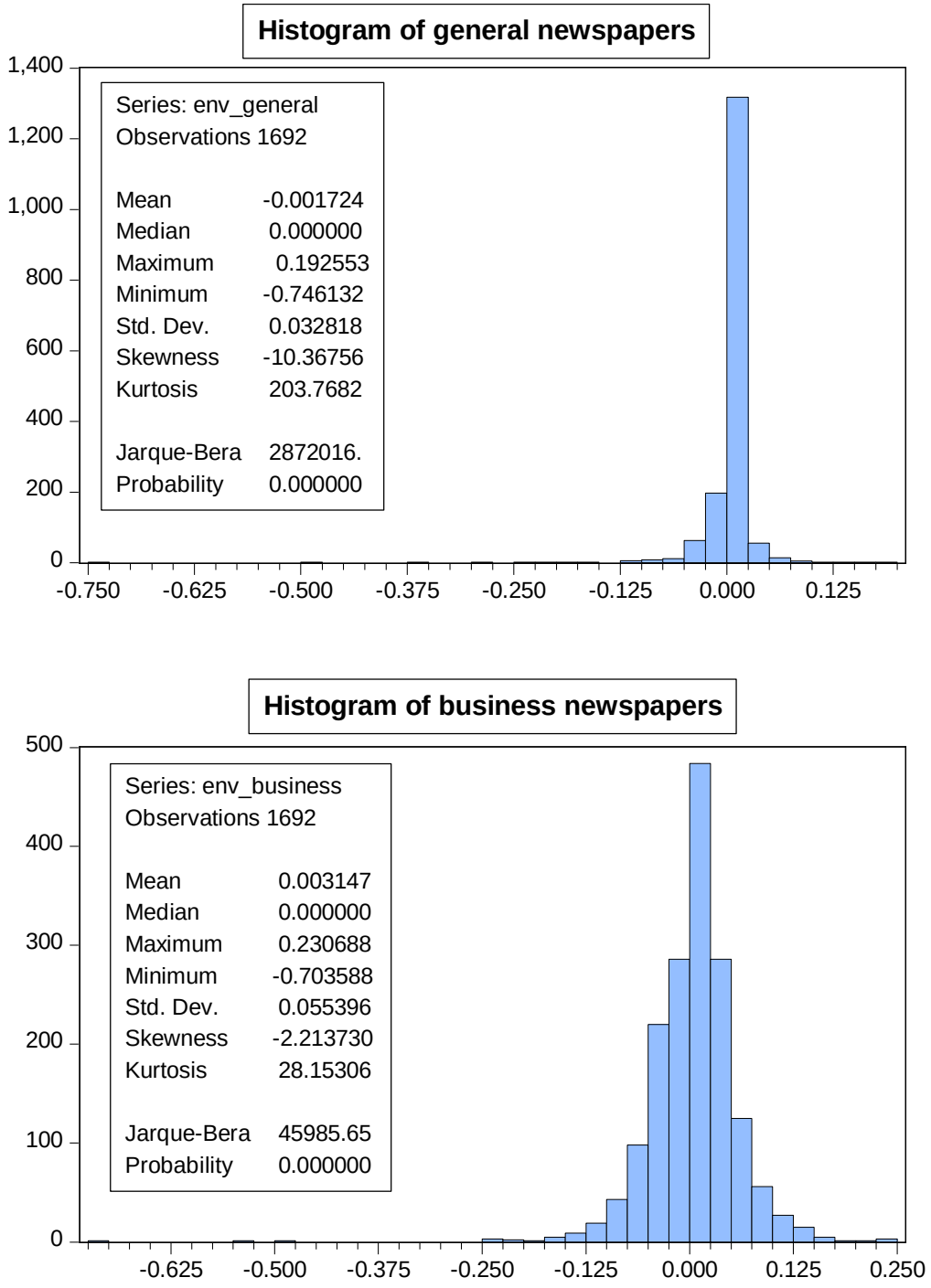
This table presents the EGARCH regression results of the three rates of return (ON, ID, and TD). "env_res" is defined in this table by Equation (7), which includes neutral tone, while all other variables and procedures are the same as in Table 4.. ON/ID/TD(-*j*) $j = \{1..3\}$ are the respective endogenous variables in lag, e.g., ID(-1) for the ID equation. In the variance equation, RESID(-1)/GARCH(-1)$^{.5}$ (leverage effect) is the asymmetric component of the EGARCH model.
***, **, * are 0.01, 0.05, 0.1 significance levels, respectively.

One can see that the statistical significance of the tone residual was weak in all equations, while the tone residual coefficient in the variance equation became positive and significant for the ON return. The coefficient signs did change in most cases but were usually insignificant, so we can conclude that the definition we selected is more appropriate.

### 5.1 The newspapers' type

The next examination regarding the tone residual concerns the type of newspaper included in the sample. Thus far, all of the major business newspapers (TheMarker, Globes, Calcalist) were included, as well as the business supplements of the general newspapers (Yedioth Ahronoth, Ma'ariv, Israel Hayom). Since, by our hypothesis, the tone residual has greater influence on naïve investors, who generally do not read the business newspapers, we examined the effect of the tone residual, similar to Figure 4, on both the business and the general newspapers. Our further hypothesis is that the positive and significant relations found at the two extremes of the distribution will weaken in the business newspapers compared with the general newspapers. We first present a comparison between the histograms and basic statistics of the tone variable calculated based on general newspapers and those of the tone calculated based on the business newspapers (hereinafter *env_econ*).

**Figure 6: Tone based on 'general' newspapers compared with 'business' newspapers**




The upper panel depicts the distribution of the 'tone' derived from general newspapers while the lower panel presents the respective 'tone' derived from business newspapers.

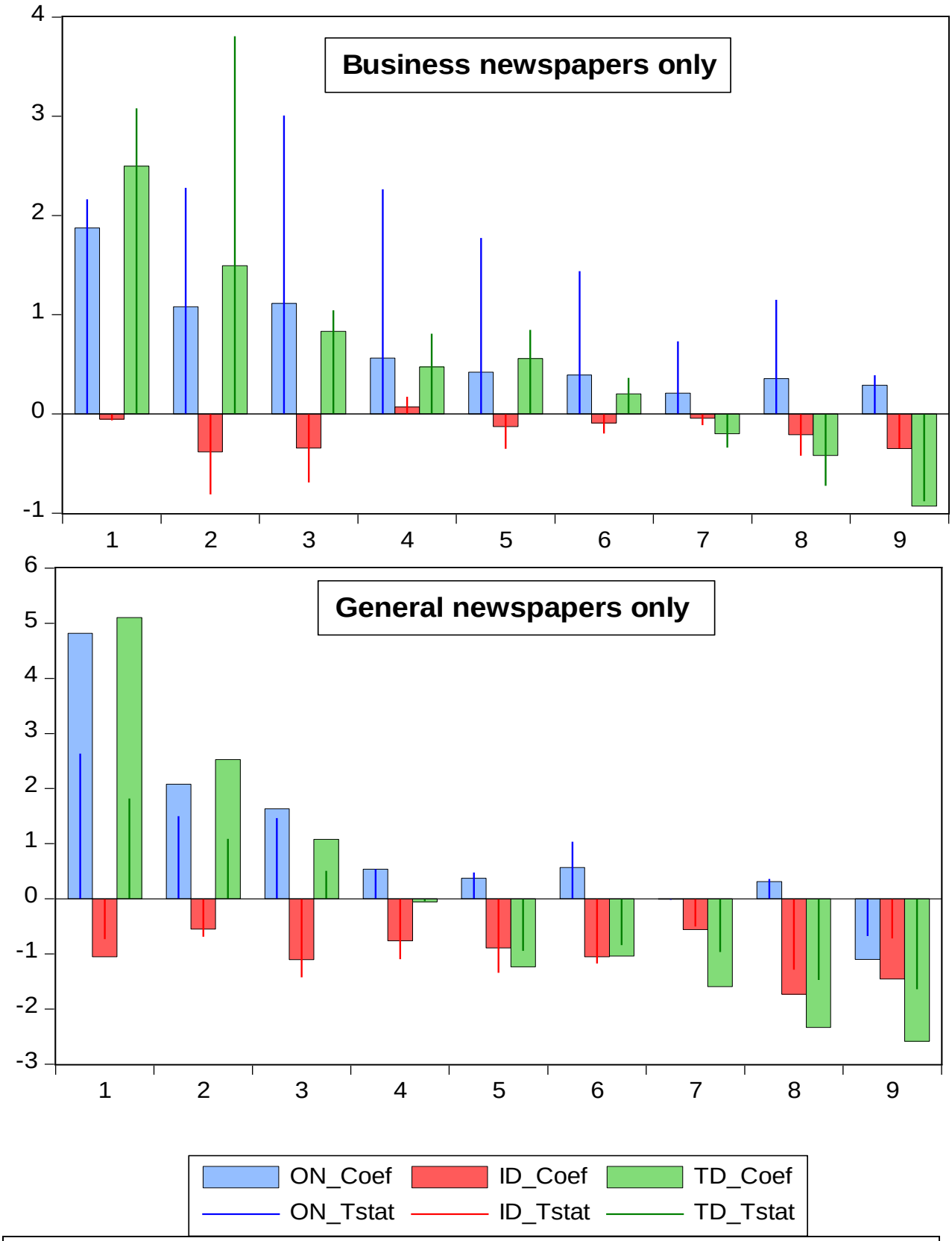
A comparison of the tone statistics calculated based on general newspapers (the upper panel) with that based on the business newspapers (the lower panel) shows that tone based on general newspapers had a negative average compared with the positive tone in the business newspapers, is less volatile (standard deviation) due its leptokurtic shape, but has much greater negative

