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***El efecto disposición: un estudio longitudinal
para inversores particulares e institucionales en
el mercado belga en diferentes condiciones de
mercado***

***The disposition effect: a longitudinal study for
private and institutional investors in the Belgian
market in different market circumstances***

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Table of Contents

Abstract	5
Resumen	6
1. Introduction	7
1.1. Introduction in English	7
1.2. Introducción en Español	11
2. Theoretical background	15
2.1. Antecedents of Prospect Theory	15
2.2. The Disposition Effect	22
2.3. Prospect Theory and the Disposition Effect	29
3. Hypotheses	31
4. Data, descriptive statistics and definition of bull- and bear markets	37
4.1. General	37
4.2. Descriptive statistics	40
4.3. Definition of bull- and bear markets	45
5. Methodology	49
5.1. General	49
5.2. Odean Method	51
5.3. Survival Analysis Method	53
5.3.1. Methodology	53
5.3.2. Variables	54
5.3.3. The Model	58
6. Results	61
6.1. The Belgian market as a whole	61

6.2.	Per individual investor category	70
6.3.	Bull- and Bear markets	80
6.4.	Gender	83
6.5.	Sophistication	85
6.5.1.	Education level	86
6.5.2.	Trading size	87
6.6.	Robustness checks:	89
6.6.1.	Size of gains and losses	89
6.6.2.	Taking dividends into account	94
7.	Conclusions and reflections	95
7.1.	Conclusions and reflections in English	95
7.2.	Conclusiones y reflexiones en Español	100
8.	References	105
Appendix 1:	Software codes	111
1.1.	Matlab codes	111
1.2.	RStudio codes	185
2.2.1.	Code for Investment Bank	185
2.2.2.	Code for Discount Broker	192

Abstract

Using two different methodologies, the Odean method for some hypotheses and survival analysis for others, the disposition effect has been studied for four different investor categories on a very long dataset from Belgium, a country which is tax neutral with regard to capital gains and losses. Then the dataset is divided in bull- and bear periods and the same analysis is done in those different market circumstances.

Overall our results support the existence of disposition effect for the Belgian market, although not all the financial agents participating in the market exhibit the same grade of this behavioral bias: private individuals show a stronger disposition effect than institutional investors but no real ranking can be deduced for the four different investor categories. During bear markets this disposition effect even seems to be aggravated.

Finally we show that gender influences the investment behavior and investor sophistication, measured here by education level and trading size, do not appear to have any influence on trading decisions.

Resumen

Empleando dos metodologías diferentes, el método Odean para algunas hipótesis y el análisis de supervivencia para otras, se ha estudiado el efecto disposición para cuatro categorías diferentes de inversores en base a una serie muy larga de datos de Bélgica, un país neutro a efectos fiscales en relación con las ganancias y pérdidas patrimoniales. Posteriormente se divide la serie de datos en periodos al alza y a la baja, y se realiza el mismo análisis en dichas condiciones diferentes de mercado.

En general, nuestros resultados apoyan la existencia del efecto disposición en el mercado belga, aunque no todos los agentes financieros que participan en el mercado muestran el mismo grado de este sesgo de comportamiento: los particulares muestran un efecto disposición más fuerte que los inversores institucionales, pero no puede deducirse una clasificación real para las cuatro categorías distintas de inversores. Durante los mercados a la baja, este efecto disposición incluso parece agravarse.

Para finalizar, mostramos que el género influye en el comportamiento de las inversiones y que la sofisticación de los inversores, aquí medida en base a su nivel educativo y tamaño comercial, no parece ejercer ninguna influencia en las decisiones comerciales.

1. Introduction

1.1 Introduction in English

Evidence of the disposition effect, selling winning stocks too early and keeping losing stocks too long, has been found for all type of investors, from pure private investors (*Odean, 1998*), to those managed by brokerage professionals (*Shapira & Venezia, 2001*), institutional investors (*Grinblatt & Keloharju, 2001*), mutual funds (*Cici, 2012*) and professional traders (*Locke & Mann, 2005*). Most of these studies, however, have been done for short data periods, on different datasets and in markets where capital gains taxes are causing tax-induced selling.

This study will examine the disposition effect on a long dataset (2001 until 2014) in Belgium, a country where all capital gains are tax-free and capital losses not tax deductible. The disposition effect will be compared among four different investor categories: private individuals not receiving professional investment advice, those who do receive advice, private individuals under discretionary management and institutional investors. The same comparison will then be tested in bull market conditions as well as in bear market conditions. Furthermore the disposition effect will be examined by gender and sophistication, here defined, on the basis of available data, by education level and trading size. Finally robustness checks will be performed for the disposition effect for different magnitudes of gains and losses and after taking dividends into account.

The disposition effect is not just an anomaly in the financial markets, but is important for 4 different reasons:

(1) Since most countries have capital gains taxes, investors pay more of these taxes than necessary since they realize too quickly their gains and let their losses run. Realizing losses alone or in combination with gains would be more tax efficient, however, non-investors should be happy, while paying too much capital gains taxes could be seen as a wealth transfer to the society as a whole, which is thus better off. *Poterba* (1987), showed that roughly two-thirds of all investors in 1982 and 1983 in the US only reported taxable gains in their tax returns. No research has been done so far into the exact magnitude of the extra taxes paid because of the disposition effect.

(2) The disposition effect would hinder investors from making profits, discouraging individuals to save and invest (leaving them more vulnerable to unforeseen events and hampering the wealth buildup for the retirement age). *Odean* (1998), *Shumway & Wu* (2005) and *Seru et al.* (2010) showed that the focus of investors on the initial purchase price or average purchase price of a specific stock instead of its future potential, results in inferior performance. *Locke & Mann* (2005) found a strong disposition effect among professional traders, however they did not find inferior trading results to this effect.

(3) One of the strongest anomalies in the financial markets, the momentum effect (*Jegadeesh & Titman*, 1993) may be linked to the disposition effect as shown first by *Grinblatt & Han* (2005). This momentum effect stems from underreaction to new information hitting the market. When investors are in gains on a specific stock position and new positive information hits the market, disposition prone investors will sell the stock and the climbing of the stock price will be halted by them. Inversely, as bad news hits the market, investors sitting

on a loss will not sell and will thus not further push the stock price down and eventually even stall the selling pressure. This may lead in the short term to undervalued asset prices in an upward market and to overvalued prices in a downward market. In the long term the fundamental stock value and the market value will converge again.

(4) Linked to the above, the volatility of a stock will decrease because of the disposition prone investors selling positions in an upward market and not selling in a downward market. Both *Lakonishok & Smidt (1986)* and *Statman, Thorley & Vorkink (2006)* find a positive relation between trading volume and the past returns of a stock, which is consistent with the disposition effect having an impact on trading volume and thus volatility of a stock. *Goetzmann & Massa (2006)* show that a stronger disposition effect leads to lower returns, smaller trading volume and less volatility at the individual stock level.

This study will contribute to the existing literature for several reasons, namely (a) the database is over a very long period with real transactional data instead of merely holding data (*Frazzini, 2006; Hur et al., 2010; Cici, 2012*); (b) only two other studies so far (*Firth, 2015; Shapira & Venezia, 2001*) have studied the disposition effect in a tax neutral environment but only for private individuals; (c) 4 different investor categories in the same country will be studied at the same time: private individuals without investment advice, private individuals under discretionary management, private individuals with investment advice and institutional investors (mostly mutual funds); (d) the investor group private individuals receiving investment advice has so far only been studied over a one year period in Israel by *Shapira & Venezia (2001)* and

never in a long database and compared to other institutional investors; (e) all investor groups will be tested in both bull- and bear markets separately; (f) for the first time the impact of education and gender on the disposition effect is studied¹ (g) all calculations will be done using both the Odean methodology and the survival method, which is here a combination of LOGIT regressions and a Weibull hazard function. For clear reasons explained below, some hypotheses will be tested with the Odean methodology as the primary methodology and with the survival method as a consistency check, and for other hypotheses, just the opposite.

¹ The only study that covers gender impact on disposition effect is *Cheng, Lee & Lin (2013)* who show in Taiwan that women show a stronger disposition effect than men.

1.2. Introducción en Español

Se han encontrado pruebas del efecto disposición, vender acciones ganadoras demasiado pronto y conservar acciones perdedoras durante demasiado tiempo, para todo tipo de inversores, desde inversores privados puros (*Odean*, 1998), hasta los gestionados por profesionales del corretaje (*Shapira & Venezia*, 2001), inversores institucionales (*Grinblatt & Keloharju*, 2001), fondos de inversión (*Cici*, 2012) y comerciantes profesionales (*Locke & Mann*, 2005). La mayoría de estos estudios, sin embargo, se han realizado por periodos cortos de datos, en diferentes series de datos y en mercados donde los impuestos sobre el patrimonio están causando ventas por motivos fiscales.

El presente estudio examinará el efecto disposición en una serie larga de datos (desde 2001 hasta 2014) en Bélgica, un país donde toda ganancia patrimonial está exenta de impuestos y toda pérdida patrimonial es no deducible de impuestos. El efecto disposición se comparará entre cuatro categorías de inversores distintas: los particulares que no reciben asesoramiento profesional sobre inversiones, aquellos que sí reciben asesoramiento, los particulares sujetos a gestión discrecional y los inversores institucionales. La misma comparación se pondrá a prueba posteriormente en condiciones de mercado alcista. Asimismo, se examinará el efecto disposición por género y sofisticación, aquí definidos, en base a los datos disponibles, por nivel educativo y tamaño comercial. Para finalizar se llevarán a cabo comprobaciones de la robustez del efecto disposición para diferentes magnitudes de ganancias y pérdidas tras tener en cuenta los dividendos.

El efecto disposición no es solo una anomalía en los mercados

financieros, sino que es importante por 4 razones distintas:

(1) Dado que la mayoría de los países poseen impuestos sobre el patrimonio, los inversores pagan más de estos impuestos de lo necesario ya que se percatan demasiado rápido de sus ganancias y dejan correr sus pérdidas. Percatarse de las pérdidas por si solas o en combinación con las ganancias sería más eficiente fiscalmente, sin embargo, los no inversores deberían alegrarse, mientras que pagar demasiados impuestos sobre el patrimonio podría verse como una transferencia de riqueza a la sociedad en su conjunto, lo cual es, por lo tanto, mejor. *Poterba* (1987), mostró que aproximadamente dos tercios de todos los inversores en 1982 y 1983 solamente en los Estados Unidos reflejaron ganancias imponibles en sus declaraciones de impuestos. No se ha realizado investigación alguna hasta la fecha sobre la magnitud exacta de los impuestos extra pagados debido al efecto disposición.

(2) El efecto disposición podría dificultar a los inversores el obtener beneficios, desalentando a las personas de ahorrar e invertir (dejándolas más vulnerables a los eventos imprevistos y obstaculizando la acumulación de riqueza para la edad de jubilación). *Odean* (1998), *Shumway & Wu* (2005) y *Seru et al.* (2010) mostraron que el foco de los inversores en el precio de compra inicial o el precio medio de compra de una acción específica en lugar de en su potencial futuro da como resultado un rendimiento inferior. *Locke & Mann* (2005) encontraron un fuerte efecto disposición entre comerciantes profesionales, sin embargo no hallaron resultados comerciales inferiores a este efecto.

(3) Una de las más fuertes anomalías en los mercados financieros, el efecto impulso (*Jegadeesh & Titman, 1993*) puede estar vinculado al efecto disposición tal y como lo muestra primero *Grinblatt & Han (2005)*. Este efecto impulso proviene de la reacción insuficiente a la nueva información que llega al mercado. Cuando los inversores están en ganancias en una posición de acciones específica y llega al mercado nueva información positiva, los inversores con tendencia a la disposición venderán las acciones y la subida del precio de las acciones será detenida por ellos. De forma inversa, cuando llegan malas noticias al mercado, los inversores que estén sentados sobre una pérdida no venderán y por tanto no empujarán hacia más abajo el precio de las acciones y finalmente incluso paralizarán la presión de venta. Esto puede conducir a corto plazo a la infravaloración de los precios de los activos en un mercado al alza y a la sobrevaloración de los precios en un mercado a la baja. A largo plazo, el valor fundamental de las acciones y el valor de mercado convergerán de nuevo.

(4) En relación con lo anterior, la volatilidad de una acción disminuirá debido a que los inversores con tendencia a la disposición vendan posiciones en un mercado al alza y no vendan en un mercado a la baja. Tanto *Lakonishok & Smidt (1986)* como *Statman, Thorley & Vorkink (2006)* encuentran una relación positiva entre volumen de comercio y los beneficios pasados de una acción, la cual es coherente con que el efecto disposición tenga impacto en el volumen de comercio y por tanto en la volatilidad de una acción. *Goetzmann & Massa (2006)* muestran que un efecto disposición más fuerte conduce a beneficios inferiores, un volumen de comercio más bajo y menos volatilidad a

nivel de acciones individuales.

El presente estudio contribuirá a la literatura existente por varias razones, a saber (a) la base de datos abarca un periodo muy extenso con datos de transacciones reales en lugar de simplemente contener datos (*Frazzini, 2006; Hur et al., 2010; Cici, 2012*); (b) únicamente otros dos estudios hasta la fecha (*Firth, 2015; Shapira & Venezia, 2001*) han estudiado el efecto disposición en un entorno fiscal neutro pero solo para particulares; (c) se estudiarán 4 categorías distintas de inversores en el mismo país al mismo tiempo: los particulares sin asesoramiento sobre inversiones, los particulares sujetos a gestión discrecional, los particulares con asesoramiento sobre inversiones y los inversores institucionales (mayoritariamente fondos de inversión); (d) el grupo de inversores de particulares que reciben asesoramiento sobre inversiones hasta la fecha solo ha sido estudiado por un periodo de un año en Israel por *Shapira & Venezia (2001)* y nunca en una base de datos larga y en comparación con otros inversores institucionales; (e) todos los grupos de inversores se analizarán tanto en mercados alcistas como bajistas por separado; (f) por primera vez se estudia el impacto de la educación y el sexo en el efecto disposición² (g) todos los cálculos se realizarán empleando tanto la metodología Odean como el método de supervivencia, que es aquí una combinación de regresiones LOGIT y una función de riesgo Weibull. Por razones claras expuestas más abajo, algunas hipótesis se pondrán a prueba con la metodología Odean como metodología

² El único estudio que cubre el impacto del género en el efecto disposición es *Cheng, Lee & Lin (2013)*, quienes muestran en Taiwán que las mujeres manifiestan un efecto disposición más fuerte que los hombres.

principal y con el método de supervivencia como comprobante de coherencia, y para otras hipótesis se hará justo lo contrario.

2. Theoretical background:

2.1. Antecedents of Prospect Theory

The notion of efficient financial markets has been raised for the first time in a mathematics dissertation by *Louis Bachelier* (1900), a paper which was actually largely ignored until *Eugene Fama* wrote his PhD dissertation at the University of Chicago Booth School of Business in the early 1960s, in which he developed the so-called “*Efficient Market Hypothesis (EMH)*”.

Numerous empirical analyses tried to prove that the EMH did not hold under all circumstances, that there are so-called anomalies: a regular pattern in an asset’s return, which is regular, reliable, widely known and inexplicable. Examples of some of these anomalies are

- the Value Line Anomaly (also called Value Line Enigma). Value Line is a service that ranks stocks from 1 to 5 for timeliness and *Copeland & Mayers* (1982) have shown that group 1 consistently outperform group 2, which at its turn consistently outperforms group 3 and so on;
- Short-term return-reversal strategies (*Rosenberg, Reid & Lanstein*, 1985; *Chan*, 1988; *Lehmann*, 1990; and *Lo & MacKinlay*, 1990)
- Medium-term momentum strategies (*Jegadeesh*, 1990; *Jegadeesh & Titman*, 1993; and *Chan, Jegadeesh & Lakonishok*, 1996);
- Stocks with low price-to-earnings ratio outperform other stocks (*Nicholson* 1968, *Basu* 1977 and *Rosenberg, Reid & Lanstein*,

1985);

- Calendar effects, such as holiday, weekend and turn-of-the-month seasonalities (*Lakonishok & Smidt, 1988*) and the January-effect (*Rozeff & Kinney, 1976, Keim, 1983 and Roll, 1983*).
- the “size effect” showing that small-capitalization stocks have consistently higher expected returns than large capitalization stocks (*Banz, 1981*)³;

The Subjective Expected Utility (SEU) also received some early critics by *Allais* (1953) but was widely accepted until cognitive psychologists started to study the behavior and preferences of market participants in the capital markets from the 1960s onwards⁴ and showed that cognitive biases could cause investors to act irrationally and therefore cause market inefficiencies. The most well known behavioral biases where market participants appear to form beliefs in practice and thus depart from the SEU, are the following:

- Overconfidence (*Fischhoff, Slovic & Lichtenstein, 1977; Barber & Odean, 2001; Gervais & Odean, 2001*): most people tend to be overconfident in their judgements;
- Overreaction (*de Bondt & Thaler, 1985*): most people tend to overreact to unexpected and dramatic news events;

³ Most part of the literature claims that the stock price premium associated with this anomaly is a compensation for unobserved risk factors (e.g. Fama and French (1992))

⁴ Earlier, Selden (1912) became aware of the effect of behavioral biases in financial markets claiming that “Both the panic and the boom are eminently psychological phenomena. This is not saying that fundamental conditions do not at times warrant sharp declines in prices and at other times equally sharp advances.” (p. 69).

- Representativeness heuristic (*Tversky & Kahneman, 1974; Barberis, Shleifer & Vishny, 1998*): some people think they see patterns in truly random sequences leading to overreaction;
- Conservatism (*Barberis, Shleifer & Vishny, 1998*): some people are slow to change their beliefs in face of new evidence leading to underreaction;
- Belief perseverance (*Lord, Ross & Lepper, 1979*): once people have formed an opinion on something, they generally hold on to it tightly and for too long.
- Anchoring (*Tversky & Kahneman, 1974*): some people tend to rely too heavily on the first piece of information offered (“the anchor”) when making decisions
- Availability biases (*Tversky & Kahneman, 1974*): more recent and especially more salient events, weigh more heavily and distort the estimates;
- Endowment effect also called Divestiture Aversion (*Thaler, 1980*): people tend to attach more value to certain things merely because they own them - investors tend to fix selling prices significant higher than buying prices for the same stocks;
- Status quo bias (*Knetsch & Sinden, 1984; Samuelson & Zeckhauser, 1988; Knetsch, 1989*): people tend to treat costs of moving away from status quo as a loss looms larger than the gain of alternative options and will therefore more frequently stay at

the status quo than predicted by expected utility theory;

- Loss aversion (*Kahneman & Tversky, 1979; Shefrin & Statman, 1985; Odean, 1998*): people tend to strongly prefer avoiding losses than acquiring gains.

Given all these violations of the expected utility theory, there have been a great number of attempts for developing a descriptive model of choice matching the experimental evidence. Of all these, the most promising and now widely accepted theory in Finance is Prospect Theory described in the paper “*Prospect theory: An Analysis of Decision under Risk*” by *Kahneman & Tversky (1979)*, showing various divergences of economic decision making from expected utility theory, consisting of an editing stage and an evaluation stage. In 1992 both authors refined the theory by only looking at the evaluation stage allowing for non-linear cumulative probability weighting and called it Cumulative Prospect Theory.