asymmetry (skewness) and larger kurtosis. The latter point to the importance of the skewness and the kurtosis in the analysis of the general newspapers. These comparative findings are in line with our prior assessment of the differences between general media coverage and business media coverage and, in particular, of the significant influence that general media coverage has on naïve investors who, for the most part, do not read the business newspapers and have limited economic analysis capability. In order to check this assessment within a regression, we ran quantile regressions (coefficients and t-tests) as in Figure 4, with the addition of the expected tone in business versus general newspapers. Figure 7 shows the results of the quantile regressions (coefficients and t-tests), in which the upper figure presents the tone residual's impact from business newspapers on the three returns, while the lower panel presents the respective tone residual impact derived from general (non-business) newspapers.

In comparing the upper and lower panels of Figure 7, and comparing them with Figure 4 (all newspapers) we find the following differences:

a. The coefficients, and especially their significance, fade less along the deciles in the upper panel of Figure 7 than in the lower panel. For instance, the only significant decile in the lower panel for both ON and TD equations is the lowest (decile 1), while in the upper panel the four lowest deciles for the ON equation and the two lowest deciles for the TD equation are significant.
b. The coefficients in decile 1 of the general newspapers are larger than the respective ones of the business newspapers.
c. The ID returns in both panels, as well as in Figure 4, are all negative but insignificant.

**Figure 7: The coefficients and t-tests of the tone residual in quantile regressions: Overnight (ON), intraday (ID), and daily (TD) returns: Business versus general newspapers**

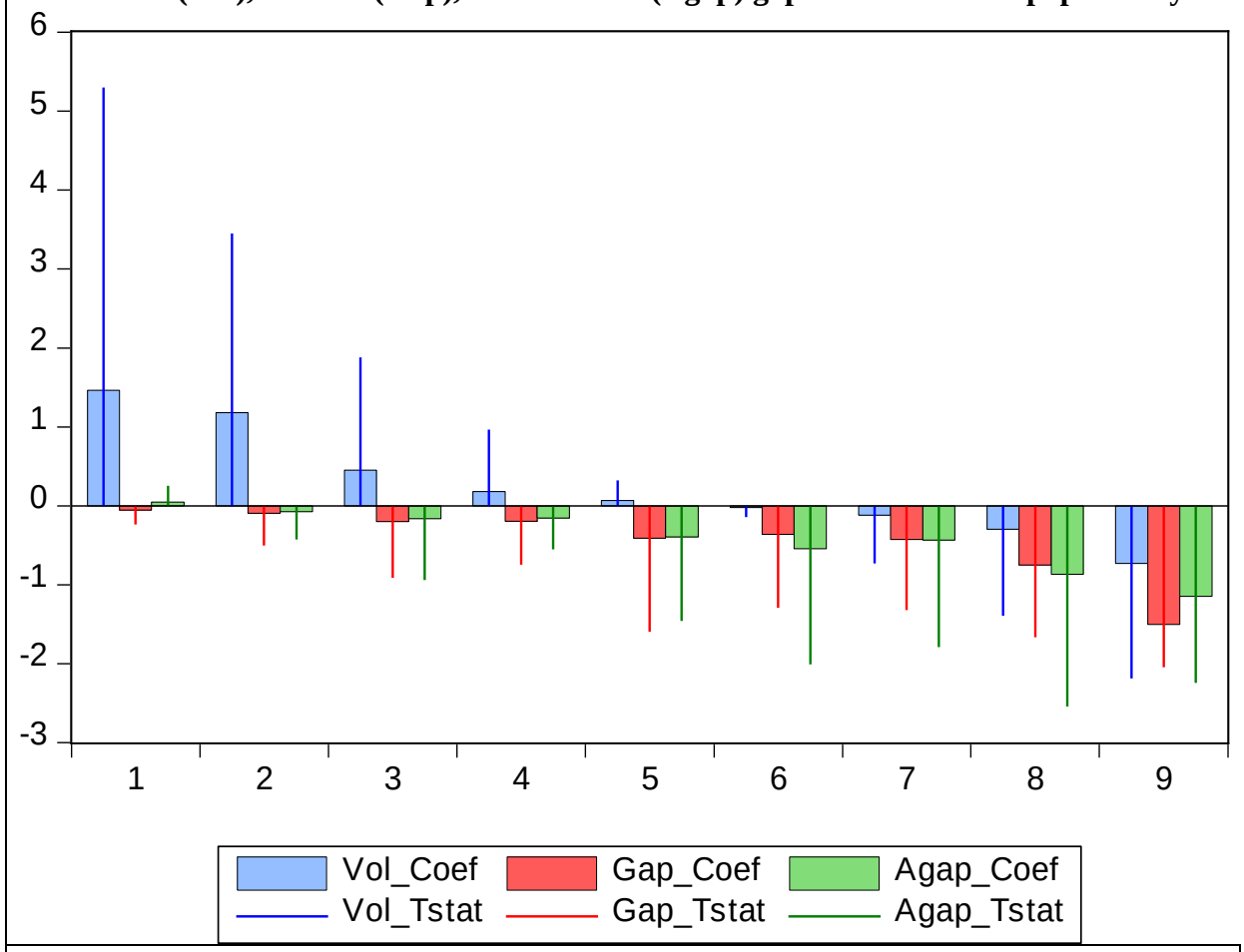



The figure presents coefficients (_Coef) and t-statistics (_Tstat) across deciles of the tone residual in ON, ID, and TD quantile regressions. The coefficients are represented by full bars and their respective t-tests by spikes.

These results are consistent with our assessment that naïve investors are more exposed and more influenced by the tone residual as reflected in the newspapers, particularly the general newspapers. Thus, we would expect dramatic headlines about declines in the stock exchange to influence naïve investors to hold a "fire sale" of their investments, thereby increasing the extent of the declines—due to "herd mentality"—mainly at the opening of the trading day. In comparison, sophisticated investors may even buy on such days (contrarians), thereby moderating the declines (see Lou et al. (2015); Branch and Ma, (2015)).

We also examined the effect of the tone residual (coefficients and t-tests) on other variables, similar to Figure 5, for the tone calculated based only on business newspapers. Figure 8 shows the results regarding trading volumes (Vol), relative gaps (Gap), and absolute gaps (Agap).

**Figure 8: The coefficients and t-tests of the tone residual in quantile regressions: Trading volume (Vol), relative (Gap), and absolute (Agap) gaps: Business newspapers only**




The figure presents coefficients (_Coef) and t-statistics (_Tstat) across deciles of the tone residual in ON, ID, and TD quantile regressions. The coefficients are represented by full bars and their respective t-tests by spikes.

In comparing Figure 8 with Figure 5, one can notice a significant difference in the coefficients of trading volume. In Figure 8, these coefficients are significantly positive up to the third decile and negative in the higher deciles, with particular significance in Deciles 8 and 9. This means that

trading volumes are more sensitive to the tone residual in the business newspapers than in the general newspapers. Further to our assumption concerning the differences between the general and business newspaper readerships, the latter may act in greater volumes than the former, particularly in the highest and lowest deciles. In contrast, there are no significant differences between Figure 8 and Figure 5 in the relative (Gap) and absolute (Agap) price gaps.

### 5.2 Number of articles

We also examined the definition of tone that is customary in the literature—by the number of articles, and not their monetary value—where tone is defined as the number of positive articles minus the number of negative articles[9] in all newspapers (both general and business). The results are depicted in Table 7.