Kahneman & Tversky (1979) propose that when people are offered a gamble

$$(x, p; y, q),$$

meaning that one could either get outcome x with probability p or outcome y with probability q , and where $x \leq 0 \leq y$ or $y \leq 0 \leq x$, people assign it a value of

$$\pi(p) v(x) + \pi(q) v(y) \tag{2}$$

where v is shown in figure 1a and π in figure 1b below:

figure 1a: value function v^5

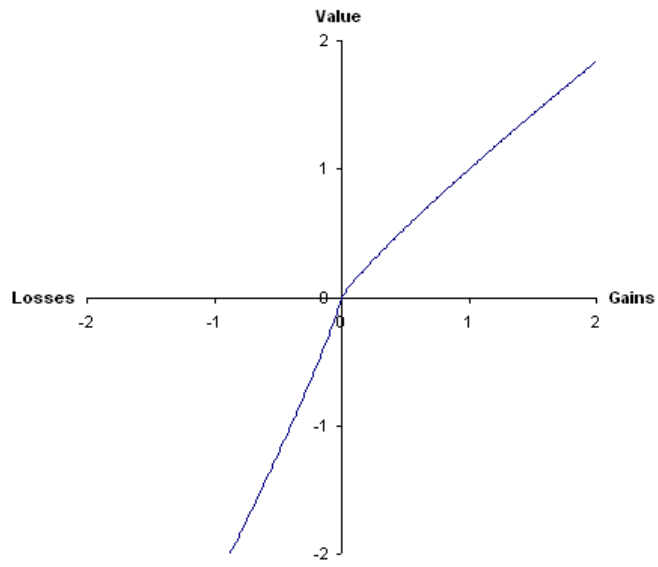
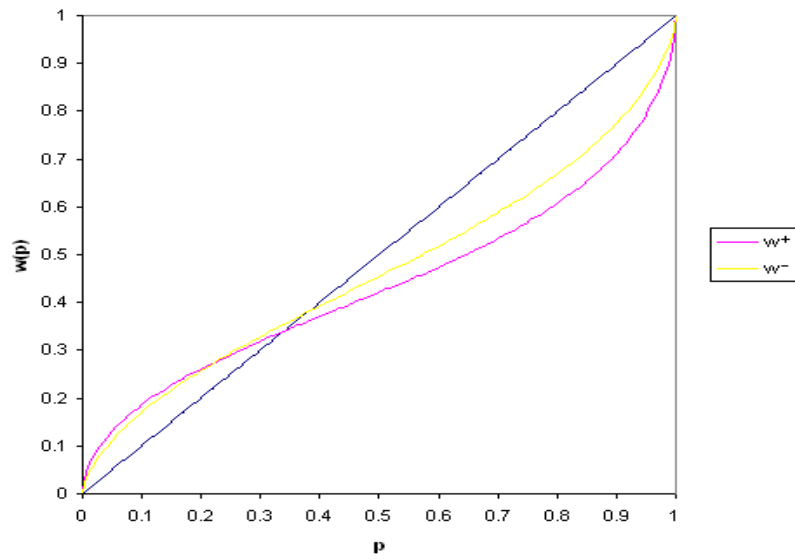


figure 1b: probability weighting function π



⁵ Both figures 1a and 1b have been copied from www.behaviouralfinance.net

In figure 1a it is shown that the value function, which is dependent on final wealth in expected utility theory while in Prospect Theory it is defined in gains and losses, has an S-shape: concave for gains and convex, and steeper, for losses. The probability function π is not linear as p in the expected utility theory, but is overweighting outcomes that are merely probable and underweighting outcomes, which are more certain, clearly showing the risk aversion of people when they are in gains and risk seeking when they are in losses (this is also called the reflection effect). The effects above shown by Prospect Theory can be summarized by the so-called four elements of Prospect Theory: (1) reference-dependence; (2) loss aversion; (3) diminishing sensitivity and (4) probability weighting.

In 1992, *Tversky & Kahneman* adjusted their model from 1979 and included cumulative decision weights instead of separable ones and they called their new model Cumulative Prospect Theory. Specifically, if a gamble promises outcome x_i with probability p_i , they propose that people assign the gamble the following value:

$$\sum_{i=-m}^n \pi_i v(x_i) \tag{3}$$

where

$$v = \begin{cases} x^\alpha & \text{if } x \geq 0 \\ -\lambda(-x)^\alpha & \text{if } x < 0 \end{cases}$$

and

$$\begin{aligned} \pi_n^+ &= w^+(p_n), \quad \pi_{-m}^- = w^-(p_{-m}), \\ \pi_i^+ &= w^+(p_i + \dots + p_n) - w^+(p_{i+1} + \dots + p_n), \quad 0 \leq i \leq n-1, \\ \pi_i^- &= w^-(p_{-m} + \dots + p_i) - w^-(p_{-m} + \dots + p_{i-1}), \quad 1-m \leq i \leq 0, \end{aligned}$$

$$w^+(p) = \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{1/\gamma}}, \quad w^-(p) = \frac{p^\delta}{(p^\delta + (1-p)^\delta)^{1/\delta}}$$

Tversky & Kahneman (1992) use experimental evidence to estimate $\alpha = 0,88$, $\lambda = 2,25$, $\gamma = 0,61$ and $\delta = 0,69$, where α is the risk attitude coefficient capturing the marginally decreasing aspect (diminishing sensitivity) of the value function, δ is the weighting function coefficient causing concavity when decreased and γ is the weighting function coefficient causing convexity when increased and λ is the coefficient of loss aversion, a measure of the relative sensitivity to gains and losses. These values have been generally accepted and used in most subsequent studies.⁶

More recently, *Lo* (2004, 2012) tried to reconcile the EMH with the different behavioral alternatives such as among others the disposition effect by applying the evolution principles – competition, adaptation and natural selection – to financial interactions and called it the Adaptive Markets Hypothesis (AMH). The five main implications of the AMH are: (1) the relationship between risk and return is existent but not stable over time; (2) arbitrage opportunities do exist from time to time; (3) investment strategies will perform well in certain environments and poor in others; (4) innovation is key to survival and therefore one has to adapt to changing market conditions to

⁶*Levy & Levy* (2002) are among few dissonant researchers rejecting the S-shaped value function as proposed by Prospect Theory and find support for the reverse S-shape thru an experimental study.

improve returns; (5) survival is the only objective that matters, profit- and utility maximization are second.

Lo (2004, p.20) describes how this evolutionary dynamic is able to reconcile in some extent the contradictions between the EMH and the empirical behavioral biases: “The former may be viewed as the steady-state limit of a population with constant environmental conditions, and the latter involves specific adaptations of certain groups that may or may not persist, depending on the particular evolutionary paths that the economy experiences”. According to *Fabozzi et al* (2008, p.7) the AMH assumes that the action of investors does not eliminate the forecast ability but changes price patterns and opens new profit opportunities that are discovered through a continuous process of trial and error. Although a promising new way of looking at things, it has not been widely picked up by many other academics so far.

2.2. The Disposition Effect

Numerous studies find evidence in favor of the disposition effect in financial markets: selling winning stocks too early and keeping losing stocks too long.

Weber & Camerer (1998) confirmed the disposition effect in securities trading with an extensive experimental analysis among German engineering, business and economy students. The design of the study was such that the students could rationally deduce which shares they should be least eager to sell, being the share which has most risen frequently and was probably most likely to rise further given this design. In other words a disposition effect would

be a mistake in this setting, nevertheless the students exhibited this effect.

Odean (1998) also showed that the disposition effect was actually present in the stock market. He developed a method to compare the proportion of the realized gains to the proportion of realized losses, using the trading records for 10.000 accounts at a large US discount brokerage house for the period 1987-1993, showing that investors demonstrated a strong preference to realize winners instead of losers, except around the end of the year when they prefer to realize losses rather than gains because of tax-motivated selling.

A similar study was conducted by *Shapira & Venezia* (2001) looking at the data of only one year (1994) of an Israeli brokerage firm and comparing the behavior of individuals making their own independent investment decisions to those investors whose accounts were managed by brokerage professionals in a tax free environment. They used a method developed by *Schlarbaum, Lewellen & Lease* (1978) where the duration of losing round trips was compared to winning ones. They do observe a disposition effect for both groups but a significantly weaker one for those clients managed by investment professionals, which makes them to conclude that professional training and experience may reduce judgmental biases but cannot eliminate them.

Firth (2015) is the other study, although rather limited in analysis, looking specifically at the disposition effect in a tax neutral environment (Singapore). He shows that the disposition effect is present and continuous throughout the year without any significant differences between the calendar months.

In addition to the disposition effect *Grinblatt & Keloharju* (2001) look for the determinants of the buy- or sell decisions by using LOGIT regressions over a data set from Finland covering a two-year period (end of 1994 until beginning of 1997). They find again proof of the disposition effect and tax-loss selling at the end of the fiscal year, furthermore they show that past returns and historical patterns do affect the trading. Stocks with large positive returns in the past and stocks where the prices are near the months' high, are more likely to be sold than others. Negative past returns are affecting the buy-sell decision more than positive past returns. They conclude that the propensity to sell is the result of an interaction between the disposition effect and past returns.

Feng & Seasholes (2005) examined the effect of sophistication and experience on the disposition effect and they find support that it eliminates the reluctance to realize losses but does not eliminate the propensity to realize gains. The methodology they developed was based on the LOGIT regressions of *Grinblatt & Keloharju* (2001) combined with a Weibull hazard function in order to calculate the propensity to sell at a daily level. They claim that this method performs better at the individual account level and produce more smooth and continuous variables for regressions than the *Odean* (1998) method. *Seru, Shumway & Stoffman* (2010) find that sophistication diminishes the disposition effect but does not eliminate it totally. They show that investors learn to improve their ability over time ("*learning by doing*") and that investors learn about their inherent ability by trading ("*learning about ability*"). Various other studies find that professional traders, whom we may assume to be sophisticated, and experienced individual or institutional investors, still show a

disposition effect although to a lesser extent than for inexperienced investors: *Locke & Mann* (2005) for CME traders, *Brown, Chappel, da Silva Rosa & Walter* (2006) for various investor classes in Australia, *Chen, Kim, Nofsinger & Rui* (2007) for Chinese investors, *Choe & Eom* (2009) for Korean Futures Exchange participants, *Jin & Scherbina* (2011) and *Cici* (2012) for US mutual fund managers.

Some works have studied the link between the disposition effect and momentum. *Shumway & Wu* (2005) show that Chinese investors exhibit the disposition effect as well, that more disposition-prone investors tend to trade less frequently and in smaller sizes than other investors and that the disposition effect drives momentum. The link between momentum and the disposition effect has also been shown by *Hur, Pritamani & Sharma* (2010) and *Birru* (2015), although the latter points out that momentum cannot be explained by the disposition effect alone.

Cheng, Lee & Lin (2013) studied data from 2003 until 2007 on the Taiwan Futures Exchange and concluded that a bear market shows a stronger disposition effect and that women and mature traders exhibit a stronger disposition effect than men and younger persons. *Borghesi* (2013), shows that gamblers betting on NBA (National Basketball Association) games on an online trading exchange between 2000 and 2008 also show a tendency to hold on to losers and sell winners prematurely.

A more detailed view on the disposition effect looking at different holding periods and different levels of positive and negative returns, comes from *Ben-David & Hirshleifer* (2012). Their findings, using the trading data of retail

investors of *Odean* (1998), show that investors' selling propensity is an asymmetric V-shaped function of past profits: the probability to sell increases as the magnitude of the gains or losses increases, with a larger slope on the gains side than on the loss side. This is indicating that the disposition effect should not be interpreted as a proof of a direct preference of realizing winners above losers and that the disposition effect is not a consequence of a selling discontinuity around zero.

This asymmetric V-shape has been confirmed by *An & Argyle* (2015) for mutual fund managers: every 1% increase in the magnitude of unrealized gains or losses for a specific stock, is associated with a 1,49 bps higher probability of selling for gains and 0,63 bps in case of losses.

Subsequently, *An* (2016) suggests that stocks with both large unrealized gains and unrealized losses will experience higher selling pressure, pushing down prices temporarily and leading to higher subsequent returns.

Another study specifically looking at institutional investors is done by *Pengfei Ye* (2014) who not only finds a strong disposition effect for institutional investors of target companies in takeovers but also that this disposition effect of this type of investors has an impact on both the takeover price as well as on the deal success of those takeovers.

Another interesting contribution came from *Rau* (2015), who showed thru an experimental study that two-person teams exhibit a more pronounced disposition effect than investors trading alone. This is especially interesting while in this dissertation private investors are compared to institutional investors, private individuals receiving investment advice and private investors

under discretionary management. Typical about institutional investors and managed accounts is that the investment decisions are often taken through investment committees, or, in other words, teams of investment professionals.

The use of stop-loss orders was examined by *Richards et al.* (2015), showing that it diminishes the disposition effect. They also found that sophisticated investors, which they define as investors not only trading stocks but also warrants, are less prone to the disposition effect.

Finally, *Chang, Solomon & Westerfield* (2016) examined the difference of the disposition effect per asset-class and found, using the same data as *Barber & Odean* (2000), that there is a disposition effect in individual stocks, no significant disposition effect in passively managed funds, like index funds, and a reverse disposition effect in actively managed funds.

Table 1 below summarizes the characteristics and main results of different disposition effect studies per type of investor.

Table 1: Overview of different studies and main results of studies on DE

Authors	Year	Methodology	Sample	Duration (yrs)	Market	Tax Neutral	Type investors	Results
Odean	1998	Odean	10.000 accounts, 162.948 transactions	7	US	No	1	PGR/PLR=1,51 and <1 in December => tax selling
Grinblatt & Keloharju	2001	Hazard	number of accounts/transactions not disclosed	2	Finland	No	1,4	DE and tax-loss selling, two major determinants of propensity to sell
Shapira & Venezia	2001	Schlarbaum	1.642 no advice accounts, 2.688 with advice accounts	1	Israel	Yes	1,3	both types show DE, but no advice significantly stronger
Garvey & Murphy	2004	Schlarbaum	one team of 15 professional proprietary traders	0,25	US	No	4	strong DE for professional traders
Goetzmann & Massa	2004	Hazard	same database as Odean (1998), 100 largest US stocks	6	US	No	1	negative correlation between DE and return, volatility and volume
Coval & Shumway	2005	Hazard	1.082 market makers in T-bond futures at CBOT	1	US	No	4	strong loss aversion
Feng & Seasholes	2005	Hazard	1.511 accounts, 21.631 round-trip transactions	2	China	No	1	sophistication and experience together (not alone) eliminate reluctance to realize losses, but do not reduce propensity to realize gains
Locke & Mann	2005	Schlarbaum	2 currency and 2 commodity futures at CME, 329 traders	1	US	No	4	strong DE, but not affecting trading results
Shumway & Wu	2005	Hazard	13.460 accounts	3	China	No	1	stronger DE results in lower performance, less frequent trading and trading in smaller sizes
Brown et al.	2006	Odean	450 IPO, 380 index stocks, estimated transaction data	5	Australia	No	1,4	PGR/PLR= 1,59 (IPO stocks), PGR/PLR=2,33 (index stocks)
Dhar & Zhu	2006	Odean	7.965 accounts, 697.746 transactions	5	US	No	1	PGR/PLR= 2,24; wealthier investors less DE, strong tax effect
Frazzini	2006	Odean	no transaction data, 29.812 mutual funds	13	US	No	4	PGR/PLR= 1,15
Chen et al.	2007	Odean	49.969 private accounts, 212 institutional	4	China	No	1,4	PGR/PLR= 1,68 (private inv.); PGR/PLR= 1,15 (institutionals)
Choe & Eom	2009	Odean	KOSPI200 indexfutures, 69.391 traders, 22mln trades	2	Korea	No	1,4	PGR/PLR= 1,19 professional futures traders (institutional and private)
Hur et al.	2010	Hazard	no transaction data, sample of NYSE/AMEX	19	US	No	1	stocks more held by private individuals, show stronger DE
Kaustia	2010	Hazard	same database as Grinblatt & Keloharju	5,5	Finland	No	1	DE not driven by Prospect theory
Jin & Scherbina	2011	Hazard	6.640 mutual funds, 30.895 different managers		US	No	4	continuing fund managers show DE, when new manager comes opposite DE
Birru	2012	Hazard	66.465 accounts	5	US	No	1	DE present before stock split, not thereafter
Cici	2012	Odean	no transaction data, 3.268 mutual funds	30	US	No	4	a team of managers show stronger DE than a single manager
Ben-David & Hirshleifer	2012	Hazard	same as Odean: 10.000 accounts, 162.948 transactions	7	US	No	1	V-shaped DE: propensity to sell increases with magnitude of gains and losses
Cheng, Lee & Lin	2013	Odean variation	stocks listed on TAIFEX (futures), 116.471 accounts	4	Taiwan	No	1	Women stronger DE than men, stronger DE in bear markets
An & Argyle	2015	Hazard	Mutual funds holding data from Thomson Reuters	32	US	no	4	V-shaped DE confirmed for mutual fund managers; no real transaction data
Firth	2015	Odean	4.800 investors with 460.000 mutual fund transactions	11	Singapore	Yes	1	PGR/PLR=1,50; DE present and no seasonality
Richards, et al.	2015	Hazard	169.608 trades for 4.328 online broker clients	3,5	UK	No	1	UK investors show strong DE, sophisticated inv. and inv. with stop-losses less
de Groot	2017	Odean/Hazard	201.620 accounts; 900.608 transactions	14	Belgium	Yes	1,2,3 & 4	

Type of investors: (1) Private, no advice; (2) Private, under management; (3) Private, with advice; (4) Institutional

2.3. Prospect Theory and the Disposition Effect

Prospect Theory has been applied in a lot of different areas, such as consumption-savings decisions, industrial organization, labor supply, insurance and last but not least financial markets, where the most interesting applications are: (1) why some securities have higher average returns than others (*Barberis & Huang, 2008*); (2) the equity premium puzzle (*Benartzi & Thaler, 1993*) and (3) the disposition effect (*Shefrin & Statman, 1985; Odean, 1998; Barberis & Xiang, 2009*).

Shefrin & Statman developed in 1985 in their seminal article “*The Disposition to Sell Winners Too Early and to Ride Losers Too Long: Theory and Evidence*” a theory they called “A Positive Theory of Selling Winners and Riding Losers” based on Prospect Theory and 3 other elements:

1. Mental Accounting (*Thaler, 1980*): Investors appear not to have their whole portfolio in mind when deciding whether to buy or sell stocks, but are putting the different stocks in different mental accounts and will then apply prospect theoretic decision rules, with the stock purchase price as the natural reference point, to each account individually without considering possible interactions between the accounts.

2. Regret Aversion (*Bell, 1982; Gross, 1982*): *Gross* suggests that investors may resist the realization of a loss because it would prove that their first judgement was wrong and would cause regret, while closing a stock account at a profit would result in pride. People tend to quest for pride and want to avoid regret naturally and they feel that as long as a loss is not realized, there is still a chance that it turns out to be a winner. In making investment decisions, investors do not feel pride or regret for their whole portfolio, but for each stock account separately.

3. Self-Control (*Thaler & Shefrin, 1981*): Self-Control is an intra-personal conflict between a rational part (a planner) and an emotional part (a doer), where the planner may not be strong enough to prevent the emotional reactions of the doers and will thus not avoid the reluctance to realize losses and gains. Setting iron clad rules and restrictions, such as stop loss orders and tax induced selling, will force proper self-control upon investors and will force taking losses.