**Table 7: Regression results on the returns of the Tel Aviv 125 index and the tone residual based on the number of transactions (in logs)**

| **Dependent Variable:** | **ON** | **ID** | **TD** |
|---|---|---|---|
| **Mean Equation** | | | |
| C | 0.061*** | -0.041*** | 0.018 |
| env_res (#positive-#negative articles) | -0.001 | -0.002 | -0.003 |
| ON/ID/TD(-1) | -0.035 | 0.009 | 0.022 |
| ON/ID/TD(-2) | 0.002 | -0.045* | -0.052** |
| ON/ID/TD(-3) | -0.034 | -0.012 | 0.005 |
| **Variance Equation** | | | |
| C | -0.146*** | -0.141*** | -0.126*** |
| \|RESID(-1)/GARCH(-1)^.5\| | 0.151*** | 0.151*** | 0.146*** |
| RESID(-1)/GARCH(-1)^.5 | -0.056*** | -0.083*** | -0.078*** |
| Log(GARCH(-1)) | 0.973*** | 0.973*** | 0.969*** |
| env_res (#positive-#negative articles) | 0.003** | 0.004* | 0.003* |
| Adj. R^2 | 0.00 | -0.01 | 0.00 |
| DW | 1.99 | 2.03 | 2.06 |

This table presents the EGARCH regression results of the three rates of return. "*env_res*" is the residual of Equation (4), as in Table 4, except for *env*, which is the gap between the number of positive and negative articles (in logs). All other variables and procedures are the same as in Table 4.
***, **, * are 0.01, 0.05, 0.1 significance levels, respectively.

The coefficients in the regressions obtained in Table 7 are in the opposite directions as in Table 4 as are the significance of the coefficients in both the conditional mean and variance equations. In particular, the coefficient of the explanatory variable examined in the study—the tone residual—

[9] Since there were either positive or negative articles in almost all cases, the examined variable is distributed around zero. For instance, if there were three negative articles published on a certain day, the tone is *env* = -log(3).

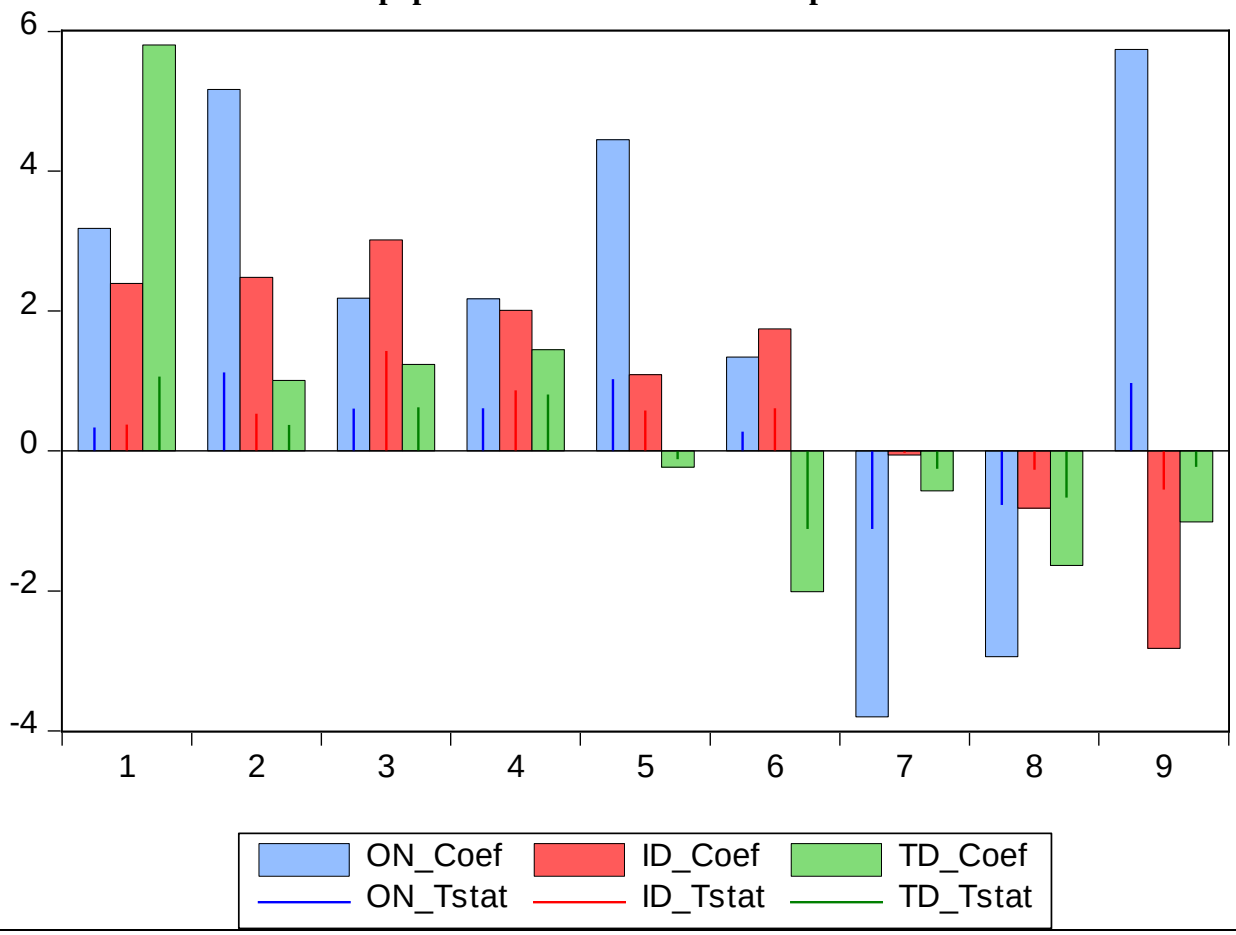
is close to 0 and is insignificant in the conditional mean equation. This finding apparently shows the advantage of the innovative definition that we used in this study, which takes into account the monetary value of the articles and not just the number of positive articles minus the negative articles. In contrast, the tone residual's coefficient is positive and significant in the conditional variance equation, which is the opposite of what we obtained in Table 4.

Another examination we conducted is in regard to various aggregates of the stock indices. The general stock index and the Tel Aviv 35 index were compared to the Tel Aviv 125 index. Usually, no significant differences were found in the tone residual's effect on returns on these alternative indices, and the results are therefore not shown here.

### 5.3 Less relevant articles

Another important examination concerns the sensitivity of the benchmark for including a news article in the dataset. As mentioned, we included only articles where the extent of relevance to the stock market was 50 percent or more. Therefore, in order to validate the obtained results, we ran the same quantile regression with tone residual as an explanatory variable where the extent of relevance was less than 50 percent. Our hypothesis is that the distribution of the coefficients over the percentiles would be similar, and in particular that there would not be different and statistically significant results at the extremes of the distribution compared with the center of the distribution. The results of the quantile regression with tone data where the relevance was less than 50 percent are shown in Figure 9.

**Figure 9: The coefficients and t-tests of the tone residual in quantile regressions: ON, ID, and TD returns for all newspaper articles with less than 50 percent relevance**




The figure presents coefficients (_Coef) and t-statistics (_Tstat) across deciles of the tone residual in ON, ID, and TD quantile regressions. The coefficients are represented by full bars and their respective t-tests by spikes.

As we can see, and particularly when compared with Figure 4 (where the extent of the relevance of tone was 50 percent or more), there is no significant difference between the coefficients of the three returns over the percentiles, and not even one coefficient is statistically significant, as expected. This result apparently justifies our choice to include only newspaper articles where the extent of relevance was 50 percent or higher.

### 5.4 Comparing the tone with Google Trend

Another important question is whether our tone variable that was manually constructed by "Ifat Media Research" (see details in the methodology section) accurately reflects the actual tone, which is a latent variable. In order to compare our results, particularly Table 4, with a popular tone variable, we replicated the Da et al. (2015) FEARS (Financial and Economic Attitudes Revealed by Search) index. That daily index is based on Google Trends terms (Search

Volume Index - SVI), and after selecting the 30 most relevant terms for an economic downturn state, Da et al. (2015) constructed the FEARS index by taking daily change rates, standardization, and control for both weekdays and monthly seasonality. Yet, our replication of their index differs in two aspects. First, we are interested in the distribution tails so we did not winsorize each series at the 5% level as they did. Secondly, we translated the English terms into Hebrew and restricted the geographical area to Israel rather than the US.[10]

Table 8 shows the regression results, as in Table 4, except for the tone residual, which is based on the FEARS index (*env* of Eq. 4) but regressed on the same explanatory variables to obtain the tone residual (*env_res*). Additionally, we restricted the sample data to start from 3/2015, as the data before that period is less reliable, and compare the FEARS results (left panel) with ours (as in Table 4 - right panel).