Mental Accounting and Regret Aversion appear to be positively related to the disposition effect, whereas Self-Control is negatively related to it (*Sun & Hsiao, 2006*).

This theory of *Shefrin & Statman (1985)* explains why investors are less inclined to take losses, but are more willing to take profits, which is thought to be caused by investors becoming more risk averse after prior gains and more risk seeking after prior loss experiences.

Opposite to *Shefrin & Statman (1985)*, *Kaustia (2010)* concludes that Prospect Theory is unlikely to explain the disposition effect by using the same database as *Grinblatt & Keloharju (2000, 2001)*, claiming that the propensity to sell is constant, thus not convex or concave, over a wide range of losses and gains and that it jumps around zero.

Barberis & Xiang (2009) formalize the link between prospect theory and disposition effect through a model that studies the trading behavior of investors with prospect theory preferences. They find that when investors preferences distinguish between paper and realized gains and losses, prospect theory do predict disposition effect.

3. Hypotheses

The disposition effect has been shown in many countries: United States (*Odean, 1998; Goetzmann & Massa, 2004; Coval & Shumway, 2005; Locke & Mann, 2005; Frazzini, 2006; Dhar & Zhu, 2006; Hur et al., 2010; Birru, 2012; and others*), Finland (*Grinblatt & Keloharju, 2001; Kaustia, 2010*), China (*Feng & Seasholes, 2005; Shumway & Wu, 2005; Chen et al., 2007*), Korea (*Choe & Eom, 2009*), Taiwan (*Cheng, Lee & Lin, 2013*), Singapore (*Firth, 2015*) and the UK (*Richards et al., 2015*) but most with rather short data periods, some with only holding data instead of transactional data, for one specific group of investors per study and above all in taxable environments. In a tax neutral environment only two studies have been done: *Shapira & Venezia (2001)* conducted a study in Israel but with one-year data only for private investors with and without advice, and *Firth (2015)* in Singapore only for private investors without advice. Therefore more research in such a tax neutral environment for all investor categories and with long data might be interesting. I predict that there will be a disposition effect in Belgium and even stronger than in countries with taxable capital gains and tax deductible losses, because of the absence of any tax motivated selling.

H1: Investors in Belgium in general do exhibit a strong disposition effect throughout the year with no significant difference between the months.

Most research on the disposition effect has been done on databases of private investors (*Odean, 1998; Goetzmann & Massa, 2004; Feng & Seasholes, 2005; Shumway & Wu, 2005; Dhar & Zhu, 2006, Hur et al., 2010; Kaustia, 2010; Birru, 2012 and Cheng, Lee & Lin, 2013*) and institutional or professional investors (*Garvey & Murphy, 2004; Coval & Shumway, 2005; Locke & Mann, 2005; Frazzini, 2006; Jin & Scherbina, 2011; and Cici, 2012*). In a few studies the same database contained information on both private investors and institutionals/professionals enabling them to compare both categories (*Grinblatt & Keloharju, 2001; Brown et al., 2006; Chen et al., 2007; and Choe & Eom, 2009*). *Shapira & Venezia (2001)* compared private investors receiving investment advice to those not receiving advice using the same one-year data. Private investors under discretionary management have never been studied as a separate group. Institutional and professional investors obviously have a better knowledge about investments and in several studies it has been shown that their disposition effect is much smaller and in some cases even non-existent (*Grinblatt & Keloharju, 2001; Frazzini, 2006; Chen et al., 2007; Hur et al., 2010*). Private investors receiving investment advice also have a better knowledge of investments and show a smaller disposition effect (*Shapira & Venezia, 2001; Dhar & Zhu, 2006*).

The assets of private investors under discretionary management are managed by investment bank employees under a specific mandate, just like the assets of the mutual funds in this database. However, those employees belong to different departments within the bank and those managing private

individuals accounts do know these individuals and do report regularly to them personally, whereas the end-investors of the mutual funds are unknown and thus anonymous to the mutual fund manager. I expect therefore that the disposition effect of the clients under management is slightly higher than from the category institutional and professional investors.

My expectation therefore is that a ranking can be made from the investor group with the strongest disposition effect, the private individuals not receiving investment advice, followed by those receiving investment advice, then the private investors under discretionary management and finally institutional investors with the lowest or no disposition effect.

H2: The four investor groups under study can be classified from the strongest to the weakest disposition effect as follows:

- 1. Private investors without investment advice (strongest DE)*
- 2. Private investors with investment advice*
- 3. Private investors under discretionary management*
- 4. Institutional investors (weakest DE)*

Bull markets are generally defined as periods when the market has risen 20% from a local minimum and bear markets as periods when the market has lost 20% from a local maximum (*Dukes, Bowlin & MacDonald, 1987*), however, the way the exact turning points are determined is another discussion to be held in chapter 4 of this dissertation. Only some research has

been done so far on whether the disposition effect is different under the various states of the stock market. *Cheng, Lee & Lin (2013)* show on the TAIEX (Taiwan Futures Exchange) that the disposition effect is stronger in a bear market. However, *Lee, Yen & Chan (2013)* demonstrate for Taiwanese mutual funds that the disposition effect holds for moderate capital gains and losses, but that it does not for extreme capital losses: investors redeem their mutual fund units more under a bear market, having extreme losses, than under a bull market. They suggest therefore future research to further study the impact of different market states on the disposition effect. My third hypothesis thus is:

H3: The disposition effect is stronger in bear markets than in bull markets for every individual investor category

Gender differences in investment behavior have been shown in both psychology studies as in behavioral finance ones. *Barber and Odean (2001)* show that men trade 45% more than women, and that trading costs reduce men's net returns by 2,65 percentage points a year, as opposed to 1,72 percentage points for women. *Cheng, Lee & Lin (2013)* have shown in Taiwan that women show a stronger disposition effect than men.

H4: Gender has an effect on the disposition effect; men and women do have a significantly different disposition effect from each other

The effect of investor sophistication and experience on the disposition effect has been tested by several authors but how to measure this sophistication varies widely among these studies. The following (demographic and other) variables have been used: professional occupation (*Shapira & Venezia, 2001; Dhar & Zhu, 2006*), initial diversification of the portfolio (*Feng & Seasholes, 2005*), portfolio value and or trading size (*Brown et al., 2006; Dhar & Zhu, 2006; Chen et al., 2007; Seru, Shumway & Stoffman, 2010*) and the complexity of the products traded (*Feng & Seasholes, 2005*). All these proxies used have been shown to reduce the disposition effect significantly.

In our two datasets (described in next section) there are two variables which might be linked to sophistication and experience: the education level which is specified for some investors in the discount broker database and trading size for both databases. The effect of education on the disposition effect, has never been studied so far.

It can be argued that the higher the education, the higher the level of sophistication of an investor, and also that the higher the transaction size, the higher the sophistication and experience of an investor.

H5: Sophistication and experience do have an impact on the disposition effect: (a) the higher the education, the higher the sophistication and the lower the disposition effect; and (b) the higher the trading size, the higher the sophistication and experience and thus the lower the disposition effect.

4. Data, descriptive statistics and definition of bull- and bear markets

4.1. General

This study will use the data from two different sources in Belgium over the period January 1, 2001 until December 31, 2014, the largest Belgian investment bank and discount broker. The reason for using different sources was to get as much information of real transactions as possible for the most important players in the Belgian market: (1) private investors acting without investment advice; (2) private investors under discretionary management, (3) private investors acting with investment advice and (4) institutional investors and mutual funds. Both sources have a specific strength in one or more of the type of investors: the largest Belgian investment bank for especially private investors with investment advice, under discretionary management and for institutional investors and its own mutual funds and finally the largest Belgian discount and online broker for mainly private investors without investment advice.

Most countries have a tax system in place where capital gains are taxable and capital losses tax deductible. *Badrinath & Lewellen* (1991) already found a strong seasonal pattern in trading behavior with loss realizations disproportionately heavy near the end of the calendar year, while both *Odean* (1998) and *Dhar & Zhu* (2006) showed numerically that there is a strong disposition effect in the months January thru November and none (*Dhar & Zhu*) or even an opposite (*Odean*) disposition effect in the month of December alone. The disposition effect leads to suboptimal trading behavior

since for tax purposes investors should postpone taxable gains and hold on to their profitable investments or realize them together with losses for tax optimization, while they are doing the opposite, but in December. *Firth* (2015), using data from tax-neutral Singapore, shows that the dispositions effect is present and continuous throughout the year without any significant differences between the calendar months for private investors.

Belgium is another interesting financial market for this study since it is completely tax-neutral for all four investor types. A stronger disposition effect is thus expected in this tax-neutral environment than in a taxable one, as well as no difference in the realization of gains and losses towards the end of the fiscal year.

Our data set of 14 years will allow to study the disposition effect over time and for two different types of market conditions: bull markets and bear markets.

The 20 Belgian stocks with the largest market capitalization and free float are used to compose the capitalization weighted-index called the BEL-20, which is reviewed annually, on the basis of three criteria: (1) market capitalization, (2) free float and (3) liquidity (traded volume). During the period 2001 until 2014, the composition of the index changed several times. It is important for this study to have liquid stocks with a substantial market capitalization in order to be followed on the equity research side by institutional investors and therefore I selected those stocks, which have been part of the BEL-20 index for the full data period. There are 13 stocks, which are meeting all these criteria and those were withheld. One stock, Belgacom-

Proximus, had its IPO in the beginning of 2004 and was almost immediately included in the BEL-20 and has been withheld as well. The data includes volume of the transaction, direction (buy or sell) and transaction price which are combined with external market data from Bloomberg.

Table 2: The 14 stocks in order of Market Capitalization (in 1.000 mln EUR) on 31/12/15

Name	Ticker	ISIN code	Market Cap	Sector
AB-InBev	ABI.BR	BE0003793107	180,6	Brewing
KBC	KBC.BR	BE0003565737	22,8	Banking
UCB	UCB.BR	BE0003739530	15,4	Pharmaceuticals
GBL	GBLB.BR	BE0003797140	10,4	Holding
Belgacom-Proximus	PROX.BR	BE0003810273	9,6	Telephone
Delhaize	DELB.BR	BE0003562700	9,1	Supermarkets
Ageas	AGS.BR	BE0003801181	8,6	Insurance
Solvay	SOLB.BR	BE0003470755	7,7	Chemical
Colruyt	COLR.BR	BE0003775898	6,7	Supermarkets
Ackermans & Van Haaren	ACKB.BR	BE0003764785	4,2	Holding
Umicore	UMI.BR	BE0003884047	3,9	Materials
Cofinimmo	COFB.BR	BE0003593044	2,0	Real Estate
D'leteren	DIE.BR	BE0003669802	1,8	Automotive
Bekaert	BEKB.BR	BE0003780948	1,5	Steel wire

The Belgian market is characterized by a few larger stocks and many small stocks and by good liquidity in the bigger stocks but very limited liquidity in the small stocks with big bid-offer spreads. Over the time period in consideration here the market capitalization of the BEL-20 index compared to the Belgian All Share Index (“BELAS”) fluctuates between 82 and 90%. The 14 stocks (“BEL-14”) withheld in this study are the stocks, which have been part of the BEL-20 index for the whole time period and represent between 77% and 86% of the market capitalization of the BELAS. The correlation of

the BEL-20 over these 14 years with the BELAS is 95,5% and significant with a 1% confidence interval (two-tailed) and the correlation of the BEL-14 with the BELAS is a significant 87,1% with a 1% confidence interval (two-tailed):

Correlations

		BELAS	BEL20	BEL14
BELAS	Pearson Correlation	1	.955**	.871**
	Sig. (2-tailed)		.000	.000
	N	3332	3332	3332
BEL20	Pearson Correlation	.955**	1	.735**
	Sig. (2-tailed)	.000		.000
	N	3332	3332	3332
BEL14	Pearson Correlation	.871**	.735**	1
	Sig. (2-tailed)	.000	.000	
	N	3332	3332	3332

** . Correlation is significant at the 0.01 level (2-tailed).

Given the above, I think that the sample of 14 stocks in this study represents a good and not significantly biased sample of the Belgian stock market in general.

4.2 Descriptive statistics

Both databases are quite substantial (Investment bank file has 183.912 trading records and Discount broker file 716.696) and therefore a closer look at each will help in better understanding them and in deciding how to use them in this research. In table 3 below, an overview is given for the number of different accounts and the number of transactions for all different categories:

Table 3: Number of accounts and transactions per type of client

	Investment Bank		Discount Broker	
	# of diff. accounts	# of transactions	# of diff. accounts	# of transactions

Private:	no advice	8.916	79.555	44.460	716.696
	with advice	337	3.249	0	0
	under management	8.383	95.777	0	0
	Institutional investors	54	5.331	0	0
Total		17.690	183.912	44.460	716.696

As can be seen above, the number of accounts and transactions of private clients receiving advice from the investment bank is rather limited and further analysis has to be performed to determine whether the results for this specific category will be statistically significant.

During the full period under study, there have been a large number of accounts active for both databases as a whole and the total traded volume has been high during the whole period as well, with clearly a peak towards the start of the financial crisis in 2008, dropping thereafter to the levels of the beginning of the sample period. For the Investment Bank database specifically, the private clients with investment advice are only becoming substantial in number of accounts as from 2005, whereas in the same database the private clients with no investment advice are diminishing strongly since 2006.

In the database of the discount broker a distinction is made for the education level and the gender of the account holder: of the 44.460 accounts 37.988 (85%) is male, 6.222 (15%) is female and 250 no gender specified; 2.204 of the account holders specified secondary school as their highest education level, 6.331 has a university or college degree and 35.925 did not specify any education level. As an additional check, I will investigate whether education level and gender have an impact on the disposition effect.

Figure 2: Evolution of total accounts

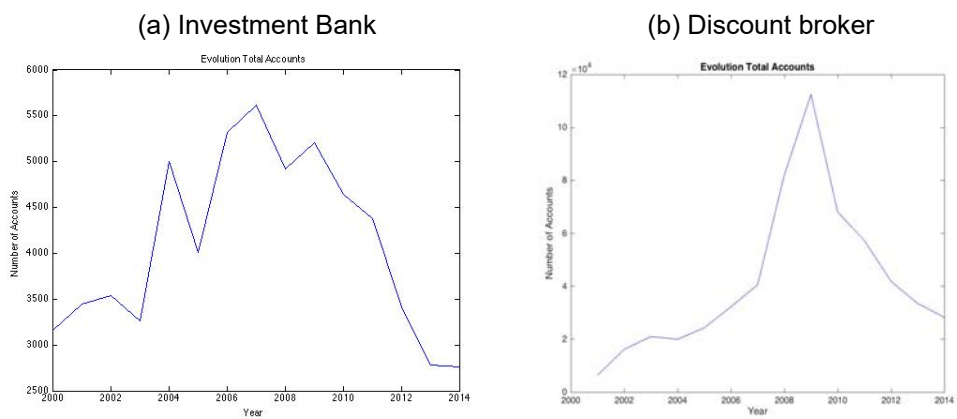
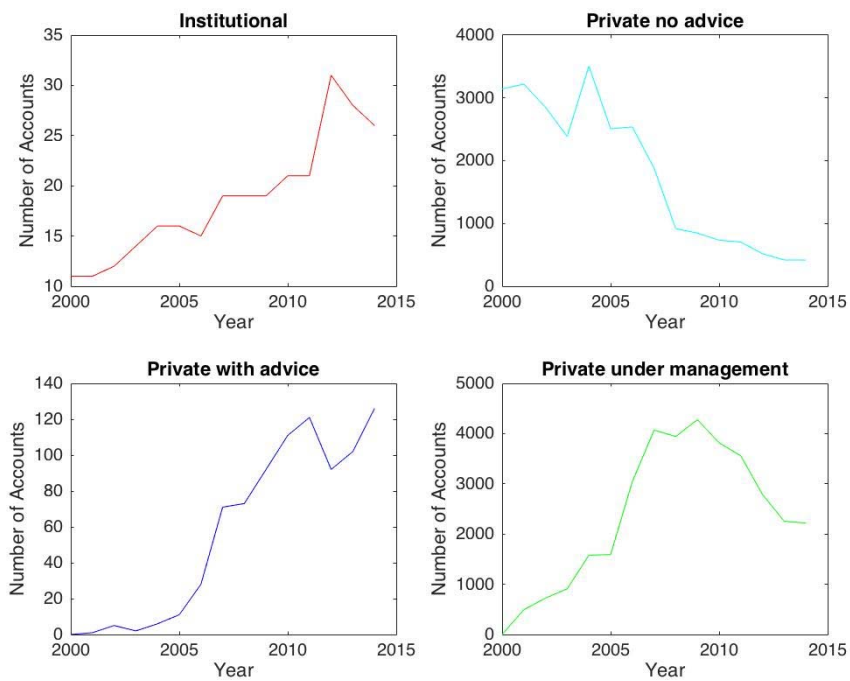


Figure 3: Evolution of number of accounts per category (investment bank)



In both databases the number of transactions per account are substantial, except for the category private individuals with no investment advice in the database of the investment bank, where the trading activity is limited to a small number of accounts. The discount broker only has private individuals without investment advice as clients and they show a high trading activity for a very large number of different accounts. In table 4 below, the trading activity is shown for the different categories of the investment bank.

Table 4: Number of transactions per account per category (Investment Bank)

# of transactions	Institutional	Private		
		No Advice	Advice	Under Mngmt
1 - 5	12	5013	199	3200
6 - 10	9	1718	45	1858
10 - 50	16	2061	84	3241
50 - 100	4	92	9	76
100 - 200	2	22	0	8
> 200	11	10	0	0
Total	54	8916	337	8383

Since I am not investigating the transactions at an individual account level, but rather per group as a whole, and also during periods of no transactions thru paper gains and losses, the fact that large numbers of accounts show a limited number of transactions, should not have any negative impact on this study.