**Table 8: EGARCH(1,1,1) regressions results: Returns of the Tel Aviv 125 index (TA-125) and the FEARS residual (adapted to Israel) versus the tone residual**

| | fear_res | | | env_res | | |
|---|---|---|---|---|---|---|
| **Dependent Variable:** | **ON** | **ID** | **TD** | **ON** | **ID** | **TD** |
| **Mean Equation** | | | | | | |
| C | 0.049*** | -0.031* | 0.018 | 0.045*** | -0.030 | 0.016 |
| fear_res/env_res | -0.015 | 0.006 | 0.011 | 1.05*** | -0.087 | 1.18** |
| ON/ID/TD(-1) | 0.042 | -0.003 | 0.055 | 0.037 | -0.003 | 0.059 |
| ON/ID/TD(-2) | -0.055 | -0.031 | -0.083** | -0.043 | -0.029 | -0.079* |
| ON/ID/TD(-3) | 0.024 | -0.024 | 0.066* | 0.037 | -0.022 | 0.064 |
| **Variance Equation** | | | | | | |
| C | -0.222*** | -0.232*** | -0.228*** | -0.244*** | -0.253*** | -0.226*** |
| \|RESID(-1)/GARCH(-1)^.5\| | 0.148*** | 0.155*** | 0.157** | 0.150*** | 0.169*** | 0.154** |
| RESID(-1)/GARCH(-1)^.5 | -0.119*** | -0.146*** | -0.196*** | -0.129*** | -0.144*** | -0.190*** |
| Log(GARCH(-1)) | 0.933*** | 0.919*** | 0.867*** | 0.921*** | 0.911*** | 0.867*** |
| fear_res/env_res | 0.025* | 0.015 | 0.022 | -0.437 | -0.117 | -0.410 |
| Adj. R^2 | 0.01 | 0.00 | 0.01 | 0.03 | 0.00 | 0.01 |
| DW | 1.95 | 2.08 | 1.96 | 2.00 | 2.08 | 2.00 |
| #N | 644 | 644 | 644 | 644 | 644 | 644 |

This table presents the EGARCH regression results of the three rates of return (ON, ID, and TD). "*fear_res*" is the residual of the FEARS index (*env* in Eq. 4) and "*env res*" is the residual of the original *env* of Equation (4). ON/ID/TD(-*j*) where $j = \{1..3\}$ are the respective endogenous variables in lag, e.g., ID(-1) for the ID equation. In the variance equation, RESID(-1)/GARCH(-1)$^{.5}$ (leverage effect) is the asymmetric component of the EGARCH model.
***, **, * are 0.01, 0.05, 0.1 significance levels, respectively.

It is quite clear that the coefficients of the *fear_res* (left panel) in the conditional mean equations are insignificant and sometimes with the opposite sign (ON and ID equations) to the *env_res* coefficients (right panel). These results corroborate our earlier findings that the "Ifat Media

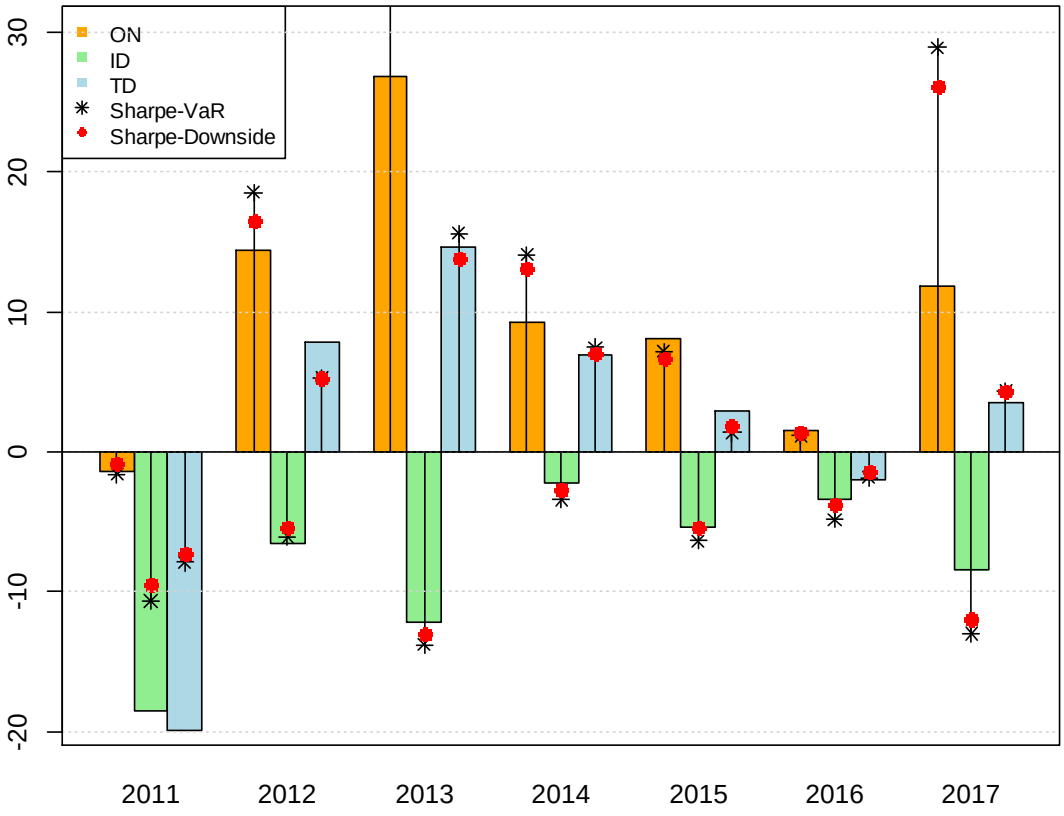
[10] Since the translation can bias the relevance of the original English terms found by Da et al. (2015), we tried different Hebrew terms but could not find any improvement of the significance of the FEARS index.

Research" classifications into "positive/neutral/negative" conveyed valuable information during the sample period. Also, the *fear_res* coefficients in the conditional variance equations are insignificant (except for the ON equation at the 0.1 significance level). Here too, the coefficients are in the opposite sign compared to the original ones (right panel) in this sample period and compared to the entire sample (Table 4).

### 5.5 Examining alternative risk definitions

Finally, we examined whether the positive overnight returns on the Tel Aviv Stock Exchange were a result of higher risk than the negative intraday returns or if the puzzle found in other stock indices (Liu and Tse (2017)) was also prevalent in the Tel Aviv 125. Figure 10 shows a number of performance indices adjusted for risk, including crash risk and downside risk.

**Figure 10: Annual returns (ON/ID/TD) and risk-adjusted returns**




The figure compares annual returns based on the above strategies (Overnight – ON, Intraday – ID, and Total day - TD) with their respective risk-adjusted returns (Sharpe-VaR and Sharpe-Downside). Sharpe-VaR is calculated as annual return divided by the Value at Risk, at a significance level of 0.05 while Sharpe-Downside reflect downside risk which is defined as the standard deviation of the negative returns only.

The (wide) bars show the annual returns during the sample period. The differences between ON and ID returns are prominent, where all the latter are negative while almost all the former are positive (except for 2011). These results are consistent with those in Table 1 (showing daily returns) and Figure 2 (showing cumulative returns). In addition, the standard deviation is also larger in ID returns than in ON returns (0.68 compared with 0.6; see Table 1). The spikes with a star at the end show the Sharpe Index adjusted to VaR (annual return divided by the Value at Risk, at a significance level of 0.05).[11] Here, the differences between the Sharpe Index adjusted to VaR of ON and TD returns are even more prominent in most sample years. However, in 2011, which was characterized by stock price declines, the common returns (the bars) were more negative than those adjusted to VaR (the spikes with stars at the end). Finally, the red dots on the spikes show the Sharpe Index adjusted to downside risk. This risk is defined as the standard deviation of the negative returns only, and the higher the value, the higher the risk. Here too, the indices of ON returns are higher than those of ID returns, but less so than for the indices based on VaR. Therefore, we can conclude based on Figure 10 and Table 1 that, for the most part, ON returns are positive and the risk-adjusted performance indices are higher than the negative ID returns, which are accompanied by higher risks. Therefore, the puzzle found in many global stock indices (see Lie and Tse (2017)) is prevalent in the Tel Aviv Stock Exchange as well.

## 6. Conclusion

This study examines the effect of daily newspaper tone on stock prices in Israel between 1/2011 and 10/2017 (inclusive). The database includes all articles written about the stock market in the business newspapers (Globes, TheMarker, and Calcalist) and in the business supplement sections of the general newspapers (Yedioth Ahronoth, Israel Hayom, and Ma'ariv), as well as data on share prices, trading volumes, and daily high and daily low prices. We used a proprietary database built by the "Ifat Media Research" company that classifies business articles into positive, negative, or neutral tone from the standpoint of the local stock market. In contrast with the current literature, we examine the impact of an article according to its equivalent monetary cost (depending mainly on the particular newspaper, placement within the newspaper, and article size). Based on that classification, we built a tone index for each trading day, which is the gap in shekels between the total value of articles with positive tone and the total value of articles with

[11] The VaR methodology is historical (daily returns during a calendar year; due to the near-zero interest rate during the sample period, we did not adjust for a risk-free return in the numerator). Alternative methods (such as the Sharpe Index adjusted for expected shortfall risk, the Sharpe Index adjusted for the four main moments of normal distribution, and information indices) generated similar results, and are therefore not shown in the study.

negative tone. The tone index was run on relevant economic variables, and the residual from the regression served as a tone index controlled for variables that influence the stock index returns (the tone residual). We examined the effect of the tone residual on the intraday returns, the overnight returns (between the opening price today and the closing price yesterday), and the common daily returns. In doing so, we actually examined the tone residual's net effect on returns, particularly the overnight returns, as the newspapers are published in the morning before the start of trading, and should therefore mainly influence those returns.

With this distinction, we basically connect two strands of the literature: one that deals with the effect of the newspapers on stock prices, and one that deals with the anomaly of intraday returns compared with overnight returns. Using a variety of statistical procedures (OLS, EGARCH, and quantile regression), we find that: (a) the effect of the tone residual of the newspapers on the stock return is positive and statistically significant, mainly for the overnight returns and to a lesser extent for the daily returns; (b) the effect is statistically significant on days with sharp fluctuations, mainly price declines and non-business (general) newspapers, in the lowest deciles of the returns distribution; and (c) the effect of the tone residual on the variance of overnight returns is negative and significant.

Our method was compared with alternate methods such as: (a) another definition of the tone index, (b) using the number of positive versus negative articles as a tone index, and (c) using an automatic classification (Google Trends) for the tone assessment. In all cases the coefficients of our method were significant and in the expected sign compared to the alternatives for the overnight and intraday equations. In addition, substantial differences in tone between business and general newspapers were found. These results are consistent with the behavioral characteristics of "naïve" retail investors, who make investment decisions after business hours and act upon them at the start of the trading day (Lou et al., 2015). The fact that these investors are mainly influenced by the newspapers (Peress, 2014), especially by bad news, may explain why the tone residual affected overnight returns, and to a lesser extent daily returns, only in the lowest deciles of the distribution. Similar to the returns, we found that the tone residual negatively influenced relative and absolute price gaps, and positively influenced trading volumes in the lowest deciles. This means that negative tone increased low volumes and decreased large daily gaps during the sample period, as expected. Finally, the findings that "naïve" retail investors are influenced by the newspapers on the one hand, and act as a "herd," particularly on days of sharp declines, on the other, is of importance to both regulators and investors.

**References**


Antweiler, W. & M. Z. Frank (2004), "Is All That Talk Just Noise? The Information Content of Internet Stock Message Boards," *The Journal of Finance*, 59(3), 1259–1294.

Barber, B. M., T. Odean, & N. Zhu (2008), "Do Retail Trades Move Markets?" *The Review of Financial Studies*, 22(1), 151–186.

Basdekidou, V. A. (2017), "The Momentum & Trend-Reversal as Temporal Market Anomalies," *International Journal of Economics and Finance*, 9(5), 1–19.

Basset, G., & R. Koenker (1978), "Regression Quantiles," *Econometrica*, 46(1), 33–50.

Berkman, H., P. D. Koch, L. Tuttle, & Y. J. Zhang (2012), "Paying Attention: Overnight Returns and the Hidden Cost of Buying at the Open," *Journal of Financial and Quantitative Analysis*, 47(4), 715–741.

Branch, B. S. & A. Ma (2015), "Overnight Return, the Invisible Hand Behind Intraday Returns?," *Journal of Applied Finance*, 22(2).

Boudoukh, J., R. Feldman, S. Kogan, & M. Richardson (2013), "Which News Moves Stock Prices? A Textual Analysis," National Bureau of Economic Research, Working Paper No. 18725.

Coval, J. D. & T. Shumway (2001), "Expected Option Returns," *The Journal of Finance*, 56(3), 983–1009.

Das, S. R. & M. Y. Chen (2007), "Yahoo! for Amazon: Sentiment Extraction from Small Talk on the Web," *Management Science*, 53(9), 1375–1388.

Fang, L. H., J. Peress, & L. Zheng (2014), "Does Media Coverage of Stocks Affect Mutual Funds' Trading and Performance?" *The Review of Financial Studies*, 27(12), 3441–3466.

Ferguson, N. J., D. Philip, H. Y. Lam, & J. M. Guo (2015), "Media Content and Stock Returns: The Predictive Power of Press," *Multinational Finance Journal*, 19(1), 1–31.

Garcia, D. (2013), "Sentiment During Recessions," *The Journal of Finance*, 68(3), 1267–1300.

Garz, M. (2014), "Good News and Bad News: Evidence of Media Bias in Unemployment Reports," *Public Choice*, 161(3–4), 499–515.

Kahneman, D. & M. W. Riepe (1998), "Aspects of Investor Psychology," *The Journal of Portfolio Management*, 24(4), 52–65.

Kearney, C., & S. Liu (2014), "Textual Sentiment in Finance: A Survey of Methods and Models," *International Review of Financial Analysis*, 33, 171–185.

Koenker, R. W. & V. d'Orey (1987), "Algorithm AS 229: Computing Regression Quantiles," *Journal of the Royal Statistical Society. Series C (Applied Statistics)*, 36(3), 383–393.

Kothari, S. P., X. Li, & J. E. Short (2009), "The Effect of Disclosures by Management, Analysts, and Business Press on Cost of Capital, Return Volatility, and Analyst Forecasts: A Study Using Content Analysis," *The Accounting Review*, 84(5), 1639–1670.

Larsen, V. H. & L. A. Thorsrud (2017), "Asset Returns, News Topics, and Media Effects," Norge Bank Research, Working Paper No. 17/2017.

Liu, Q. & Y. Tse (2017), "Overnight Returns of Stock Indexes: Evidence from ETFs and Futures," *International Review of Economics & Finance*, 48, 440–451.

Lou, D., C. Polk, & S. Skouras (2015), "A Tug of War: Overnight Versus Intraday Expected Returns," SSRN Working Paper.

Loughran, T. & B. McDonald (2011), "When is a Liability not a Liability? Textual Analysis, Dictionaries, and 10-Ks," *The Journal of Finance*, 66(1), 35–65.

Muddiman, A., & N. J. Stroud (2017), "News Values, Cognitive Biases, and Partisan Incivility in Comment Sections," *Journal of Communication*, 67(4), 586–609.

Pastor, L. & P. Veronesi (2009), "Learning in Financial Markets," *Annual Review of Finance and Economics*, 1(1), 361–381.

Peress, J. (2014), "The Media and the Diffusion of Information in Financial Markets: Evidence from Newspaper Strikes," *The Journal of Finance*, 69(5), 2007–2043.

Pruitt, S. W., J. R. Robert, & E. H. George (1988), "The Effect of Media Presentation on the Formation of Economic Expectations: Some Initial Evidence," *Journal of Economic Psychology*, 9(3), 315–325.

Ranyard, R., F. Del Missier, N. Bonini, D. Duxbury, & B. Summers (2008), "Perceptions and Expectations of Price Changes and Inflation: A Review and Conceptual Framework," *Journal of Economic Psychology*, 29(4), 378–400.

Riedel, C. & N. Wagner (2015), "Is Risk Higher During Non-Trading Periods? The Risk Trade-off for Intraday Versus Overnight Market Returns," *Journal of International Financial Markets, Institutions and Money*, 39, 53–64.

Shiller, R. J. (2005), *Irrational Exuberance,* Princeton University Press.

Soroka, S. N. (2006), "Good News and Bad News: Asymmetric Responses to Economic Information," *Journal of Politics*, 68(2), 372–385.

Tetlock, P. C. (2007), "Giving Content to Investor Sentiment: The Role of Media in the Stock Market," *The Journal of Finance*, 62(3), 1139–1168.

Tversky, A., & Kahneman, D. (1992), "Advances in Prospect Theory: Cumulative Representation of Uncertainty." *Journal of Risk and Uncertainty*, 5(4), 297–323.

Yuan, Y. (2015). "Market-wide attention, trading, and stock returns." *Journal of Financial Economics*, 116(3), 548-564.