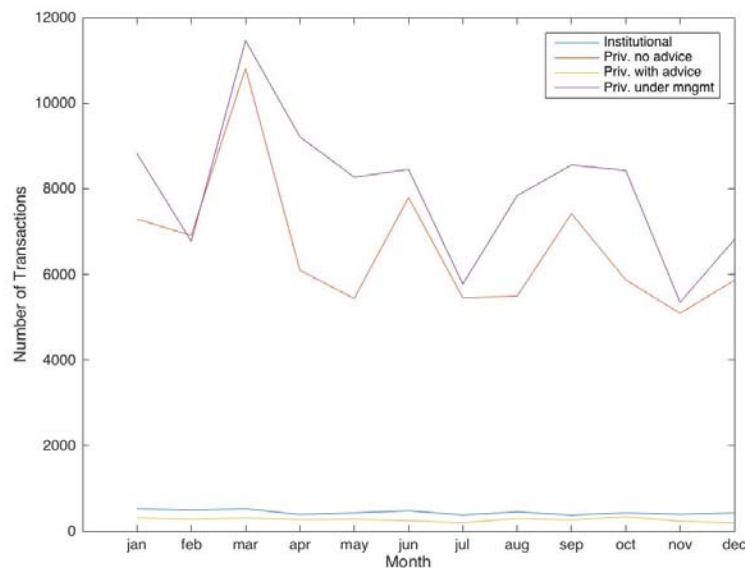
Table 5: Number of transactions per account (Discount broker)

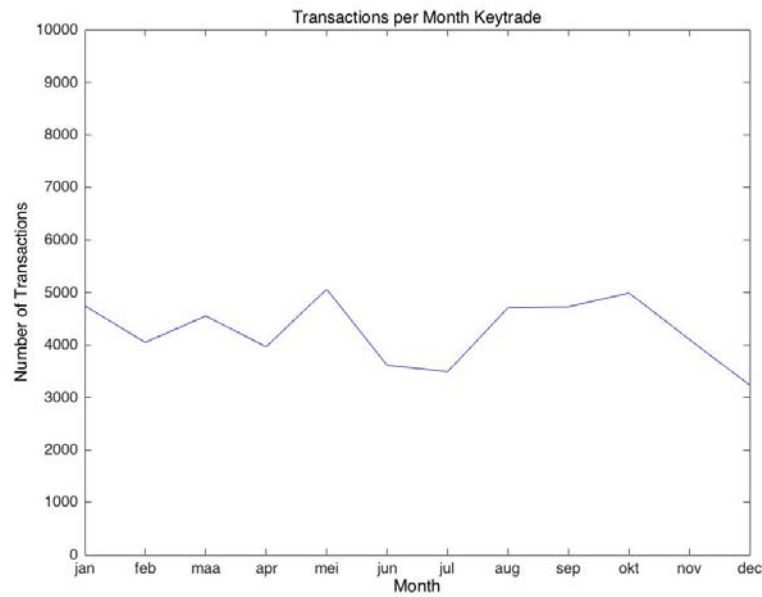
# of transactions	# of accounts
1 - 5	22.150
6 - 10	8.026

10 – 50	11.571
50 – 100	1.702
100 – 200	706
> 200	305
Total	44.460

As was shown in the literature review, all research except two on the Disposition effect so far has been done in markets where there is no tax neutrality and where as a consequence tax induced selling appears towards the end of the fiscal year. In Belgium where there is tax neutrality for gains and losses, no specific pattern can be observed in none of the two databases here under study. The transactions seem to be unrelated to the calendar month and definitely to the fact that a fiscal year-end is approaching.

Fig. 5: number of transactions per calendar month
 Top = Investment bank; Bottom = Discount broker





4.3 Definition of bull- and bear markets

Dukes, Bowlin & MacDonald (1987) defined bull- and bear markets as follows: A period is called a bull market when the market has risen 20% from a local minimum and a bear market when the market has lost 20% from a local maximum, this definition is also generally applied by most market practitioners.

An alternative method for identifying these turning points is the Hamilton regime switching (*Hamilton, 1989* and *Maheu & McCurdy, 2000*), defining bull markets as high return and stable states and bear markets as low return and volatile states. *Gordon & St-Amour (2000)* in their turn define bull- and bear markets as periods of low or high risk aversion respectively, using a two-state Markov preference regime. These turning points are not directly observable, but implied by the estimation of their model.

Bry & Boschan (1971) refined the definition of bull- and bear markets by stating that markets go from a bull to a bear state if prices have declined by 20% for a substantial period since their previous (local) peak. Sequences of negative price movements during a bull market, or of positive movements during a bear market, are thus not ruled out by this method, but extra rules have to be included to restrict the extent of these movements. The algorithm they developed is a pattern-recognition program which isolates patterns by applying a sequence of rules. The first rule is one of finding the location of potential peaks and bottoms by comparing it to the surrounding points. Then as a second rule the duration is measured between these points and censoring rules are applied restricting the minimal lengths of any phase as well as those of complete cycles.

The most commonly used method in determining the turning points, is the one developed by *Pagan & Sossounov* (2003) who adapted the *Bry & Boschan* (1971) algorithm above by imposing a 4-month minimum duration clause per cycle, unless the 20% move occurred within a month, as a censoring rule.

Applying this method to the BEL-20 over the period 1991-2015 is giving the following bull- and bear periods:

Table 7: Bull- and bear periods for BEL-20

Date	BEL20	Rule 1:	Rule 2:	State switch	State
		Location +/- 20%	Duration		
06/01/99	3681.92	Top		n/a	Bull
04/08/99	2945.02	-20%, start bear mkt?	D<4mths	no	Bull
21/01/00	2930.97	-20%, start bear mkt?	D>4mths	yes	Bear

12/03/03	1426.59	Bottom		no	Bear
21/03/03	1764.39	+20% within month	D>4mths	yes	Bull
23/05/07	4756.82	Top		no	Bull
16/01/08	3801.37	-20%, start bear mkt?	D>4mths	yes	Bear
06/03/09	1527.27	Bottom		no	Bear
15/04/09	1848.33	+20% within month	D>4mths	yes	Bull
17/02/11	2770.81	Top		no	Bull
05/08/11	2177.91	-20%, start bear mkt?	D>4mths	yes	Bear
24/11/11	1916.26	Bottom		no	Bear
03/02/12	2304.58	+20%, start bull mkt?	D<4mths	no	Bear
30/07/12	2315.91	+20%, start bull mkt?	D>4mths	yes	Bull

Notes: Rule 1 indicates the day when for the first time the index has gone down by 20% compared to last top, or gone up by 20% compared to last bottom, while Rule 2 measures the time it stays down or up by more than 4 months. If both rules are met, there is a state switch

In table 7 above, first rule 1 is applied to find the locations where the market has moved by at least 20% since the last top or bottom, and then the second rule is applied being that the duration has to be at least 4 months unless the 20% move occurred within a month. In other words: if the market moved by more than 20% and the duration of this move was less than 4 months and did not occur within 1 month, the state of the market will not switch from bull to bear or from bear to bull. When the move was maintained for at least 4 months or the move happened within 1 month, the market state switched from bull to bear or vice versa.

5. Methodology

5.1. General

The methodologies used in the various studies on the disposition effect, can be grouped in three streams with, in a few cases, slight variations of the original method: (1) *Odean* (1998) comparing the proportion of realized gains with the proportion of realized losses; (2) *Schlarbaum et al.* (1978) comparing the duration of losing round trips to winning ones and (3) a survival analysis method based on *Feng & Seasholes* (2005).

Table 6 classifies the studies reviewed in section 2 according to these methodologies.

Table 6: Disposition studies per methodology used

Odean	Schlarbaum	Survival analysis
Odean (1998)	Shapira & Venezia (2001)	Goetzmann & Massa (2004)
Goetzmann & Massa (2004)	Locke & Mann (2005)	Feng & Seasholes (2005)
Brown et al. (2006)		Coval & Shumway (2005)
Dhar & Zhu (2006)		Shumway & Wu (2006)
Frazzini (2006)		Kaustia (2010)
Chen et al. (2007)		Hur et al. (2010)
Choe & Eom (2009)		Seru et al. (2010)
Cici (2012)		Birru (2015)
Cheng, Lee & Lin (2013)		Richards et al. (2015)
Meng (2014)		
Firth (2015)		

The Odean (sometimes also called ratio analysis) method has a strong logic and is especially applicable when testing for a disposition effect on average for a specific dataset without looking at the individual account level.

When we want to test the disposition effect for specific investors with a particular trait, like gender, education level or trading size, we have to go to the individual account level and divide the dataset on that basis. The survival analysis is particularly suited for this by using these demographic variables as a control variable in the regression.

In this study, hypotheses 1 – 3 are looking at the disposition effect for the whole dataset or parts of it, without the necessity to go to the individual account level. Therefore the Odean methodology will be used to test these hypotheses, and the survival analysis of Feng & Seasholes will only be used as a consistency check. Hypotheses 4 and 5 look at the individual account level because for every account it is checked whether the holder is male or female, what its highest education level is or what the average trading size is. The survival analysis is therefore the appropriate methodology to test these hypotheses and Odean will merely be used as a consistency check.

The database starts at the 1st of January 2001 and I do not have access to the account history before that date, so in case an account starts after January 1, 2001 with a sales transaction, this is normally linked to a buying transaction before that date, since the two institutions (discount broker and investment bank) did not offer any stock borrowing to its clients back in 2001 (and actually still not now), making it impossible for them to start with a net short position. Therefore I assume that each investor has no position at the first day of the data period and starts to accumulate positions from that day or from the moment the investor becomes active if that is a later date and I will thus not take any sells into account in the beginning whenever these

would put the total position in a net short one.

5.2 Odean method

For every increase in the shareholding for stock i , the investor's weighted average purchase price is recalculated and for every decrease in the shareholdings of stock i , a realized gain or realized loss is recorded, by taking the product of the shares sold and the difference between the closing price of stock i on day t and the weighted average purchase price of stock i . For days without any transactions for a certain investor in a specific stock, I record either a paper gain or a paper loss, by comparing the closing price of stock i with the weighted average purchase price for that specific trading day. This is done for every shareholder and for each of the selected 14 stocks in the database. All the gains and losses, both realized and paper, are then summed for each investor and by each of the four investor categories defined above.

In order to determine whether there is a disposition effect and how strong, the proportion of gains realized (PGR) and the proportion of losses realized (PLR) is then calculated as follows:

$$\textit{Proportion of Gains Realized (PGR)} = \frac{\textit{Realized Gains}}{\textit{Realized Gains} + \textit{Paper Gains}}$$

$$\textit{Proportion of Losses Realized (PLR)} = \frac{\textit{Realized Losses}}{\textit{Realized Losses} + \textit{Paper Losses}}$$

If the proportion of gains realized significantly exceeds the proportion of losses realized, it shows that investors are more willing to sell winners and hold on to their losers. The weighted average PGR and PLR for each category will be tested whether it is significantly different from the null hypothesis by using a one-tailed *t*-test⁷. In examining whether the difference between PGR and PLR is significantly different for one group of investors compared to another group of investors, *Welch's t-test* is used since the two samples are independent with unequal variances and unequal sample sizes⁸.

In calculating the weighted average purchase price above, transaction costs are not taken into account, since they are not available in our dataset. They do affect the total gains and losses, but to a limited extent only since they are very low (around 0,3% for a roundtrip). The dividend ratio in the Belgian market hovers around 3% per annum, which is therefore substantial, and in the second robustness check the average purchase price is adjusted in case a dividend is received during the holding period.

The difference between PGR and PLR for all categories will then be ranked and checked whether these ranks are significantly different. If the ranking corresponds to the one defined under hypothesis 2, there will be

⁷ In calculating the *t*-statistics, the standard error for the difference in PGR and PLR is:

$$\sqrt{\frac{PGR(1-PGR)}{n_{rg}+n_{pg}} + \frac{PLR(1-PLR)}{n_{rl}+n_{pl}}}$$

where n_{rg} , n_{pg} , n_{rl} and n_{pl} are the number of realized gains, paper gains, realized losses and paper losses.

⁸ The difference between PGR and PLR for one population (\bar{X}_1) is compared to the difference between PGR and PLR for another population (\bar{X}_2) using the following formula:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}}$$

where s_1^2 and s_2^2 are the sample variances and N_1 and N_2 are the sample sizes

support for this ranking.

The *Pagan & Sossounov* (2003) algorithm is applied to the database in order to divide it in bull- and bear market states. *Cheng, Lee & Lin* (2013) have found a stronger disposition effect in bear markets than in bull markets. For the two market conditions, I will again calculate the PGR and PLR defined above, and investigate whether the disposition effect is different in any of these market conditions for the market as a whole, and for the four investor categories individually (Hypothesis 3).

5.3. Survival analysis method

5.3.1. Methodology

For each day after an investor purchases a stock, the conditional probability of that stock being sold is calculated, using a proportional intensity model allowing for time varying covariates for the calculation of this conditional probability. The model becomes basically an extended Cox (1972) proportional hazard model, since I leave the baseline hazard undefined. Time t is defined here as the days the Euronext stock market is open and $t = 1$ is when an investor i is first buying a stock and thus starts with a position k . A dummy variable “sale” is introduced, taking the value of 0 as long as the stock is held in position and the value 1 on the day of sale. The sale dummy variable is used to track the survival time T for each position k .

The extended Cox model is defined as:

$$h_{i,k}(t|X, Z(t)) = h_0(t)e^{\{\sum_{i=1}^p \beta_i X_i + \sum_{i=1}^p \delta_i Z_i(t)\}} \quad (4)$$

where $h_{i,k}(t|X, Z(t))$ refers to the probability of position k being sold by investor i at time T , conditional that it is not being sold before at time t . The extended Cox model (1972) is a semi-parametric model and therefore the baseline hazard function $h_0(t)$ is left unspecified. The regression coefficients β_i and δ_i are calculated using the maximum likelihood method. X_i are time independent variables, to be described later in this section, which are constant over time and Z_i are time dependent variables which are allowed to change for every change in t . In this model only the control variable “market returns” can have both positive and negative values, whereas the other dependent variables can only be positive. The influence of a variable is measured with hazard ratios, which can be interpreted as follows:

Hazard ratio	Impact of covariates compared to baseline
1	Covariates have no effect
> 1	Covariates increase the conditional probability of selling stocks
< 1	Covariates decrease the conditional probability of selling stocks

5.3.2. Variables

Time

Time is the only time dependent variable (Z_i) in the extended Cox model above and is measured in the number of days a stock is held until it is sold. Only trading days of the Euronext exchange are taken in consideration and all weekends and bank holidays are excluded.

Gains and losses

A weighted average purchase price is calculated in the same way as for the Odean methodology above: for every increase in the shareholding for stock i , the investor's weighted average purchase price is recalculated and for every decrease in the shareholdings of stock i , a realized gain or realized loss is recorded, by taking the product of the shares sold and the difference between the closing price of stock i on day t and the weighted average purchase price of stock i . Two covariates are then calculated: the trading loss indicator (TLI) and the trading gain indicator (TGI). For the TLI, if a stock is held or sold on any day at a loss, in other words when the weighted average purchase price is higher than the closing price or the transaction price, it takes a value of one and otherwise a value of zero. For the TGI, if a stock is held or sold on any day at a gain, in other words when the weighted average purchase price is lower than the closing price or the transaction price, it takes a value of one and otherwise a value of zero. Both TGI and TLI do vary over time since a specific position might be trading at a loss one day and at a profit another day. When the hazard ratio for the TLI is lower than 1, it indicates that investors are less likely to sell a position at a loss than the baseline hazard function indicates. A hazard ratio higher than one for the TGI indicates that

investors are more likely to sell a position at a gain than the baseline hazard function assumes.

Investor category

For the database of the investment bank, there are four types of investors: the covariate investor category is assigned the value of 1 for institutional investors, the value of 2 for private investors under discretionary management, the value of 3 for private investors with investment advice and the value of 4 for private investors without investment advice.

Market state (Bull- or Bear market)

The covariate market state is assigned here the value of one for every business day the algorithm puts this specific day in a bear period and the value of zero whenever it puts it in a bull market. Having this covariate interact as a control variable with TGI and TLI, will allow investigating whether there is a correlation between the market state and the disposition effect as a consistency check to the Odean method for hypothesis 3.

Gender

In the discount broker dataset, for 250 accounts the gender is not specified and the covariate gender will be assigned a value of 1, 37.988

accounts are held by males and the covariate gender takes the value of 2, and it takes the value of 3 for the 6.222 accounts held by females. The covariate gender will then be used as a control variable interaction term together with TGI and TLI, to check hypothesis 4 whether gender is correlated with changes in investor's propensity to avoid losses and realize gains.

Education level

Education level so far has never been used as a proxy to investor sophistication, but one could argue that university graduates are more sophisticated than non-university graduates.

Of the 44.460 accounts at the discount broker, 35.925 have no education level specified and the covariate education level will be assigned the value of 1 for this group, 2.204 have a highest education level indicated as secondary school and the covariate education level gets the value of 2 assigned. 6.331 accounts have university or college as the highest level of education attained and are assigned the value of 3. The covariate education level will then be used as a control variable interaction term together with TGI and TLI, to test the first part of hypothesis 5.

Trading size

Trading size has already been used as a proxy to investor sophistication by *Brown et al. (2006)*, *Dhar & Zhu (2006)*, *Chen et al. (2007)* and *Seru, Shumway & Stoffman (2010)*. Here the accounts have been divided

in four quartiles, with the lowest 25% the quartile with the lowest average trading size per account and the upper 25%, those with the highest average trading size per account. These two quartiles will then be used as a control variable interaction term together with TGI and TLI, to test the second part of hypothesis 5.

Size of gains and losses

Ben-David & Hirshleifer (2012) and *An & Argyle* (2015) showed that the propensity to sell, for private investors and institutional investors respectively, varies according to the magnitude of the gains and losses. The higher the gains (and losses), the higher the propensity to sell a position, but the increase in the propensity to sell is higher for gains than for losses. The data in this study will be divided in three groups: small gains (losses), medium gains (losses) and high gains (losses), while the definition of small, medium and high is flexible and can be tested at various levels.⁹ A covariate will be introduced with a value of 1 for small gains (losses), 2 for medium and 3 for high and the interaction with TGI and TLI will be examined as a robustness check for differences in the propensity to sell for different levels of gains and losses.

⁹ Three ranges of gains and losses have therefore been defined: small, ranging in absolute values from 0 to 10%, moderate, from 10 to 30% and high, all above 30%. Groups have been defined first to have a more or less equal number of observations in every group and second because it is in line with previous studies (in particular *Ben-David & Hirshleifer, 2012*).

5.3.3. The model

In equation (4) above, the left-hand side of the equation is equal to 0 for every day the investor is holding on to the position and equal to 1 if the investor sells the position or a part of it. The right-hand side of equation (4) contains the TLI or the TGI and the control covariates defined under 5.3.2. To test for a disposition effect on average for all investors, equation (4) will be changed into two equations, one for TGI and one for TLI:

$$h_{i,k}(t|X, Z(t)) = h_0(t)e^{\{\sum_{i=1}^p \delta_i TGI_i(t)\}} \quad (5)$$

$$h_{i,k}(t|X, Z(t)) = h_0(t)e^{\{\sum_{i=1}^p \delta_i TLI_i(t)\}} \quad (6)$$

If the hazard ratio of equation (5) is significantly higher than one, it indicates a significantly increased probability of selling, relative to the baseline, in case the position is at a gain, in other words the conditional probability of a sale increases when a position is at a gain and the investors have a propensity to sell winners¹⁰. If at the same time the hazard ratio of equation (6) is significantly lower than 1, it shows a significantly decreased probability of selling, relative to the baseline, in case the position is trading at a loss, in other words the conditional probability of a sale decreases when a position is at a loss and the investors have a propensity to hold on to losers, thus there is a significant disposition effect.

¹⁰ For the most part, stocks are either trading at a gain or at a loss. Therefore, TLI and TGI are tested separately since a constant is also fit in the regression to estimate the parameter p.

To test the other control variables described above under 5.3.2., the specific covariate is added to the equations (5) and (6) as follows:

$$h_{i,k}(t|X, Z(t)) = h_0(t)e^{\{\sum_{i=1}^P \delta_i TGI_i(t) + \delta_i TGI_i x IC_t + \beta_i IC\}} \quad (7)$$

$$h_{i,k}(t|X, Z(t)) = h_0(t)e^{\{\sum_{i=1}^P \delta_i TLI_i(t) + \delta_i TLI_i x IC_t + \beta_i IC\}} \quad (8)$$

where *IC* is the covariate investor category. For the other control variables *IC* is simply replaced by the new covariate to be tested: *MS* for market state; *Size* for size of gains (losses); *G* for gender and *EL* for education level.

6. Results

6.1. The Belgian market as a whole

In this section we present the results obtained for our first hypothesis - *H1: Investors in Belgium in general do exhibit a strong disposition effect throughout the year with no significant difference between the months-* through the analysis carried out by the Odean method followed by the Survival method as a consistency check to the investment bank and discount broker databases.

Table 8 below gives the results obtained with the Odean method, where the null hypothesis is $PGR=PLR$. One can observe that the difference between PGR and PLR is significantly higher than 0 for all shares but AGS and that the null hypothesis of $PGR - PLR$ is equal to zero can be rejected with relatively high t -statistics. For all stocks together the ratio of PGR to PLR is around 1,16 in the investment bank database and 1,39 in the discount broker database, indicating that a stock that is up in value is around 16% or 39% (depending on the database) more likely to be sold than a stock that is down in value. Thus, our first analysis support the evidence of a disposition effect in the Belgium market.

Remarkable though, there is one stock, AGS, which is around 100% more likely to be sold with a loss than with a profit. Therefore we try to get more insights about AGS, in an effort to understand why this stock behavior is opposite to the other stocks.

Table 8: PGR and PLR statistics

a) Investment bank database

	mean PGR	mean PLR	mean PGR/PLR	mean PGR-PLR	t-stat	h	p	df
ACK	0.0063	0.0013	4.8462	0.0050	7.8690	1	9.12E-15	1,015
AGS	0.0020	0.1341	0.0149	-0.1321	-25.7424	1	4.12E-135	3,903
ABI	0.0211	0.0114	1.8509	0.0097	4.9931	1	6.35E-07	2,529
BEK	0.0155	0.0016	9.6875	0.0139	11.3716	1	2.05E-29	3,276
BEL	0.0248	0.0009	28.6705	0.0239	31.3575	1	8.80E-199	5,520
COF	0.0223	0.0008	27.2283	0.0215	14.9274	1	4.31E-48	2,223
COL	0.0187	0.0009	20.7218	0.0178	12.8149	1	1.99E-35	1,259
DIE	0.0381	0.0020	19.0500	0.0361	10.5446	1	1.45E-24	882
DEL	0.0105	0.0038	2.7632	0.0067	6.0377	1	1.79E-09	2,529
GBL	0.0480	0.0019	25.2632	0.0461	12.7786	1	1.54E-36	3,323
KBC	0.0281	0.0051	5.5098	0.0230	7.5866	1	5.28E-14	1,763
SOL	0.0081	0.0023	3.5217	0.0058	7.3891	1	1.81E-13	3,721
UCB	0.0063	0.0021	3.0000	0.0042	5.5583	1	2.91E-08	3,842
UMI	0.0217	0.0013	16.6923	0.0204	13.9941	1	5.63E-43	2,634
Total	0.0184	0.0160	1.1562	0.0025	9.0010	1	0.00E+00	38,432

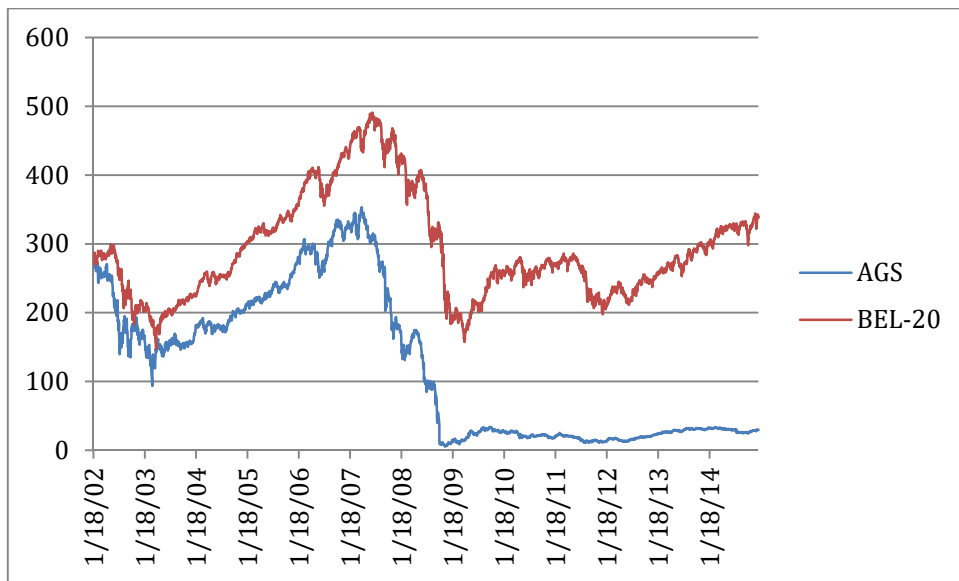
b) Discount broker database

	mean PGR	mean PLR	mean PGR/PLR	mean PGR- PLR	t-stat	h	p	df
ACK	0.0278	0.0128	2.1719	0.0150	8.5096	1	2.33E-17	4,614
AGS	0.0001	0.0785	0.0007	-0.0784	-59.9185	1	0.00E+00	21,876
ABI	0.0529	0.0247	2.1417	0.0282	12.3066	1	1.92E-34	6,874
BEK	0.0814	0.0003	239.4118	0.0811	27.5192	1	5.60E-154	4,405
BEL	0.0522	0.0098	5.3265	0.0424	19.4155	1	7.15E-82	7,143
COF	0.0438	0.0085	5.1529	0.0353	10.3935	1	7.60E-25	2,755
COL	0.0879	0.0000	27046.1538	0.0879	24.1445	1	7.50E-119	3,340
DIE	0.1034	0.0006	176.7521	0.1028	20.0423	1	2.71E-81	1,921
DEL	0.0448	0.0175	2.5600	0.0273	15.7027	1	8.18E-55	8,686
GBL	0.0187	0.0108	1.7315	0.0079	7.0714	1	1.66E-12	8,121
KBC	0.0674	0.0261	2.5824	0.0413	25.4213	1	1.70E-139	14,414
SOL	0.0380	0.0198	1.9192	0.0182	8.8904	1	8.10E-19	5,546
UCB	0.0510	0.0197	2.5888	0.0313	14.5106	1	5.29E-47	6,731
UMI	0.0453	0.0180	2.5167	0.0273	13.9336	1	1.67E-43	6,485
Total	0.0408	0.0293	1.3925	0.0115	19.9216	1	0.0000	102,905

AGS, short for Ageas, dropped from a high of 353 in April 2007 to a low of 5,6 EUR in December 2008 (-98,4%) and from there gradually climbed back to around 40 EUR at the end of 2014 (-88,4%) as figure 6 illustrates.

While the general market index BEL-20 from 2001 until the end of 2014 oscillates around the initial level, AGS is decimated from 2007. Returns in stockholdings in AGS built up before April 2007, are consequently very negative throughout the whole period after this date, making it impossible to produce any PGR's. None of the other stocks show such a dramatic drop of almost 95% without any significant recovery. All other stocks show a normal market behavior, some even with a significant market drop (KBC and DEL) of 50-70% compared to the BEL-20, but then both followed by a sharp recovery.

Fig.6: stock evolution of AGS vs BEL-20



Ageas was a bank/insurance holding formerly known as Fortis. During the 2008 crisis, Fortis was on the verge of collapsing until the Belgian and Dutch government came at its rescue by taking over all banking activities, which it sold later on to the French BNP Paribas. The remaining insurance activities remained in the holding and the name was changed in Ageas.

The special situation of Ageas and the resulting evolution of AGS stock compared to the other stocks and the market can therefore be considered as abnormal and therefore excluded in further analyses in order to prevent any distortions.

The totals in table 8 above with AGS excluded would read as follows:

Table 9: PGR and PLR totals

	mean PGR	mean PLR	mean PGR/PLR	PGR- PLR	t-stat	h	p	df
Investment bank	0,0190	0,0033	5,7576	0,0157	31,2812	1	0,0000	34.528
Discount broker	0,0470	0,0182	2,5824	0,0288	49,0712	1	0,0000	81.024

Notes: Table 9 shows the mean PGR, mean PLR, the ratio and the difference for both Investment bank database as well as for the Discount broker database. Both datasets show a strong disposition effect with $PGR/PLR \gg 1$ and $PGR - PLR \gg 0$

The Belgian market thus clearly shows a strong disposition effect following the Odean method: the investment bank clients will sell stocks which are up in value 5,76 times more likely than stocks that are down in value (t -statistic > 31 , p -value = 0) and the discount broker clients are 2,58 times more likely to sell winners than losers (t -statistic > 49 , p -value = 0).

Applying the survival analysis method now as a consistency check of the Odean results, gives the following graphical representation for the investment bank clients (figure 7). The dotted line represents the survival analysis of TGI according to equation (5) and the full line (TGI = 0) is the survival analysis of TLI according to equation (6) both for the investment bank database. The graph clearly shows that the survival rate of gains is much

shorter than the survival rate of losses, in other words investors, on average, hold on to losses much longer and take profits earlier.

Fig.7 Survival analysis all clients investment bank

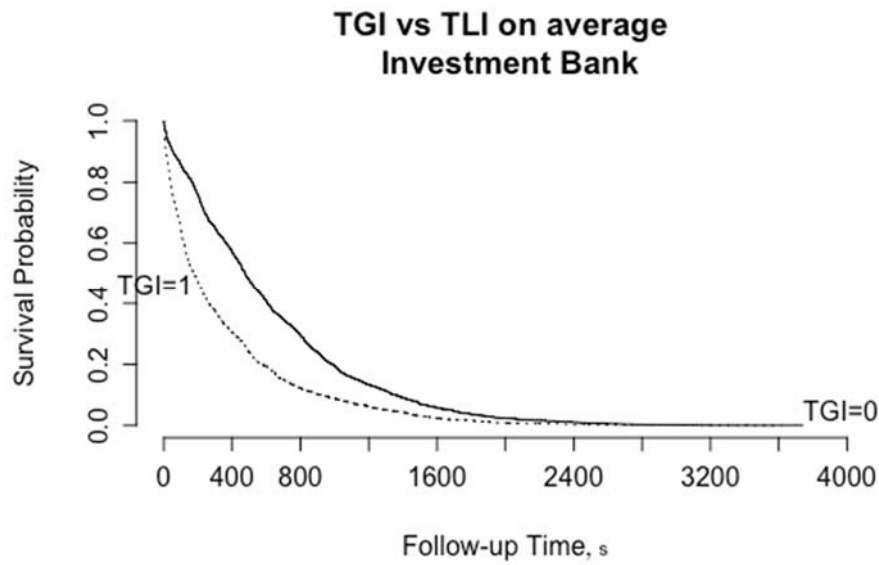


Fig.8 Survival analysis all clients discount broker

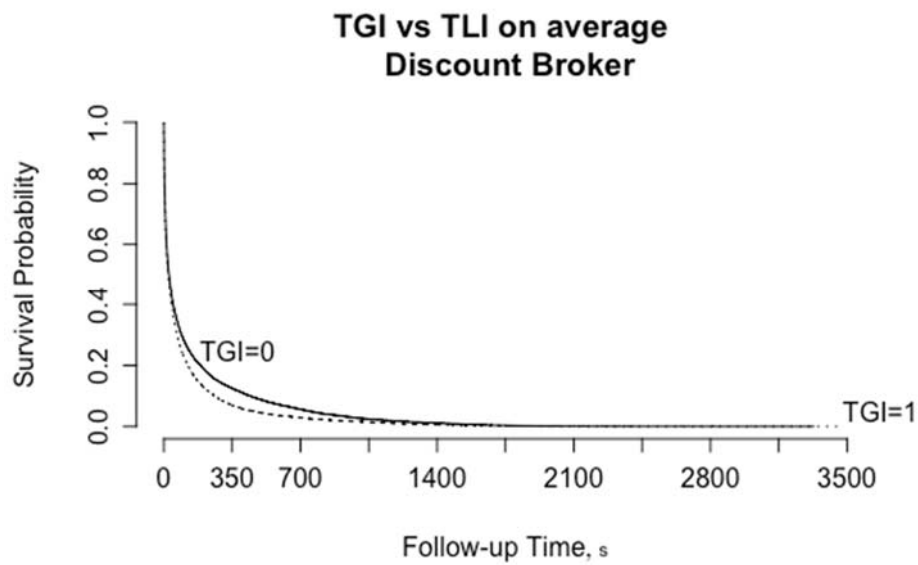


Figure 8 presents the results for the discount broker database. The dotted line represents again the survival analysis of TGI according to equation (5) and the full line (TGI = 0) is the survival analysis of TLI according to equation (6) both for the discount broker database. The graph shows that the survival rate of gains is shorter than the survival rate of losses, in other words investors, on average, hold on to losses much longer and take profits earlier, but the distance is not so outspoken as in the investment bank database.

The data in table 10 and 11 demonstrates strong evidence of the disposition effect because the hazard ratio for TGI is for both the investment bank and the discount broker significantly higher than 1 and the hazard ratio for TLI for both databases significantly lower than 1. The interpretation of these hazard ratios is as follows: clients of the investment bank who have their positions trading at a gain have a 57,28% ($1 - 1,5728 = -0,5728$) increased conditional probability of being sold, relative to the baseline, while those of the discount broker have, under the same circumstances, a 26,28% ($1 - 1,2628 = -0,2628$) increased conditional probability of being sold, relative to the baseline. Positions trading at a loss have a decrease in the conditional probability of being sold of 36,42% ($1 - 0,6358 = 0,3642$) for the investment bank clients and of 20,81% ($1 - 0,7919 = 0,2081$) for the discount broker clients. This data confirms that the disposition effect we find through the survival analysis is stronger for the investment bank clients exactly like what was found with the Odean method.

The Odean method also showed a strong disposition effect for both databases, namely a ratio between PGR and PLR of 5,76 for the investment

banking clients and of 2,58 for the discount broker clients. Both methodologies are therefore consistent for the disposition effect as a whole for the Belgian market, and exhibit both a stronger disposition effect for investment banking clients compared to discount broker clients.

Table 10: Disposition effect tests on average (investment bank)

	Regression 1	Regression 2
TGI (Z-stat)	1,5728*** (38,6)	
TLI (Z-stat)		0,6358*** (-38,6)

Notes: The hazard ratios are given here linked to the investors' tendency to sell or hold positions at a gain or a loss. The dependent variable is equal to zero for every day a position is held and equal to one for the first day it is sold. The independent variable TGI takes the value of one every time a position trades at a gain and zero otherwise. The independent variable TLI takes the value of one every time a position trades at a loss and zero otherwise.

*** Significant at the 1% level.

Table 11: Disposition effect tests on average (discount broker)

	Regression 1	Regression 2
TGI (Z-stat)	1,2628*** (30,0)	
TLI (Z-stat)		0,7919*** (-30,0)

Notes: The hazard ratios are given here linked to the investors' tendency to sell or hold positions at a gain or a loss. The dependent variable is equal to zero for every day a position is held and equal to one for the first day it is sold. The independent variable TGI takes the value of one every time a position trades at a gain and zero otherwise. The independent variable TLI takes the value of one every time a position trades at a loss and zero otherwise.

*** Significant at the 1% level.

The vast majority of all accounts of the investment bank are held by private individuals and one could argue that the level of interest and

sophistication of the private clients of the discount broker is higher than that of the investment bank's private clients and therefore it sounds logic that their disposition effect is smaller.

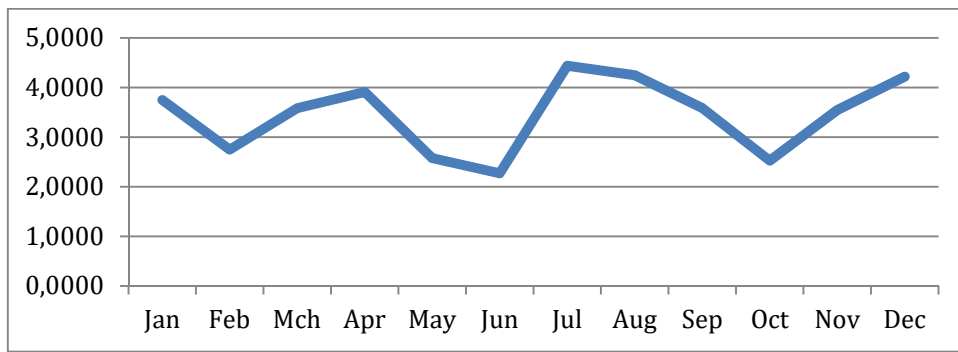
Odean (1998) found an average ratio of PGR/PLR for the whole year of 1,51 while for his sample it was just 0,844 for the month of December alone¹¹. Both figures were significantly different from 1 and for the year as a whole it thus confirmed the existence of a positive disposition effect, while for the month of December it confirmed an opposite disposition effect. The average ratio of PGR/PLR in a study done by *Dhar & Zhu* (2006) was found to be 2,235, significantly different from 1, for the whole year while they found this ratio for the month of December at 1,0106, which was not significantly different from 1¹². In other words a strong positive disposition effect for the entire year and no significant disposition effect for the month of December.

Figure 9 below shows the average ratio of PGR over PLR for the two databases combined for the different months of the year, and no significant pattern can be deducted.

Fig.9 Evolution of ratio PGR/PLR per calendar month on average

¹¹ *Odean* (1998) found a mean PGR of 0,148 and a mean PLR of 0,098 on average for the whole year, and a mean PGR of 0,108 and a mean PLR of 0,128 for the month of December alone

¹² *Dhar & Zhu* (2006) had a mean PGR of 0,38 and a mean PLR of 0,17 on average for the whole year, and a mean PGR of 0,1613 and a mean PLR of 0,1596 for the month of December alone



Using Welch's *t*-test, a 99% confidence interval of the ratio PGR/PLR is then calculated for every individual month in order to see whether any specific month is significantly different from any other and especially if the month of December is so. Table 12 below shows these confidence intervals and the months of April and August are the only two months which have a significantly different ratio PGR/PLR compared to the other months. The month of December is perfectly in line with all other months.

Table 12: 99% confidence intervals for ratio PGR/PLR per calendar month

	mean	mean	mean	sd PGR	sd PLR	99% CI	
	PGR	PLR	PGR/PLR			mean PGR/PLR	
Jan	0.004	0.001	2.929	0.045	0.026	2.260	3.865
Feb	0.003	0.001	2.231	0.036	0.026	1.683	3.018
Mch	0.004	0.001	2.786	0.044	0.026	2.142	3.688
Apr	0.004	0.001	3.333	0.043	0.025	2.534	4.501
May	0.005	0.002	2.091	0.051	0.033	1.655	2.665
Jun	0.002	0.001	1.750	0.032	0.022	1.290	2.397
Jul	0.003	0.001	3.096	0.038	0.020	2.243	4.391
Aug	0.005	0.001	3.692	0.048	0.028	2.819	4.980
Sep	0.003	0.001	2.667	0.036	0.025	2.009	3.635
Oct	0.004	0.002	2.000	0.048	0.033	1.566	2.580
Nov	0.004	0.001	3.000	0.043	0.024	2.265	4.058
Dec	0.002	0.001	3.034	0.032	0.020	2.172	4.401

Notes: In table 13 confidence intervals have been obtained for the mean PGR/PLR using Welch's *t*-test. In case the intervals of the groups overlap, it

means that the disposition effect is not significantly different from one group compared to the other

Both *Odean* (1998) and *Dhar & Zhu* (2006) used data from the US, which is not tax-neutral, and concluded that there clearly was tax-induced selling towards the end of the fiscal year in December. The data here under study is from Belgium, which is tax-neutral with regard to capital gains, and there is no special effect towards the end of the fiscal year, therefore supporting that the lack of disposition effect in the month of December in other countries is due to tax reasons.