Wiener, Z. & R. Tompkins (2008), "Bad Days and Good Nights: A Re-Examination of Non-Traded and Traded Period Returns," Available at SSRN: https://ssrn.com/abstract=1102165 or http://dx.doi.org/10.2139/ssrn.1102165

**Published papers** (in English)

| | |
|---|---|
| R. Melnick and Y. Golan - Measurement of Business Fluctuations in Israel. | 91.01 |
| M. Sokoler - Seigniorage and Real Rates of Return in a Banking Economy. | 91.03 |
| E.K. Offenbacher - Tax Smoothing and Tests of Ricardian Equivalence Israel 1961-1988. | 91.04 |
| M. Beenstock, Y. Lavi and S. Ribon - The Supply and Demand for Exports in Israel. | 91.07 |
| R. Ablin - The Current Recession and Steps Required for Sustained Sustained Recovery and Growth. | 91.08 |
| M. Beenstock - Business Sector Production in the Short and Long Run in Israel: A Cointegrated Analysis. | 91.10 |
| .A. Marom - The Black-Market Dollar Premium: The Case of Israel | 91.13 |
| A. Bar-Ilan and A. Levy - Endogenous and Exoqenous Restrictions on Search for Employment. | 91.14 |
| .The Market for Labor in Israel - M. Beentstock and S. Ribon | 91.15 |
| O. Bar Efrat - Interest Rate Determination and Liberalization of International Capital Movement: Israel 1973-1990. | 92.02 |
| Z. Sussman and D.Zakai - Wage Gaps between Senior and Junior Physicians and Crises in Public Health in Israel, 1974-1990. | 92.03 |
| O. L iviatan - The Impact of Real Shocks on Fiscal Redistribution and Their Long-Term Aftermath. | 92.05 |
| A. Bregman, M. Fuss and H. Regev - The Production and Cost Structure of the Israeli Industry: Evidence from Individual Firm Data. | 92.06 |
| -M. Beenstock, Y. Lavi and A. Offenbacher - A Macroeconometric Model for Israel 1962-1990: A Market Equilibrium Approach to Aggregate Demand and Supply. | 92.07 |
| R. Melnick - Financial Services, Cointegration and the Demand for Money in Israel. | 92.09 |
| R. Melnick - Forecasting Short-Run Business Fluctuations in Israel | 92.12 |
| K. Flug, N. Kasir and G. Ofer - The Absorption of Soviet Immigrants in to the Labor Market from 1990 Onwards: Aspects of Occupational Substitution and Retention. | 92.13 |

B. Eden - How to Subsidize Education and Achieve Voluntary Integration: An Analysis of Voucher Systems. 93.01

A.Arnon, D. Gottlieb - An Economic Analysis of the Palestinian Economy: The West Bank and Gaza, 1968-1991. 93.07

K. Flug, N. Kasir - The Absorption in the Labor Market of Immigrants from the CIS - the Short Run. 93.09

R. Ablin - Exchange Rate Systems, Incomes Policy and Stabilization Some Short and Long-Run Considerations. 94.01

B.Eden - The Adjustment of Prices to Monetary Shocks When Trade is Uncertain and Sequential. 94.02

K. Flug, Z. Hercowitz and A. Levi - A Small -Open-Economy Analysis of Migration. 94.04

R. Melnick and E. Yashiv - The Macroeconomic Effects of Financial Innovation: The Case of Israel. 94.05

?A. Blass - Are Israeli Stock Prices Too High 94.09

Arnon and J. Weinblatt - The Potential for Trade Between Israel the Palestinians, and Jordan. 94.10

B. Eden - Inflation and Price Dispersion: An Analysis of Micro Data. 94.13

B. Eden - Time Rigidities in The Adjustment of Prices to Monetary Shocks: An Analysis of Micro Data. 94.16

O. Yosha - Privatizing Multi-Product Banks. 94.17

B. Eden - Optimal Fiscal and Monetary Policy in a Baumol-Tobin Model. 95.01

B. Bar-Nathan, M. Beenstock and Y. Haitovsky - An Econometric Model of The Israeli Housing Market. 95.02

A. Arnon and A. Spivak - A Seigniorage Perspective on the Introduction of a Palestinian Currency. 95.04

M. Bruno and R. Melnick - High Inflation Dynamics: Integrating Short-Run Accommodation and Long-Run Steady-States. 95.06

M. Strawczynski - Capital Accumulation in a Bequest Economy. 95.08

A. Arnon and A. Spivak - Monetary Integration Between the Israeli, Jordanian and Palestinian Economies. 95.11

| | |
|---|---|
| A. Blass and R. S. Grossman - A Harmful Guarantee? The 1983 Israel Bank Shares Crisis Revisited. | 96.03 |
| Z. Sussman and D. Zakai - The Decentralization of Collective Bargaining and Changes in the Compensation Structure in Israeli`s Public Sector. | 96.04 |
| .M. Strawczynski - Precautionary Savings and The Demand for Annuities | 96.05 |
| Y. Lavi and A. Spivak - The Impact of Pension Schemes on Saving in Israel: Empirical Analysis. | 96.09 |
| M. Strawczynski - Social Insurance and The Optimum Piecewise Linear Income Tax. | 96.10 |
| M. Dahan and M. Strawczynski - The Optimal Non-Linear Income Tax. | 97.02 |
| H. Ber, Y. Yafeh and O. Yosha - Conflict of Interest in Universal Banking: Evidence from the Post-Issue Performance of IPO Firms. | 97.05 |
| A. Blass, Y. Yafeh and O. Yosha - Corporate Governance in an Emerging Market: The Case of Israel. | 97.08 |
| N. Liviatan and R. Melnick - Inflation and Disinflation by Steps in Israel. | 98.01 |
| A. Blass, Y. Yafeh - Vagabond Shoes Longing to Stray - Why Israeli Firms List in New York - Causes and Implications. | 98.02 |
| G. Bufman, L. Leiderman - Monetary Policy and Inflation in Israel. | 98.04 |
| Z. Hercowitz and M. Strawczynski - On the Cyclical Bias in Government Spending. | 98.06 |
| A. Brender - The Effect of Fiscal Performance on Local Government Election Results in Israel: 1989-1998. | 99.04 |
| S. Ribon and O. Yosha - Financial Liberalization and Competition In Banking: An Empirical Investigation. | 99.05 |
| L. Leiderman and H. Bar-Or - Monetary Policy Rules and Transmission Mechanisms Under Inflation Targeting in Israel. | 2000.01 |
| Z. Hercowitz and M. Strawczynski - Public-Debt / Output Guidelines: the Case of Israel. | 2000.03 |
| Y. Menashe and Y. Mealem - Measuring the Output Gap and its Influence | 2000.04 |

on The Import Surplus.

| | |
|---|---|
| J. Djivre and S. Ribon - Inflation, Unemployment, the Exchange Rate and Monetary Policy in Israel 1990-1999: A SVAR Approach. | 2000.06 |
| J. Djivre and S. Ribon - Monetary Policy, the Output Gap and Inflation: A Closer Look at the Monetary Policy Transmission Mechanism in Israel 1989-1999. | 2000.09 |
| J. Braude - Age Structure and the Real Exchange Rate. | 2000.10 |
| Z. Sussman and D. Zakai - From Promoting the Worthy to Promoting All: The Public Sector in Israel 1975-1999. | 2000.11 |
| H. Ber, A. Blass and O. Yosha - Monetary Transmission in an Open Economy: The Differential Impact on Exporting and Non-Exporting Firms. | 2001.01 |
| N. Liviatan - Tight Money and Central Bank Intervention (A selective analytical survey). | 2001.03 |
| Y. Lavi, N. Sussman - The Determination of Real Wages in the Long Run and its Changes in the Short Run - Evidence from Israel: 1968-1998. | 2001.04 |
| J. Braude - Generational Conflict? Some Cross-Country Evidence. | 2001.06 |
| Z. Hercowitz and M. Strawczynski, - Cyclical Ratcheting in Government Spending: Evidence from the OECD. | 2001.09 |
| D. Romanov and N. Zussman - On the Dark Side of Welfare: Estimation of Welfare Recipients Labor Supply and Fraud. | 2001.12 |
| A. Blass O. Peled and Y. Yafeh - The Determinants of Israel's Cost of Capital: Globalization, Reforms and Politics. | 2002.03 |
| N. Liviatan - The Money-Injection Function of the Bank of Israel and the Inflation Process. | 2002.04 |
| Y. Menashe - Investment under Productivity Uncertainty. | 2002.07 |
| T. Suchoy and A. Friedman - The NAIRU in Israel: an Unobserved Components Approach. | 2002.08 |
| R. Frish and N. Klein – Rules versus Discretion - A Disinflation Case. | 2002.09 |
| S. Ribon - Is it labor, technology or monetary policy? The Israeli economy 1989-2002. | 2003.02 |