Therefore, **strong support** is found for **Hypothesis 1**: there is a disposition effect in the Belgian market on average and there is no specific seasonal pattern and definitely no end-of-year effect.

6.2. Per individual investor category

All investor categories in table 13 below exhibit a clear disposition effect using the Odean methodology at the 1% confidence level, except for the institutional investors where it is only at the 10% level. The degrees of freedom for the institutional investor category, however, are rather low, explaining the lower confidence level. The strongest disposition effect in the investment bank dataset is exhibited by the category private investors without investment advice, followed consecutively by private investors with advice, and finally the private investors under management and institutional investors with roughly the same PGR-PLR. The ranking in other words looks consistent with the one presumed under hypothesis 2.

In order to determine whether the disposition effect for the different categories is significantly different from each other, *Welch's t-test* has been applied and different confidence intervals of the difference of PGR-PLR have been obtained.

Table 13: PGR and PLR for each individual investor category

	mean PGR	mean PLR	PGR- PLR	t-stat	h	p	df
Institutional	0.0188	0.0071	0.0117	1.8615	1	0.0649	133
Private, discretionary mngmt	0.0131	0.0023	0.0108	29.4348	1	0.0000	20,768
Private, with advice	0.0232	0.0046	0.0186	5.2627	1	0.0000	725
Private, no advice (Inv.Bank)	0.0286	0.0040	0.0246	23.4832	1	0.0000	16,364
Private, no advice (Disc.Broker)	0.0470	0.0182	0.0288	49.0712	1	0.0000	81,024

Notes: Table 13 shows the disposition effect measured as the difference between PGR and PLR for every type of investors. Aim is to see whether the ranking as stated under Hypothesis 2 holds

In table 14 below the different confidence intervals show that, using the Odean method, for the investment bank dataset there is an overlap for all confidence levels between institutional investors on the one hand and the three groups of private investors on the other hand, in other words no significant difference can be shown between the institutional investors and the

other three categories. Due to the relatively low degrees of freedom for the institutional investors, the confidence levels for this group is wide.

Table 14: Confidence intervals for investor categories (Odean method)

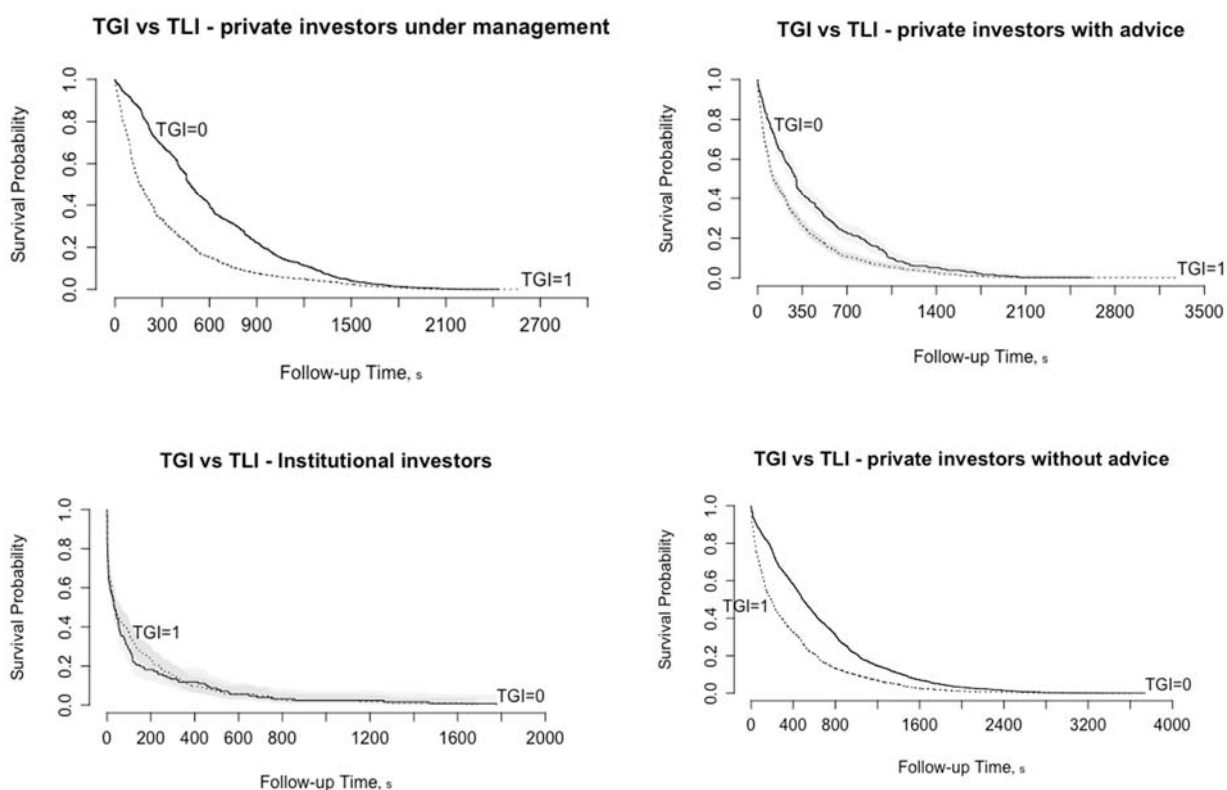
	mean PGR	mean PLR	mean PGR- PLR	sd PGR	sd PLR	90% CI mean PGR-PLR		95% CI mean PGR- PLR		99% CI mean PGR-PLR	
Institutional	0.019	0.007	0.012	0.072	0.017	-0.001	0.024	-0.003	0.027	-0.008	0.032
Private, discr. mngmt	0.013	0.002	0.011	0.049	0.019	0.010	0.012	0.010	0.012	0.010	0.012
Private, with advice	0.023	0.005	0.019	0.093	0.019	0.012	0.025	0.010	0.027	0.008	0.029
Private, no advice	0.029	0.004	0.025	0.128	0.039	0.022	0.027	0.022	0.027	0.021	0.028
Total	0.019	0.003	0.016	0.088	0.030						

Notes: In table 14 confidence intervals have been obtained for the mean PGR – PLR using Welch’s *t*-test. In case the intervals of the groups overlap, it means that the disposition effect is not significantly different from one group compared to the other

Although the same ranking has been found as under hypothesis 2, the differences in the strength of the disposition effect (i.e. difference between PGR and PLR) is not significant and therefore **no support** for **Hypothesis 2** is found.

A survival analysis of the TGI and TLI is then performed as a consistency check for the different investor categories and the results are shown graphically in figure 10 below. There is a disposition effect for each one of them at a different level, except for the group institutional investors where TGI and TLI lines are inversed indicating a slightly opposite disposition effect

Fig. 10: TGI vs TLI for the different investor categories (Inv.Bank)



We run individual regressions for each category of investors to test for the existence of the disposition effect based on the survival analysis, and report the results in Table 15. Although it shows a slight inverse disposition effect for the investor group institutional investors, it is not significant however, so institutional investors do not exhibit a significant disposition effect.

Table 15: The disposition effect per investor category

	Regression 1	Regression 2
<i>Institutional investors</i>		
TGI	0,8810	
(Z-stat)	(-1,17)	
TLI		1,1350
(Z-stat)		(1,17)
<i>Private investors under management</i>		
TGI	1,7356***	
(Z-stat)	(23,30)	
TLI		0,5762***
(Z-stat)		(-23,30)

<i>Private investors with advice</i>		
TGI	1,6012***	
(Z-stat)	(7,74)	
TLI		0,6245***
(Z-stat)		(-7,74)
<i>Private investors without advice</i>		
TGI	1,5580***	
(Z-stat)	(31,60)	
TLI		0,6420***
(Z-stat)		(-31,60)

Notes: Table 15 shows the hazard ratios for every different investor category separately. The dependent variable TGI and TLI takes the value of zero every day an investor holds on to the position and the value of one the first day it is sold

* Significant at the 10% level

** Significant at the 5% level

*** Significant at the 1% level

An institutional investor with positions trading at a gain, have a 11,9% ($1 - 0,8810 = 0,119$) decreased conditional probability of being sold, relative to the baseline, while they have an increased conditional probability of being sold of 13,5% ($1 - 1,1350 = -0,1350$) when the position is trading at a loss, however these increased and decreased probabilities are not significantly different from the baseline.

For institutional investors support has been found in different countries for a disposition effect (see Table 16), some just observed it, others found it to be either limited or, on the contrary, strong. Only *Chen et al.* (2007) did a comparison in the same data period between private investors and all institutional and professional investors in one group.

Here both Odean and the survival analysis find, consistently, no significant disposition effect (at the 1% level) for the institutional investors in Belgium.

Table 16: Disposition effect for institutional investors

Author(s)	Year	Country	Effect found
Grinblatt & Keloharju	2001	Finland	DE found
Garvey & Murphy	2004	USA	strong DE
Coval & Shumway	2005	USA	strong loss aversion
Locke & Mann	2005	USA	strong DE

Frazzini	2006	USA	limited DE
Chen et al.	2007	China	limited DE, much lower than for Private investors
Choe & Eom	2009	Korea	limited DE
Jin & Scherbina	2011	USA	DE found
Cici	2012	USA	DE found
An & Argyle	2015	USA	DE found
De Groot	2017	Belgium	No DE found

For the three other investor categories the survival analysis shows, in Table 15, consistent with the Odean methodology, a strong positive disposition effect, all at a 1% confidence level. Private investors receiving investment advice and private investors not receiving advice both have a strong disposition effect with an increased conditional probability of selling a position at a gain of respectively 60,1% and 55,8%, while private investors under discretionary management exhibit the strongest disposition effect with an increased conditional probability of 73,6% of selling a position at a gain, all significant at a 1% level.

A strong disposition effect has been shown for the investor category private individuals without investment advice in many different markets and by many different authors: *Odean* (1998, US), *Feng & Seasholes* (2005, China), *Shumway & Wu* (2005, China), *Dhar & Zhu* (2006, US), *Hur et al.* (2010, US), *Ben-David & Hirshleifer* (2012, US), *Firth* (2015, Singapore) and *Richards et al.* (2015, UK). Only the study in Singapore (*Firth*, 2015) was done in a tax-neutral country like this study in Belgium.

In tables 17 and 18 below all the investor categories are included as variables in equation (7) and (8), and interacted with TGI and TLI. The interactions show the influence the specific investor category has on the propensity to sell a position either at a gain or at a loss.

Table 17: TGI and independent variables

	Regression 1	Regression 2	Regression 3	Regression 4
<i>Independent variable</i>				
TGI	1,5886***	1,5483***	1,5725***	1,6195***
(Z-stat)	(39,10)	(32,35)	(37,85)	(22,53)
TGI x institutional inv	0,5120***			
(Z-stat)	(-6,20)			
TGI x private inv under mngmt		1,0809***		
(Z-stat)		(2,88)		
TGI x private inv with advice			1,0230	
(Z-stat)			(0,37)	
TGI x private inv no advice				0,9686
(Z-stat)				(-1,25)
<i>Control variables</i>				
institutional inv	3,9069***			
(Z-stat)	(17,90)			
private inv under mngmt		1,0361		
(Z-stat)		(1,57)		
private inv with advice			1,2220***	
(Z-stat)			(3,90)	
private inv no advice				0,8719***
(Z-stat)				

Notes: Table 17 shows the hazard ratios associated with the different investor categories tendency to sell/hold positions at a gain. The TGI (dependent variable) takes the value of zero every day an investor holds on to the position and the value of one the first day it is sold. Every investor category is interacted with TGI and thus allows for the interpretation of cross-category differences in investor's propensity to sell positions at a gain..

Regression 1 in table 17 shows that the hazard ratio for the TGI interacted with the investor category institutional investors is significantly below one, indicating that an institutional investor is 48,80% ($1 - 0,5120 = 0,4880$) less likely to sell a position at a gain relative to the baseline.

Regression 1 in table 18 shows then that the hazard ratio of TLI interacted with institutional investors is significantly above one, meaning that being an institutional investor increases the conditional probability of selling a position at a loss by 95,30% ($1 - 1,9530 = -0,9530$) relative to the baseline.

Institutional investors have, in other words, a significantly lower disposition effect than the Belgian market as a whole, if still any. This result is congruent

with our previous reported finding of no disposition effect in institutional investors in table 15.

Table 18: TLI and independent variables

	Regression 1	Regression 2	Regression 3	Regression 4
<i>Independent variable</i>				
TLI	0,6295***	0,6459***	0,6359***	0,6175***
(Z-stat)	(-39,15)	(-37,85)	(-41,05)	(-22,53)
TLI x institutional inv	1,9530***			
(Z-stat)	(6,20)			
TLI x private inv under mngmt		0,9252***		
(Z-stat)		(-2,88)		
TLI x private inv with advice			0,9775	
(Z-stat)			(-0,37)	
TLI x private inv no advice				1,0324
(Z-stat)				(1,25)
<i>Control variables</i>				
institutional inv	2,0005***			
(Z-stat)	(9,06)			
private inv under mngmt		1,1199***		
(Z-stat)		(7,56)		
private inv with advice			1,2501***	
(Z-stat)			(6,62)	
private inv no advice				0,8493
(Z-stat)				(-11,72)

Notes: Table 18 shows the hazard ratios associated with the different investor categories tendency to sell/hold positions at a loss. The TLI (dependent variable) takes the value of zero every day an investor holds on to the position and the value of one the first day it is sold. Every investor category is interacted with TLI and thus allows for the interpretation of cross-category differences in investor's propensity to sell positions at a loss.

* Significant at the 10% level (both for table 17 and 18)

** Significant at the 5% level (both for table 17 and 18)

*** Significant at the 1% level (both for table 17 and 18)

In table 17 and 18 can be seen that private investors under discretionary management have a 8,09% higher conditional probability, significant at the 1% level, of selling a position at a gain than the total investor population and that the private investors with and without investment advice do not show a significant different disposition effect from the total population. No research has been done into private investors who have their money managed by a professional manager so far. However the interpretation of this result is intriguing given that Investors under discreptionary management

would be close to institutional investors and “above” those private investors with investment advice and with no investment advice, and therefore shouldn’t exhibit higher disposition effect than private investors with advice and overall with no advice. *Shapira & Venezia (2001)* who studied and compared private investors without investment advice to those receiving advice and found that those without advice exhibit a much stronger disposition effect than those receiving advice.

Again *Welch’s t-test* has been applied and different confidence intervals of the TGI and TLI have been determined and the results have been produced in table 19 below.

The TGI of the institutional investors is significantly lower, at the 1% level, than the TGI from all other categories. Institutional investors have a decreased conditional probability of selling a position at a gain of 11,9% compared to an increased conditional probability of 73,6%, 60,1% and 55,8% for respectively private investors under management, private investors receiving investment advice and private investors without investment advice.

Table 19: Confidence intervals for TGI and TLI (survival analysis)

	TGI	se TGI	z	90% CI TGI		95% CI TGI		99% CI TGI	
Institutional	0.8810	0.1080	-1.2	0.7033	1.0587	0.6693	1.0927	0.6028	1.1592
Private, discretionary mngmt	1.7356	0.0237	23.3	1.6966	1.7746	1.6891	1.7821	1.6745	1.7967
Private, with advice	1.6012	0.0608	7.7	1.5012	1.7012	1.4820	1.7204	1.4446	1.7578
Private, no advice	1.5580	0.0140	31.6	1.5350	1.5810	1.5306	1.5854	1.5219	1.5941

	TLI	se TLI	z	90% CI TLI		95% CI TLI		99% CI TLI	
Institutional	1.1350	0.1080	1.2	0.9573	1.3127	0.9233	1.3467	0.8568	1.4132
Private, discretionary mngmt	0.5762	0.0237	-23.3	0.5372	0.6152	0.5297	0.6227	0.5151	0.6373
Private, with advice	0.6245	0.0608	-7.7	0.5245	0.7245	0.5053	0.7437	0.4679	0.7811
Private, no advice	0.6420	0.0140	-31.6	0.6190	0.6650	0.6146	0.6694	0.6059	0.6781

Notes: In table 19 confidence intervals have been obtained for TGI and TLI using *Welch’s t-test*. In case the intervals of the groups overlap, it means

that the disposition effect is not significantly different from one group compared to the other

The TLI of institutional investors is significantly higher, also at the 1% level, than the TLI from all other categories. Institutional investors have an increased conditional probability of selling a position at a loss of 13,5% compared to a decreased conditional probability of 42,4%, 37,6% and 35,8% for respectively private investors under management, private investors receiving investment advice and private investors without investment advice. The disposition effect of institutional investors, if any, is therefore significantly lower than that of all other categories.

Private investors under discretionary management have a TGI, which is significantly higher at the 1% level than the TGI from all other categories, but their TLI is only significantly lower (at the 1% level) than the one from the institutional investors and than the private investors without advice (only at a 10% level), but not significantly different from the private investors with investment advice, partly due to the relatively low degrees of freedom of the group private investors receiving investment advice. The private investors under discretionary management, therefore, have a higher propensity to sell positions at a gain compared to all other categories, and only a lower propensity to sell positions at a loss than the institutional investors (at a 1% level) and private investors without advice (at a 10% level).

All the obtained results can be summarized as below.

Table 20: Summary of obtained results using Odean and Survival methods

	(1) Institutional	(2) Private discretionary management	(3) Private with advice	(4) Private no advice
ODEAN	No DE (*) not different than the other investors	DE not different than the other investors	DE not different than the other investors	DE not different than the other investors (**)
SURVIVAL	No DE lower than the other investors	DE stronger than the other investors (***)	DE stronger than 1, not different than 2 and 4	DE stronger than 1, weaker than 2, and not different than 3

Notes:

(*) The DE is only marginally significant at 10% level

(**) They only show a higher DE than investors under discretionary advice at 1% level

(***) They don't show a different DE in losses related to investors with advice

In short, the ranking as proposed under Hypothesis 2 is found in the data using the Odean methodology but the differences between the groups are not significant, except for the institutional investors, where no disposition effect is found, while a strong disposition effect is found for all other categories. Also the consistency check, done through the survival analysis, finds no disposition effect for the institutional investors and a strong disposition effect for all other groups. The ranking of the groups as described under **Hypothesis 2** is therefore **not supported**.

6.3. Bull- and Bear markets

Cheng, Lee & Lin (2013) were the only authors so far looking at the disposition effect under bull- and bear markets. They found a stronger disposition effect in bear markets than in bull markets. Below the effect will be examined for all different investor categories using both the Odean method and the survival analysis.

Table 21: Confidence intervals for PGR-PLR in bull-and bear markets (Odean)

Bull period	PGR-PLR	t-stat	df	sd PGR	sd PLR	90% CI PGR-PLR		95% CI PGR-PLR		99% CI PGR-PLR	
Institutional	0.014	1.560	133	0.072	0.017	-0.001	0.024	-0.003	0.027	-0.008	0.032
Discr.mngmt	0.016	15.113	20768	0.049	0.019	0.010	0.012	0.010	0.012	0.010	0.012
With advice	0.029	2.589	725	0.093	0.019	0.012	0.025	0.010	0.027	0.008	0.029
No advice	0.015	18.343	16364	0.128	0.039	0.022	0.027	0.022	0.027	0.021	0.028
No advice (disc.broker)	0.028	30.700	35081	0.148	0.094	0.026	0.031	0.026	0.031	0.025	0.032
Total	0.015	19.832	28864	0.108	0.070	0.013	0.017	0.013	0.017	0.012	0.018

Bear period	PGR-PLR	t-stat	df	sd PGR	sd PLR	90% CI PGR-PLR		95% CI PGR-PLR		99% CI PGR-PLR	
Institutional	0.012	1.206	90	0.094	0.018	-0.008	0.031	-0.011	0.035	-0.019	0.042
Discr.mngmt	0.014	9.214	5946	0.096	0.056	0.010	0.017	0.010	0.017	0.008	0.019
With advice	0.018	1.956	258	0.127	0.060	-0.002	0.037	-0.005	0.040	-0.013	0.048
No advice	0.050	16.195	5366	0.215	0.059	0.044	0.056	0.042	0.057	0.040	0.059
No advice (disc.broker)	0.038	49.606	70004	0.176	0.097	0.037	0.040	0.036	0.040	0.036	0.041
Total	0.027	17.312	11444	0.155	0.059	0.024	0.030	0.023	0.031	0.022	0.032

Notes: In table 21 confidence intervals have been obtained for the mean PGR – PLR using Welch’s *t*-test. In case the intervals of the groups overlap, it means that the disposition effect is not significantly different from one group compared to the other. The same holds for comparisons of the same groups between Bull- and Bear periods, if intervals overlap the disposition effect is not significantly different between those two market states.

Applying Welch’s *t*-test to the difference between PGR and PLR for every category in both bull- and bear markets, it can be observed that the disposition effect is only significantly stronger in bear markets than in bull markets for the category private investors without investment advice in both the investment bank and the discount broker database.

The institutional investors, the private investors receiving investment advice and the private investors under discretionary management show a

stronger disposition effect in bull markets than in bear markets but not significantly different however.

The consistency check with the survival analysis method exhibits a stronger disposition effect in bear markets than in bull markets for private investors (without investment advice) in the discount broker database significant at the 1% level for the TGI and at the 5% level for the TLI. The private investors without advice in the investment bank database show a higher TGI and lower TLI in bear markets than in bull markets but it is not significant. Again Welch's t-test is used to create confidence intervals for TGI and TLI.

Table 22: Confidence intervals for TGI and TLI in bull-and bear markets (Survival analysis)

Bull period	TGI	t-stat	df	se	90% CI TGI		95% CI TGI		99% CI TGI	
				TGI						
Institutional	0.848	1.290	250	0.12	0.63	1.05	0.59	1.09	0.51	1.17
		21.80		8	7	9	7	9	8	8
Discr. Mngmt	1.826	0	6861	0.02	1.78	1.87	1.77	1.88	1.75	1.89
				8	0	1	1	0	4	7

				0.07	1.65	1.90	1.63	1.92	1.58	1.97
With advice	1.779	7.770	960	4	7	1	4	4	8	0
		29.30	1905	0.01	1.62	1.67	1.61	1.68	1.60	1.69
No advice	1.651	0	4	7	3	9	7	4	7	5
No advice (disc.broker)	1.330	27.90	8104	0.01	1.31	1.34	1.31	1.35	1.30	1.35
		0	2	0	3	7	0	0	4	6
Total	1.660	35.80	2712	0.01	1.63	1.68	1.63	1.68	1.62	1.69
		0	5	4	6	3	2	8	3	6

Bear period	TGI	t-stat	df	se TGI	90% CI TGI		95% CI TGI		99% CI TGI	
Institutional	0.838	0.840	98	0.21	0.49	1.18	0.42	1.25	0.29	1.37
		11.50		0	3	3	6	0	7	9
Discr. Mngmt	1.789	0	1617	0.05	1.70	1.87	1.68	1.88	1.65	1.91
				1	5	2	9	8	8	9
With advice	1.415	3.150	348	0.11	1.23	1.59	1.19	1.63	1.13	1.69
		19.80		0	4	6	9	1	2	8
No advice	1.667	0	6350	0.02	1.62	1.70	1.61	1.71	1.60	1.73
				6	5	9	6	8	1	3
No advice (disc.broker)	1.551	34.30	2853	0.01	1.53	1.57	1.52	1.57	1.51	1.58
		0	5	3	0	2	6	6	8	4
Total	1.660	22.80	8413	0.02	1.62	1.69	1.61	1.70	1.60	1.71
		0		2	3	6	6	3	3	7

Bull period	TLI	t-stat	df	se TLI	90% CI TLI		95% CI TLI		99% CI TLI	
Institutional	1.179	1.290	250	0.12	0.96	1.39	0.92	1.43	0.84	1.50
		21.80		8	8	0	8	0	9	9
Discr. Mngmt	0.548	0	6861	0.02	0.50	0.59	0.49	0.60	0.47	0.61
				8	2	3	4	2	6	9
With advice	0.562	7.770	960	0.07	0.44	0.68	0.41	0.70	0.37	0.75
		29.30	1905	0.01	0	4	7	7	1	3
No advice	0.606	0	4	7	8	4	2	9	2	0
				0.01	0.57	0.63	0.57	0.63	0.56	0.65
No advice (disc.broker)	0.752	27.90	8104	0.01	0.73	0.77	0.73	0.77	0.72	0.78
		0	2	0	7	2	3	6	7	2
Total	0.603	35.80	2712	0.01	0.57	0.62	0.57	0.63	0.56	0.63
		0	5	4	9	6	5	0	6	9

Bear period	TLI	t-stat	df	se TLI	90% CI TLI		95% CI TLI		99% CI TLI	
Institutional	1.194	0.840	98	0.21	0.84	1.53	0.78	1.60	0.65	1.73
		11.50		0	9	9	2	6	3	5
Discr. Mngmt	0.559	0	1617	0.05	0.47	0.64	0.46	0.65	0.42	0.68
				1	6	2	0	8	9	9
With advice	0.707	3.150	348	0.11	0.52	0.88	0.49	0.92	0.42	0.99
		19.80		0	6	8	1	3	4	0
No advice	0.600	0	6350	0.02	0.55	0.64	0.54	0.65	0.53	0.66
				6	7	2	9	0	3	6
No advice (disc.broker)	0.645	34.30	2853	0.01	0.58	0.71	0.57	0.73	0.54	0.75
		0	5	3	3	9	0	2	5	7
Total	0.602	22.80	8413	0.02	0.56	0.63	0.55	0.64	0.54	0.66
		0		2	6	9	9	6	5	0

Notes: In table 22 confidence intervals have been obtained for TGI and TLI using Welch's *t*-test. In case the intervals of the groups overlap, it means that the disposition effect is not significantly different from one group compared to the other. The same holds for comparisons of the same groups between Bull- and Bear periods, if intervals overlap the disposition effect is not significantly different between those two market states.

The institutional investors and the private investors under discretionary management do not show any significantly different disposition effect in bull

markets than in bear markets, whereas the private investors receiving investment advice have a significantly stronger disposition effect in bull markets than in bear markets for the TGI.

Table 23: Relative strength Disposition Effect in Bull- and Bear markets

	Bull market		Bear Market	
	Odean	Survival	Odean	Survival
Institutional	stronger	not different	weaker	not different
Private, discretionary mngmt	stronger	not different	weaker	not different
Private, with advice	stronger	stronger **	weaker	weaker **
Private, no advice	weaker ***	weaker	stronger ***	stronger
Private, no advice (disc.broker)	weaker ***	weaker ***	stronger ***	stronger ***

*** significant at 1% level

** significant at 5% level

* significant at 10% level

no * means no statistical significance

Hypothesis 3 supposed a stronger disposition effect in bear markets than in bull markets for all investor categories, which is clearly not the case as can be seen in table 23 above and is therefore only **partially supported** for the investor group private individuals without investment advice.

6.4. Gender

A lot of different studies have been done on gender differences in financial decision making, both with real data and as experiments. Most studies show that women are more risk averse than men (*Powell & Ansic, 1997; Barber & Odean, 2001; Borghans et al., 2009; Charness & Gneezy, 2012*), but there are also some not encountering any gender differences in investment decisions (*Schubert et al., 1999; Fehr-Duda, de Gennaro & Schubert, 2006*). The only study specifically looking at the difference in the

disposition effect by gender has been done by *Cheng, Lee & Lin (2013)* and they observed a stronger disposition effect for women than for men.

In our study the discount broker database has 44.460 accounts of which only 250 (0,6%) does not have a gender specified, 37.988 (85,4%) are male and 6.222 (14,0%) are female.

In table 24 below, one can observe that the TGI for males is significantly lower, at the 1% level, than the TGI of the females. Females show an increased conditional probability of selling a position at a gain of 34,8% compared to 25,5% for males. The TLI is also significantly lower, significant at the 10% level, for females than for males with a decreased conditional probability of selling a position at a loss of 25,8% compared to 20,3% for males. In other words the disposition effect for women is significantly stronger than for men.

Table 24: Confidence intervals for TGI and TLI by gender (survival analysis)

	TGI	se TGI	z	90% CI TGI		95% CI TGI		99% CI TGI	
Male	1.255	0.008	27.6	1.241	1.268	1.239	1.271	1.233	1.276
Female	1.348	0.024	12.3	1.308	1.388	1.300	1.396	1.285	1.410

	TLI	se TLI	z	90% CI TLI		95% CI TLI		99% CI TLI	
Male	0.797	0.008	-27.6	0.783	0.811	0.781	0.813	0.776	0.818
Female	0.742	0.024	-12.3	0.702	0.782	0.694	0.790	0.679	0.804

Notes: In table 24 confidence intervals have been obtained for TGI and TLI using Welch's *t*-test. In case the intervals of the gender groups overlap, it means that the disposition effect is not significantly different from one group compared to the other.

Running a consistency check thru the Odean methodology (table 25) shows a slightly lower difference between PGR and PLR for females (0,0275) than for males (0,0292) but this difference is not significant.

Table 25: Confidence intervals for PGR-PLR by gender (Odean)

	mean PGR	mean PLR	mean PGR- PLR	sd PGR	sd PLR	90% CI mean PGR- PLR		95% CI mean PGR- PLR		99% CI mean PGR- PLR	
Male	0.048	0.019	0.029	0.143	0.092	0.028	0.031	0.027	0.031	0.027	0.031
Female	0.040	0.013	0.028	0.128	0.074	0.024	0.031	0.024	0.031	0.022	0.033
Total	0.047	0.018	0.029								

Notes: In table 25 confidence intervals have been obtained for the difference between PGR and PLR using Welch's *t*-test. In case the intervals of the gender groups overlap, it means that the disposition effect is not significantly different from one group compared to the other.

Since the survival analysis is more reliable for an analysis at the individual account level, **Hypothesis 4 is supported.**

6.5. Sophistication

The effect of investor sophistication on the disposition effect has been tested by several authors but how to measure this sophistication varies widely among these studies. The following (demographic and other) variables have been used: professional occupation (*Shapira & Venezia, 2001; Dhar & Zhu, 2006*), initial diversification of the portfolio (*Feng & Seasholes, 2005*), portfolio value and or trading size (*Brown et al., 2006; Dhar & Zhu, 2006; Chen et al., 2007; Seru, Shumway & Stoffman, 2010*) and the complexity of the products traded (*Feng & Seasholes, 2005*). All these proxies used have been shown to reduce the disposition effect significantly.

Sophistication is only used as a possible proxy for private individuals in the literature, since for institutional investors it does not make sense, they are

either institutional and hence a professional and thus a sophisticated investor or they are not a professional. In this particular study it means that only the discount broker database and the private investors without investment advice group of the investment bank are used.

In the discount broker database there are two variables, which will be used to test the effect of sophistication: the education level and the trading size.

6.5.1 Education level

As can be seen in table 26 below, a lower disposition effect is found for College/University graduates compared to investors with secondary school as their highest education level, however, this difference is not significant. The second group has a 28,85% increase in the conditional probability of selling a position at a gain compared to a 23,84% increase in the same conditional probability for investors of the highest education level. College/University graduates show a decrease in the conditional probability of selling a position at a loss of 19,25% against a decrease of 22,39% for those only having finished secondary school.

Table 26: Confidence intervals for TGI and TLI by education level (survival analysis)

	TGI	se TGI	z	90% CI TGI		95% CI TGI		99% CI TGI	
College/University	1.238	0.018	11.800	1.209	1.268	1.203	1.274	1.192	1.285
Secondary School	1.289	0.033	9.850	1.235	1.342	1.225	1.352	1.205	1.372

	TLI	se TLI	z	90% CI TGI		95% CI TGI		99% CI TGI	
College/University	0.808	0.018	11.800	0.778	0.837	0.772	0.843	0.761	0.854
Secondary School	0.776	0.033	-9.850	0.722	0.830	0.712	0.840	0.692	0.860

Notes: In table 26 confidence intervals have been obtained for TGI and TLI using Welch's *t*-test. In case the intervals of the education level groups overlap, it means that the disposition effect is not significantly different from one group compared to the other

College/University graduates therefore do not have a significantly lower disposition effect.

The consistency check thru the Odean method in table 27 below, shows a lower disposition effect for college or university graduates compared to investors with only secondary school as their highest education level, but this difference is not significant. Of the 44.460 accounts at the discount broker, only 8.535 (19,2%) had an education level specified (2.204 secondary school and 6.331 college/university), which explains the low degrees of freedom and thus the wide confidence levels for both methods.

Table 27: Confidence intervals for PGR and PLR by education level (Odean)

Highest Education level	mean	mean	mean			90% CI		95% CI		99% CI	
	PGR	PLR	PGR-PLR	sd PGR	sd PLR	mean PGR-PLR		mean PGR-PLR		mean PGR-PLR	
College/University	0.049	0.019	0.030	0.141	0.088	0.028	0.041	0.027	0.042	0.025	0.044
Secondary School	0.054	0.020	0.035	0.155	0.093	0.027	0.033	0.026	0.034	0.025	0.035

Notes: In table 27 confidence intervals have been obtained for the difference between PGR and PLR using Welch's *t*-test. In case the intervals of the education level groups overlap, it means that the disposition effect is not significantly different from one group compared to the other.

6.5.2. Trading size

Dhar & Zhu (2006), among others, found a lower disposition effect for wealthier investors, hence for investors trading in a larger size.

To test for the trading size in this database, it is divided in four quartiles, and the top quartile will be compared to the bottom quartile. The average transaction size of the top quartile for the discount broker is 16.902 euro per transaction and of the bottom quartile it is 843 euro.

In table 28 below, no significant difference can be found between the two groups using the survival analysis, in other words the disposition effect is not affected by the trading size.

Table 28: Confidence intervals for TGI and TLI by trading size (Survival method)

Trading size	TGI	se TGI	z	90% CI TGI		95% CI TGI		99% CI TGI	
top 25% quartile	1.248	0.014	15.600	1.224	1.271	1.220	1.276	1.211	1.284
bottom 25% quartile	1.224	0.020	10.300	1.191	1.256	1.185	1.262	1.173	1.274

Trading size	TLI	se TLI	z	90% CI TLI		95% CI TLI		99% CI TLI	
top 25% quartile	0.801	0.014	15.600	0.778	0.825	0.774	0.829	0.765	0.838
bottom 25% quartile	0.817	0.020	10.300	0.785	0.850	0.779	0.856	0.767	0.868

Notes: In table 28 confidence intervals have been obtained for TGI and TLI using Welch's *t*-test. In case the intervals of the trading size groups overlap, it means that the disposition effect is not significantly different from one group compared to the other

In the consistency check with the Odean methodology, surprisingly, the transactions with the lowest trading size appear to show a difference in PGR over PLR which is significantly lower at the 1% level than the top quartile of the highest trading size.

Table 29: Confidence intervals for PGR-PLR by trading size (Odean)

mean	mean	mean		90% CI	95% CI	99% CI
------	------	------	--	--------	--------	--------

Trading size	PGR	PLR	PGR-PLR	sd PGR	sd PLR	mean PGR-PLR		mean PGR-PLR		mean PGR-PLR	
top 25% quartile	0.063	0.025	0.038	0.171	0.109	0.035	0.042	0.034	0.042	0.033	0.043
bottom 25% quartile	0.035	0.014	0.021	0.116	0.079	0.019	0.024	0.018	0.024	0.017	0.025

Notes: In table 29 confidence intervals have been obtained for the difference between PGR and PLR using Welch's *t*-test. In case the intervals of the trading size groups overlap, it means that the disposition effect is not significantly different from one group compared to the other.

Summarizing the results for the two indicators for sophistication, education level and trading size, it is shown above that sophistication does not have any effect on the disposition effect in Belgium, and therefore **Hypothesis 5 is not supported.**

6.6 Robustness checks

6.6.1. Size of gains and losses

A V-shaped pattern for the propensity to sell at different levels of gains and losses was first found by *Ben-David & Hirshleifer (2012)* and confirmed by *An & Argyle (2015)*. They found that the higher the gains (and losses), the higher the propensity to sell a position.

In our sample different intervals of gains and losses have been tested, but since the database is over such a long period, the majority of the gains and losses are relatively high (>ABS(50%)) and there are very few positions traded at very low levels (<ABS(5%)). Three ranges of gains and losses have therefore been defined in such a way to have sufficient data for relatively small gains and losses: small, ranging in absolute values from 0 to 10%, moderate, from 10 to 30% and high, all above 30%. Subsequently the

disposition effect is calculated and arranged according to in which range the position is trading at that particular moment. The same calculations are then done with different intervals to see whether the results are consistent: small is for gains and losses up to 20%, moderate from 20% to 50% and high is above 50%. Table 30 and 31 report the results.

As we can see in table 30, when the position is trading at a small gains under 10% a strong inverse disposition effect is found with investors having a 23,61% ($1 - 0,7639 = 0,2361$) decreased conditional probability of being sold, relative to the baseline, while they have an increased conditional probability of being sold of 30,90% ($1 - 1,3090 = -0,3090$) when the position is trading at a small loss up to -10%.

Table 30: Confidence intervals for TGI and TLI by size of gain/loss (survival analysis)

size of gain	TGI	se TGI	z	df	90% CI TGI		95% CI TGI		99% CI TGI	
small <10%	0.76 4	0.02 8	-9.8	5756	0.71 8	0.80 9	0.71 0	0.81 8	0.69 3	0.83 5
moderate 10-30%	1.16 2	0.02 1	7.1	1081 1	1.12 8	1.19 7	1.12 1	1.20 4	1.10 8	1.21 7
high >30%	1.99 2	0.01 5	46.2	8703 7	1.96 8	2.01 7	1.96 3	2.02 2	1.95 4	2.03 1

size of loss	TLI	se TLI	z	df	90% CI TLI		95% CI TLI		99% CI TLI	
small <10%	1.30 9	0.02 8	9.8	5756	1.26 4	1.35 4	1.25 5	1.36 3	1.23 8	1.38 0
moderate 10-30%	0.86 0	0.02 1	-7.1	1081 1	0.82 6	0.89 5	0.81 9	0.90 2	0.80 6	0.91 5
high >30%	0.50 2	0.01 5	-	8703 7	0.47 7	0.52 6	0.47 3	0.53 1	0.46 4	0.54 0

Notes: In table 30 confidence intervals have been obtained for TGI and TLI using Welch's *t*-test for the different groups based on the size of gains and losses. In case the intervals of the groups overlap, it means that the disposition effect is not significantly different from one group compared to the other

For positions trading at moderate gains between 10% and a 30%, a disposition effect is found with investors having a 16,24% increased conditional probability of being sold, relative to the baseline, while they have a decreased conditional probability of being sold of 13,97% when the position is trading at a loss between 10 and 30%.