| | |
|---|---|
| A. Marom, Y. Menashe and T. Suchoy - The State-of-The-Economy Index and The probability of Recession: The Markov Regime-Switching Model. | 2003.05 |
| N. Liviatan and R. Frish – Public Debt in a Long Term Discretionary Model. | 2003.07 |
| D. Romanov - The Real Exchange Rate and the Balassa-Samuelson Hypothesis: An Appraisal of Israel's Case Since 1986. | 2003.09 |
| R. Frish - Restricting capital outflow - the political economy perspective. | 2003.10 |
| H. Ber and Y. Yafeh - Venture Capital Funds and Post-IPO Performance in Booms and Busts: Evidence from Israeli IPO's in the US in the 1990s. | 2003.12 |
| N. Klein - Reputation and Indexation in an Inflation Targeting Framework. | 2003.13 |
| N. Liviatan - Fiscal Dominance and Monetary Dominance in the Israeli Monetary Experience. | 2003.17 |
| A. Blass and S. Ribon - What Determines a Firm's Debt Composition – An Empirical Investigation. | 2004.04 |
| R. Sharabany - Business Failures and Macroeconomic Risk Factors. | 2004.06 |
| N. Klein - Collective Bargaining and Its Effect on the Central Bank Conservatism: Theory and Some Evidence. | 2004.07 |
| J. Braude and Y. Menashe - Does the Capital Intensity of Structural Change Matter for Growth? | 2004.10 |
| S. Ribon - A New Phillips Curve for Israel. | 2004.11 |
| A. Barnea and J. Djivre - Changes in Monetary and Exchange Rate Policies and the Transmission Mechanism in Israel, 1989.IV – 2002.I. | 2004.13 |
| M. Dahan and M. Strawczynski - The Optimal Asymptotic Income Tax Rate. | 2004.15 |
| N. Klein - Long-Term Contracts as a Strategic Device. | 2004.16 |
| D. Romanov - The corporation as a tax shelter: evidence from recent Israeli tax changes. | 2004.17 |
| T. Suchoy - Does the Israeli Yield Spread Contain Leading Signals? A Trial of Dynamic Ordered Probit. | 2004.18 |

| | |
|---|---|
| A. Brender - Ethnic Segregation and the Quality of Local Government in the Minorities Localities: Local Tax Collection in the Israeli-Arab Municipalities as a Case Study. | 2005.01 |
| A. Zussman and N. Zussman - Targeted Killings: Evaluating the Effectiveness of a Counterterrorism Policy. | 2005.02 |
| N. Liviatan and R. Frish - Interest on reserves and inflation**.** | 2005.03 |
| A. Brender and A. Drazen - Political Budget Cycles in New versus Established Democracies. | 2005.04 |
| Z. Hercowitz and M. Strawczynski - Government Spending Adjustment: The OECD Since the 1990s. | 2005.09 |
| Y. Menashe - Is the Firm-Level Relationship between Uncertainty and Irreversible Investment Non- Linear? | 2005.12 |
| A. Friedman - Wage Distribution and Economic Growth. | 2005.13 |
| E. Barnea and N. Liviatan - Nominal Anchor: Economic and Statistical Aspects. | 2006.01 |
| A. Zussman, N. Zussman and M. ∅rregaard Nielsen - Asset Market Perspectives on the Israeli-Palestinian Conflict. | 2006.02 |
| N. Presman and A. Arnon - Commuting patterns in Israel 1991-2004. | 2006.04 |
| G. Navon and I. Tojerow - The Effects of Rent-sharing On the Gender Wage Gap in the Israeli Manufacturing Sector. | 2006.05 |
| S. Abo Zaid - The Trade–Growth Relationship in Israel Revisited: Evidence from Annual Data, 1960-2004. | 2006.11 |
| M. Strawczynski and J. Zeira - Cyclicality of Fiscal Policy In Israel. | 2007.04 |
| A. Friedman - A Cross-Country Comparison of the Minimum Wage. | 2007.05 |
| K. Flug and M. Strawczynski - Persistent Growth Episodes and Macroeconomic Policy Performance in Israel. | 2007.08 |
| S. Miaari, A. Zussman and N. Zussman – Ethnic Conflict and Job Separations. | 2008.04 |
| Y. Mazar – Testing Self-Selection in Transitions between the Public Sector and the Business Sector | 2008.07 |

| | |
|---|---|
| A. Brender and L. Gallo – The Response of Voluntary and Involuntary Female Part-Time Workers to Changes in Labor-Market Conditions. | 2008.08 |
| A. Friedman – Taxation and Wage Subsidies in a Search-Equilibrium Labor Market. | 2008.10 |
| N. Zussman and S. Tsur – The Effect of Students' Socioeconomic Background on Their Achievements in Matriculation Examinations. | 2008.11 |
| R. Frish and N. Zussman – The Causal Effect of Parents' Childhood Environment and Education on Their Children's Education. | 2009.02 |
| E. Argov – The Choice of a Foreign Price Measure in a Bayesian Estimated New-Keynesian Model for Israel. | 2009.04 |
| G. Navon – Human Capital Spillovers in the Workplace: Labor Diversity and Productivity. | 2009.05 |
| T. Suhoy – Query Indices and a 2008 Downturn: Israeli Data. | 2009.06 |
| J. Djivre and Y. Menashe – Testing for Constant Returns to Scale and Perfect Competition in the Israeli Economy, 1980–2006. | 2009.07 |
| S. Ribon – Core Inflation Indices for Israel | 2009.08 |
| A. Brender – Distributive Effects of Israel's Pension System. | 2009.10 |
| R. Frish and G. Navon – The Effect of Israel's Encouragement of Capital Investments in Industry Law on Product, Employment, and Investment: an Empirical Analysis of Micro Data. | 2009.12 |
| E. Toledano, R. Frish, N. Zussman, and D. Gottlieb – The Effect of Child Allowances on Fertility. | 2009.13 |
| D. Nathan – An Upgrade of the Models Used To Forecast the Distribution of the Exchange Rate. | 2010.01 |
| A. Sorezcky - Real Effects of Financial Signals and Surprises. | 2010.02 |
| B. Z. Schreiber – Decomposition of the ILS/USD Exchange Rate into Global and Local Components. | 2010.03 |
| E. Azoulay and S. Ribon – A Basic Structural VAR of Monetary Policy in Israel Using Monthly Frequency Data. | 2010.04 |
| S. Tsur and N. Zussman – The Contribution of Vocational High School Studies to Educational Achievement and Success in the Labor Market. | 2010.05 |

| | |
|---|---|
| Y. Menashe and Y. Lavi – The Long- and Short-Term Factors Affecting Investment in Israel's Business-Sector, 1968-2008. | 2010.06 |
| Y. Mazar – The Effect of Fiscal Policy and its Components on GDP in Israel. | 2010.07 |
| P. Dovman – Business Cycles in Israel and Macroeconomic Crises—Their Duration and Severity. | 2010.08 |
| T. Suhoy – Monthly Assessments of Private Consumption. | 2010.09 |
| A. Sorezcky – Did the Bank of Israel Influence the Exchange Rate? | 2010.10 |
| Y. Djivre and Y. Yakhin – A Constrained Dynamic Model for Macroeconomic Projection in Israel. | 2010.11 |
| Y. Mazar and N. Michelson – The Wage Differentials between Men and Women in Public Administration in Israel – An Analysis Based on Cross-Sectional and Panel Data. | 2010.12 |
| A. Friedman and Z. Hercowitz – A Real Model of the Israeli Economy. | 2010.13 |
| M. Graham – CEO Compensation at Publicly Traded Companies. | 2010.14 |
| E. Azoulay and R. Shahrabani – The Level of Leverage in Quoted Companies and Its Relation to Various Economic Factors. | 2010.15 |
| G. Dafnai and J. Sidi – Nowcasting Israel GDP Using High Frequency Macroeconomic Disaggregates. | 2010.16 |
| E. Toledano, N. Zussman, R. Frish and D. Gottleib – Family Income and Birth Weight. | 2010.17 |
| N. Blass, S. Tsur and N. Zussman – The Allocation of Teachers' Working Hours in Primary Education, 2001–2009. | 2010.18 |
| T. Krief – A Nowcasting Model for GDP and its Components. | 2011.01 |
| W. Nagar – Persistent Undershooting of the Inflation Target During Disinflation in Israel: Inflation Avoidance Preferences or a HiddenTarget? | 2011.02 |
| R. Stein – Estimating the Expected Natural Interest Rate Using Affine Term-Structure Models: The Case of Israel. | 2011.03 |
| R. Sharabani and Y. Menashe – The Hotel Market in Israel. | 2011.04 |

A. Brender – First Year of the Mandatory Pension Arrangement: Compliance with the Arrangement as an Indication of its Potential Implications for Labor Supply. 2011.05

P. Dovman, S. Ribon and Y. Yakhin – The Housing Market in Israel 2008-2010: Are Housing Prices a "Bubble"? 2011.06

N. Steinberg and Y. Porath – Chasing Their Tails: Inflow Momentum and Yield Chasing among Provident Fund Investors in Israel. 2011.07

I. Gamrasni – The Effect of the 2006 Market Makers Reform on the Liquidity of Local-Currency Unindexed Israeli Government Bonds in the Secondary Market. 2011.09

L. Gallo – Export and Productivity – Evidence From Israel. 2011.08

H. Etkes – The Impact of Employment in Israel on the Palestinian Labor Force. 2011.11

S. Ribon – The Effect of Monetary Policy on Inflation: A Factor Augmented VAR Approach using disaggregated data. 2011.12

A. Sasi-Brodesky – Assessing Default Risk of Israeli Companies Using a Structural Model. 2011.13

Y. Mazar and O. Peled – The Minimum Wage, Wage Distribution and the Gender Wage Gap in Israel 1990–2009. 2012.01

N. Michelson – The Effect of Personal Contracts in Public Administration in Israel on Length of Service. 2012.02

S. Miaari, A. Zussman and N. Zussman – Employment Restrictions and Political Violence in the Israeli-Palestinian Conflict. 2012.04

E. Yashiv and N. K. (Kaliner) – Arab Women in the Israeli Labor Market: Characteristics and Policy Proposals. 2012.05

E. Argov, E. Barnea, A. Binyamini, E. Borenstein, D. Elkayam and I. Rozenshtrom – MOISE: A DSGE Model for the Israeli Economy. 2012.06

E. Argov, A. Binyamini, E. Borenstein and I. Rozenshtrom – Ex-Post Evaluation of Monetary Policy. 2012.07

G. Yeshurun – A Long School Day and Mothers' Labor Supply. 2012.08

| | |
|---|---|
| Y. Mazar and M. Haran – Fiscal Policy and the Current Account. | 2012.09 |
| E. Toledano and N. Zussman – Terror and Birth Weight. | 2012.10 |
| A. Binyamini and T. Larom – Encouraging Participation in a Labor Market with Search and Matching Frictions. | 2012.11 |
| E. Shachar –The Effect of Childcare Cost on the Labor Supply of Mothers with Young Children. | 2012.12 |
| G. Navon and D. Chernichovsky – Private Expenditure on Healthcare, Income Distribution, and Poverty in Israel. | 2012.13 |
| Z. Naor – Heterogeneous Discount Factor, Education Subsidy, and Inequality. | 2012.14 |
| H. Zalkinder – Measuring Stress and Risks to the Financial System in Israel on a Radar Chart. | 2012.15 |
| Y. Saadon and M. Graham – A Composite Index for Tracking Financial Markets in Israel. | 2013.01 |
| A. Binyamini – Labor Market Frictions and Optimal Monetary Policy. | 2013.02 |
| E. Borenstein and D. Elkayam – The equity premium in a small open economy, and an application to Israel. | 2013.03 |
| D. Elkayam and A. Ilek – Estimating the NAIRU for Israel, 1992–2011. | 2013.04 |
| Y. Yakhin and N. Presman – A Flow-Accounting Model of the Labor Market: An Application to Israel. | 2013.05 |
| M. Kahn and S. Ribon – The Effect of Home and Rent Prices on Private Consumption in Israel—A Micro Data Analysis. | 2013.06 |
| S. Ribon and D. Sayag – Price Setting Behavior in Israel – An Empirical Analysis Using Microdata. | 2013.07 |
| D. Orpaig (Flikier) – The Weighting of the Bank of Israel CPI Forecast—a Unified Model. | 2013.08 |
| O. Sade, R. Stein and Z. Wiener – Israeli Treasury Auction Reform. | 2013.09 |
| D. Elkayam and A. Ilek– Estimating the NAIRU using both the Phillips and the Beveridge curves. | 2013.10 |

| | |
|---|---|
| A. Ilek and G. Segal – Optimal monetary policy under heterogeneous beliefs of the central bank and the public. | 2014.01 |
| A. Brender and M. Strawczynski – Government Support for Young Families in Israel. | 2014.02 |
| Y. Mazar – The Development of Wages in the Public Sector and their Correlation with Wages in the Private Sector. | 2014.03 |
| H. Etkes – Do Monthly Labor Force Surveys Affect Interviewees' Labor Market Behavior? Evidence from Israel's Transition from Quarterly to Monthly Surveys. | 2014.06 |
| N. Blass, S. Tsur and N. Zussman – Segregation of students in primary and middle schools. | 2014.07 |
| A. Brender and E. Politzer – The Effect of Legislated Tax Changes on Tax Revenues in Israel. | 2014.08 |
| D. Sayag and N. Zussman – The Distribution of Rental Assistance Between Tenants and Landlords: The Case of Students in Central Jerusalem. | 2015.01 |
| A. Brender and S. Ribon –The Effect of Fiscal and Monetary Policies and the Global Economy on Real Yields of Israel Government Bonds. | 2015.02 |
| I. Caspi – Testing for a Housing Bubble at the National and Regional Level: The Case of Israel. | 2015.05 |
| E. Barnea and Y. Menashe – Banks Strategies and Credit Spreads as Leading Indicators for the Real Business Cycles Fluctuations. | 2015.07 |
| R. Frish – Currency Crises and Real Exchange Rate Depreciation. | 2016.01 |
| V. Lavy and E. Sand – On the Origins of Gender Gaps in Human Capital: Short and Long Term Consequences of Teachers' Biases. | 2016.02 |
| R. Frish – The Real Exchange Rate in the Long Term. | 2016.03 |
| A. Mantzura and B. Schrieber – Carry trade attractiveness: A time-varying currency risk premium approach. | 2016.04 |
| I. Caspi and M Graham – Testing for Bubbles in Stock Markets With Irregular Dividend Distribution. | 2016.06 |

| | |
|---|---|
| E. Borenstein, and D. Elkayam – Financial Distress and Unconventional Monetary Policy in Financially Open Economies. | 2016.09 |
| S. Afek and N. Steinberg – The Foreign Exposure of Public Companies Traded on the Tel Aviv Stock Exchange. | 2016.10 |
| R. Stein – Review of the Reference Rate in Israel:Telbor and Makam Markets. | 2016.12 |
| N. Sussmana and O. Zoharb – Has Inflation Targeting Become Less Credible? Oil Prices, Global Aggregate Demand and Inflation Expectations during the Global Financial Crisis. | 2016.13 |
| E. Demalach, D. Genesove A. Zussman and N Zussman – The Effect of Proximity to Cellular Sites on Housing Prices in Israel. | 2016.14 |
| E. Argov – The Development of Education in Israel and its Contribution to Long-Term Growth Discussion Paper. | 2016.15 |
| S. Tsur – Liquidity Constraints and Human Capital: The Impact of Welfare Policy on Arab Families in Israel. | 2017.01 |
| G. Segal – Interest Rate in the Objective Function of the Central Bank and Monetary Policy Design. | 2017.02 |
| N. Tzur-Ilan – The Effect of Credit Constraints on Housing Choices: The Case of LTV limit. | 2017.03 |
| A. Barak – The private consumption function in Israel | 2017.04 |
| S. Ribon – Why the Bank of Israel Intervenes in the Foreign Exchange Market, and What Happens to the Exchange Rate. | 2017.04 |
| E. Chen, I. Gavious and N. Steinberg – Dividends from Unrealized Earnings and Default Risk. | 2017.05 |
| A. Ilek and I. Rozenshtrom – The Term Premium in a Small Open Economy: A Micro-Founded Approach. | 2017.06 |
| A Sasi-Brodesky – Recovery Rates in the Israeli Corporate Bond Market 2008–2015. | 2017.07 |

D. Orfaig – A Structural VAR Model for Estimating the Link between Monetary Policy and Home Prices in Israel. 2017.09

M. Haran Rosen and O. Sade – Does Financial Regulation Unintentionally Ignore Less Privileged Populations? The Investigation of a Regulatory Fintech Advancement, Objective and Subjective Financial Literacy. 2017.10

E. Demalach and N. Zussman – The Effect of Vocational Education on Short- and Long-Term Outcomes of Students: Evidence from the Arab Education System in Israel. 2017.11

S. Igdalov, R. Frish and N. Zussman – The Wage Response to a Reduction in Income Tax Rates: The 2003–2009 Tax Reform in Israel. 2017.14

Y. Mazar – Differences in Skill Levels of Educated Workers between the Public and Private Sectors, the Return to Skills and the Connection between them: Evidence from the PIAAC Surveys. 2018.01

Itamar Caspi, Amit Friedman, and Sigal Ribon – The Immediate Impact and Persistent Effect of FX Purchases on the Exchange Rate. 2018.04

D. Elkayam and G Segal – Estimated Natural Rate of Interest in an Open Economy: The Case of Israel. 2018.05

N. B. Itzhak ¯ The Effect of Terrorism on Housing Rental Prices: Evidence from Jerusalem 2018.08

M. Rosenboim, Y. Saadon, B. Z. Schreiberc - "Much Ado about Nothing"? The Effect of Print Media Tone on Stock Indices 2018.10