For positions trading at high gains above 30%, a very strong disposition effect is found with investors having a 99,24% increased conditional probability of being sold, relative to the baseline, while they have a decreased conditional probability of being sold of 49,81% when the position is trading at a loss above 30%.

Therefore, it can be concluded that the right leg of the V-shape (the gains), as first found by *Ben-David & Hirshleifer* (2012), does also exist in the Belgian market, but not for the left leg of the V-shape (the losses). Our result implies that for small gains the propensity to sell is lower, going to a very strong propensity to sell for large gains, exactly as found by *Ben-David & Hirshleifer*, but for losses we do not find the same, since for small losses the propensity to sell is higher than for large losses. The implications of this showed behavior for the Belgium market, is that there is an inverse disposition effect for small gains and losses, while for medium and large gains and losses there is an increasing disposition effect.

Doing the same analysis as above but then for intervals of small (up to 20%), moderate (20% - 50%) and high (more than 50%), gives similar results as can be seen in table 31 below.

In 6.2 it was found that the institutional investors exhibit no disposition effect and now interestingly the shape for the different magnitudes of gains and losses observed for this group is as follows: at small levels of gains and losses a strong disposition effect could be found at 10% confidence level (very low degrees of freedom however), going to no specific disposition effect at moderate gains and losses and to an inverse disposition effect for large gains and losses, however not significantly so because of the low degrees of freedom. So for the different levels of gains and losses, exactly the opposite pattern is found compared to private investors.

Table 31: Confidence intervals for TGI and TLI by size of gain/loss (survival analysis) for different intervals

size of gain	TGI	se TGI	z	df	90% CI TGI		95% CI TGI		99% CI TGI	
small <20%	0.66 7	0.02 7	- 15.3	6632	0.62 3	0.71 0	0.61 5	0.71 9	0.59 9	0.73 5
moderate 20-50%	1.67 8	0.02 4	- 21.6	7794	1.63 9	1.71 7	1.63 1	1.72 5	1.61 6	1.74 0
high >50%	2.08 9	0.02 0	- 37.1	8481	2.05 6	2.12 2	2.05 0	2.12 8	2.03 8	2.14 0

	TLI	se TLI	z		90% CI TLI		95% CI TLI		99% CI TLI	
small <20%	1.50 0	0.02 7	15.3	6632	1.45 6	1.54 3	1.44 8	1.55 2	1.43 1	1.56 8
moderate 20-50%	0.59 6	0.02 4	- 21.6	7794	0.55 7	0.63 5	0.54 9	0.64 3	0.53 4	0.65 8
high >50%	0.47 9	0.02 0	- 37.1	8481	0.44 6	0.51 1	0.44 0	0.51 8	0.42 8	0.53 0

Notes: In table 31 confidence intervals have been obtained for TGI and TLI using Welch's *t*-test for the different groups based on the size of gains and losses. In case the intervals of the groups overlap, it means that the disposition effect is not significantly different from one group compared to the other

In table 32, a breakdown is given, using the same ranges of levels of gains and losses as for the discount broker above, for the different investor categories of the investment bank.

For private investors under discretionary management no disposition effect can be observed for small gains and losses and a strong disposition effect for moderate and high gains.

The private investors receiving investment advice do not show any difference in disposition effect for the different levels of gains and losses.

The private investors not receiving any advice do exhibit an increasing disposition effect for different levels of gains and losses but flattened out for the moderate and high levels.

Thus, we find that institutional investors only exhibit a disposition effect for small gains and losses while the rest of investors exhibit in general a stronger disposition effect for moderate and large gains and losses.

Table 32: CI for TGI and TLI by size of gain/loss per investor category (survival analysis)

Institutional	TGI	se TGI	z	df	90% CI TGI		95% CI TGI		99% CI TGI	
small <10%	3.332	0.679	1.8	14	2.215	4.449	2.001	4.663	1.583	5.081
moderate 10-30%	0.959	0.277	-0.2	54	0.504	1.415	0.417	1.502	0.246	1.672
high >30%	0.858	0.123	-1.2	268	0.656	1.060	0.617	1.099	0.541	1.175

Institutional	TLI	se TLI	z	df	90% CI TLI		95% CI TLI		99% CI TLI	
small <10%	0.300	0.679	-1.8	14	0.817	1.417	1.031	1.631	-1.449	2.049
moderate 10-30%	1.042	0.277	0.2	54	0.587	1.498	0.500	1.585	0.329	1.755
high >30%	1.165	0.123	1.2	268	0.963	1.367	0.924	1.406	0.848	1.482

Private, discretionary management	TGI	se TGI	z	df	90% CI TGI		95% CI TGI		99% CI TGI	
small <10%	1.108	0.147	0.7	353	0.866	1.350	0.820	1.396	0.729	1.487
moderate 10-30%	2.800	0.140	7.4	714	2.570	3.030	2.526	3.074	2.439	3.161
high >30%	1.755	0.028	20.0	7313	1.709	1.802	1.700	1.810	1.683	1.828

Private, discretionary management	TLI	se TLI	z	df	90% CI TLI		95% CI TLI		99% CI TLI	
small <10%	0.902	0.147	-0.7	353	0.660	1.144	0.614	1.190	0.523	1.281
moderate 10-30%	0.357	0.140	-7.4	714	0.127	0.587	0.083	0.631	-0.004	0.718
high >30%	0.570	0.028	-20.0	7313	0.523	0.616	0.515	0.625	0.497	0.642

Private, with advice	TGI	se TGI	z	df	90% CI TGI		95% CI TGI		99% CI TGI	
small <10%	1.616	0.219	2.2	96	1.256	1.976	1.187	2.045	1.052	2.180
moderate 10-30%	1.799	0.222	2.7	128	1.434	2.164	1.364	2.234	1.227	2.371
high >30%	1.762	0.079	7.1	1042	1.631	1.892	1.606	1.917	1.557	1.966

Private, with advice	TLI	se TLI	z	df	90% CI TLI		95% CI TLI		99% CI TLI	
small <10%	0.619	0.219	-2.2	96	0.259	0.979	0.190	1.048	0.055	1.183
moderate 10-30%	0.556	0.222	-2.7	128	0.191	0.921	0.121	0.991	-0.016	1.128
high >30%	0.568	0.079	-7.1	1042	0.437	0.698	0.412	0.723	0.363	0.772

Private, no advice	TGI	se TGI	z	df	90% CI TGI		95% CI TGI		99% CI TGI	
small <10%	1.529	0.057	7.5	1760	1.435	1.622	1.417	1.640	1.382	1.675
moderate 10-30%	2.582	0.045	21.0	2618	2.507	2.656	2.493	2.670	2.465	2.698
high >30%	2.234	0.018	27.1	2041 2	2.205	2.263	2.200	2.268	2.189	2.279

Private, no advice	TLI	se TLI	z	df	90% CI TLI		95% CI TLI		99% CI TLI	
small <10%	0.654	0.057	-7.5	1760	0.561	0.748	0.543	0.766	0.508	0.801
moderate 10-30%	0.387	0.045	-21.0	2618	0.313	0.462	0.299	0.476	0.271	0.504
high >30%	0.448	0.018	-27.1	2041 2	0.419	0.476	0.413	0.482	0.403	0.493

Notes: In table 32 confidence intervals have been obtained for TGI and TLI using Welch's *t*-test for the different groups based on the size of gains and losses and for every investor category. In case the intervals of the groups overlap, it means that the disposition effect is not significantly different from one group compared to the other

6.6.2. Taking dividends into account

Most Belgian shares pay annual dividends around April/May and some shares also pay an interim dividend in September/October. These dividends are quite substantial, over the 14 year period under study around 3% per annum, and therefore it is interesting to test whether taking into account these dividends would alter the disposition effect.

Table 33: Disposition effect before and after dividends taken in account

Total period	No Dividends taken into account			Dividends taken into account		
	mean	<i>t</i> -stat	p	mean	<i>t</i> -stat	p
Institutional	2.6479	1.8615	0.0649	2.2727	2.1313	0.0349
Private, discretionary mngmt	5.6957	29.4348	0.0000	5.3333	28.4610	0.0000
Private, with advice	5.0435	5.2627	0.0000	4.8936	5.1236	0.0000
Private, no advice	7.1500	23.4832	0.0000	7.1210	23.0238	0.0000

Notes: In table 33 the disposition effect measured by the ratio PGR/PLR according to the Odean method is compared before and after taking dividends into account

After adjusting the weighted average price for dividends received during the holding period, the Odean method is used to calculate the ratio PGR/PLR and the results are shown in table 33 above. The ratio is only slightly lower for most categories, but for the category of the institutional investors the t -statistic is higher which means the disposition effect is statistically significant with a 95% confidence interval as opposed to a 90% confidence interval without taking dividends into account.

7. Conclusions and reflections

7.1. Conclusions in English

This study examined the disposition effect on a long dataset (2001 until 2014) in Belgium, a country where all capital gains are tax-free and capital losses not tax deductible. The dataset came from two Belgian institutions: the biggest local investment bank and the biggest online discount broker, with together four different investor categories, institutional investors, private investors under discretionary management, private investors receiving professional advice and finally private investors not receiving any advice.

The disposition effect is not just another anomaly in the financial markets, but is important for 4 different reasons: (1) it induces investors to pay more capital gains taxes than needed since they take profits too early and let their losses run; (2) it might lead to inferior investment performance, discouraging the propensity to saving of individuals; (3) it is linked to the momentum effect (*Jegadeesh & Titman, 1993*) thru the undervaluation and overvaluation of stocks in gaining-losing positions that will indice momentum when stock prices return to their fundamental values as claimed by *Grinblatt & Han (2005)*, and (4) it decreases the volatility of individual stocks and thus of the market in general, by moderating both the up (by selling) and down (by not selling) trends as supported by *Goetzmann & Massa (2006)*.

The study uses two different methodologies: the Odean or ratio-analysis method for the hypotheses (1 – 3) which look at the market on average or at specific investor groups on average; and the survival analysis

method for the hypotheses (4 – 5) where an analysis is done at the individual account level. The other method is always used as a consistency for the primary method used.

A strong disposition affect was found in the Belgian market on average with no seasonal pattern or end-of-year effects, confirming that the fact that in other markets where there are taxes, the end of fiscal year selling which pushes the disposition effect to zero or even inverse, is mainly due to tax reasons (Hypothesis 1).

Obviously, the disposition effect present in the Belgian market does not have any impact on the capital gains taxes paid since there are none.

Many studies have found that institutional and professional investors tend to have a lower disposition effect than private individuals. Intuitively, one could therefore argue that private individuals whose assets are professionally managed under a discretionary mandate, will have a disposition effect close to institutional investors. Since those managers are generally in direct contact with their clients, while pure institutional clients do not and only have anonymous clients, some influence of those clients might transpire into the managers investment decisions and therefore a slightly higher disposition effect might be expected than for pure institutional investors. Private investors receiving professional advice can then be expected to have again a higher disposition effect and private investors not receiving any advice would have the highest disposition effect.

In the Belgian market no disposition effect is indeed found for institutional investors at aggregate level. Interestingly when we breakdown

trades around the size of gains and losses they do exhibit disposition effect for small gains and losses, what means that they have a higher propensity to sell small gains than small losses. On the other side, a strong disposition effect is found for the other three investor categories, and in general this disposition effect increase with the trade size.

No support, however, is found for the ranking of the investor categories described above (Hypothesis 2). Although a problem of degrees of freedom when breaking down our sample in the different investors categories could be affecting our results. Thus, future study might be directed to datasets with a much higher number of private investors under discretionary management and with advice as well as institutional investors in order to narrow the confidence intervals with higher degrees of freedom.

Given that disposition effect hampers performance, and that institutional investors do not exhibit it, while all categories of private investors do behave with this bias, we wonder whether this anomaly is reallocating gains from private investors to institutional investors. An exploration of this hypothesis could be of interest for future research.

Cheng, Lee & Lin (2013) found a stronger disposition effect in bear markets than in bull markets and this is confirmed in our study for private investors not receiving any investment advice (Hypothesis 3) adding evidence to the findings that market conditions do have an impact on investor decision making. This stronger disposition effect in bear markets should diminish the risk (thru its effect in smoothing volatility as supported by *Goetzmann and Massa (2006)*), what would be a positive side effect of the disposition bias in

downturns that are characterized, precisely, by being periods of high levels of volatility. Further research in this area would be of great interest.

Most studies show that women are more risk averse than men, e.g. *Charness & Gneezy (2012)*. However, the framework offered by Prospect Theory to explain the disposition effect, is based on the empirical finding that investors are only risk averse on the side of gains, while they show risk seeking behavior on the side of losses. Surprisingly the literature about disposition effect has omitted the analysis of gender behavior. One exception is *Cheng, Lee & Lin (2013)*, who found a stronger disposition effect for women than for men. In Belgium, women also exhibit a significantly stronger disposition effect than men (Hypothesis 4) which is consistent with literature on sociology, psychology and decision-taking by gender.

Given the negative impact of disposition effect on investment performance, this behavior would not help to narrow the gender wealth gap reported in the literature that results from a lifetime of lower earnings for women, see *Neelakantan & Chang (2010)* and *Cha & Weeden (2014)*.

The highest attained education level of the investor and the average trading size per investor is used as a proxy for sophistication here. Although many studies showed that more sophistication lead to a lower disposition effect, no support for this has been found in the Belgian market (Hypothesis 5). The fact that education level seems to have no influence in the disposition effect, means that we would not be able to correct this harmful behavior for individuals by increasing their education status.

Overall our results support the existence of disposition effect for the Belgian market, although not all the financial agents participating in the market exhibit the same grade of this behavioral bias and this is probably the most interesting finding of this work. Even when at aggregate level the disposition effect would induce some positive consequences for the market at a whole, reducing the volatility and therefore the risk by smoothing price movements, it is clear that at individual level, the effect is harmful for those investors who suffer it, hampering their investment performance and discouraging them from investing. Moreover, while most private investors would be suffering disposition effect and its consequences, institutional investors would be perhaps profiting from strategies based on the momentum effect generated by the disposition effect. Further research in this area is worthy.

7.2. Conclusiones y reflexiones en Español

El presente estudio examinó el efecto disposición sobre una serie larga de datos (desde 2001 hasta 2014) en Bélgica, un país donde toda ganancia patrimonial está exenta de impuestos y toda pérdida patrimonial es no deducible de impuestos. La serie de datos provino de dos instituciones belgas: el mayor banco local de inversiones locales y el mayor corredor de descuento en línea, junto con cuatro categorías diferentes de inversores, inversores institucionales, inversores particulares sujetos a gestión discrecional, inversores particulares que reciben asesoramiento profesional y por último inversores particulares que no reciben ningún asesoramiento.

El efecto disposición no es solamente otra anomalía en los mercados financieros, sino que es importante por 4 razones distintas: (1) induce a los inversores a pagar más impuestos sobre el patrimonio de los necesarios, ya que toman los beneficios demasiado pronto y dejan correr sus pérdidas; (2) puede llevar a un rendimiento inferior de las inversiones, desalentando la tendencia a ahorrar de las personas; (3) está vinculado al efecto impulso (*Jegadeesh & Titman, 1993*) a través de la infravaloración y la sobrevaloración de las acciones en posiciones de ganancia-pérdida que inducirán el impulso cuando los precios de las acciones regresen a sus valores fundamentales, tal y como afirmaron *Grinblatt & Han (2005)*, y (4) reduce la volatilidad de las acciones individuales y por lo tanto del mercado en general, moderando tanto la tendencia alcista (al vender) como bajista (al no vender) según defienden *Goetzmann & Massa (2006)*.

El estudio emplea dos metodologías diferentes: el método Odean o de análisis de ratios financieros para las hipótesis (1 – 3) que contempla el mercado en media o grupos de inversores específicos en media; y el método del análisis de supervivencia para las hipótesis h (4 – 5) donde se realiza un análisis a nivel de cuenta individual. El otro método siempre es empleado como comprobador de coherencia para el método principal.

Se ha encontrado, en media, un fuerte efecto disposición en el mercado belga sin patrón estacional ni efectos de fin de año, lo cual confirma que el hecho de que en otros mercados donde hay impuestos, la venta de fin de año fiscal que empuja el efecto disposición a cero o incluso al inverso, se debe principalmente a razones de impuestos. (Hipótesis 1).

Evidentemente, el efecto disposición presente en el mercado belga no tiene impacto alguno en los impuestos pagados sobre el patrimonio, ya que éstos no existen. Numerosos estudios han descubierto que los inversores institucionales y profesionales tienden a tener un efecto disposición más bajo que los particulares. De forma intuitiva, podría argumentarse que los particulares cuyos activos son gestionados profesionalmente bajo mandato discrecional, tendrán un efecto disposición cercano al de los inversores institucionales. Dado que dichos gestores generalmente están en contacto directo con sus clientes, mientras que los clientes institucionales puros no lo están y solo tienen clientes anónimos, una parte de la influencia de tales clientes puede traspasarse a las decisiones de inversión de los gestores y por lo tanto podría esperarse un efecto disposición ligeramente más alto que para los inversores institucionales puros. Puede esperarse entonces que los

inversores particulares que reciben asesoramiento profesional tengan de nuevo un efecto disposición más alto y los inversores particulares que no reciben asesoramiento alguno tendrían el efecto disposición más alto.

En el mercado belga no se encuentra ningún efecto disposición para los inversores institucionales a nivel agregado. Curiosamente, cuando desglosamos el comercio entorno a la dimensión de las ganancias y las pérdidas, éste si muestra efecto disposición para pequeñas ganancias y pérdidas, lo cual significa que poseen una tendencia más alta a vender pequeñas ganancias que pequeñas pérdidas. Por otro lado, se encuentra un fuerte efecto disposición para las otras 3 categorías de inversores, y en general este efecto disposición aumenta con el tamaño del comercio. Sin embargo, no se halla ningún apoyo para la clasificación de las categorías de inversores anteriormente descritas (Hipótesis 2). Aunque un problema de grados de libertad a la hora de desglosar nuestra muestra en las diferentes categorías de inversores podría estar afectando a nuestros resultados. Por ello, futuros estudios podrían dirigirse a series de datos con un número mucho más elevado de inversores particulares sujetos a gestión discrecional y con asesoramiento, así como a inversores institucionales, para estrechar los intervalos de confianza con grados más elevados de libertad.

Dado que el efecto disposición obstaculiza el rendimiento, y que los inversores no lo exhiben, mientras que todas las categorías de inversores particulares se comportan con este sesgo, nos preguntamos si esta anomalía está reasignando ganancias de inversores particulares a inversores

institucionales. Una exploración de esta hipótesis podría ser de interés para investigaciones futuras.

Cheng, Lee & Lin (2013) encontraron un efecto disposición más fuerte en los mercados a la baja que en los mercados al alza y esto queda confirmado en nuestro estudio para los inversores particulares que no reciben ningún asesoramiento de inversiones (Hipótesis 3) lo cual añade pruebas a las conclusiones de que las condiciones del mercado efectivamente tienen impacto en la toma de decisiones de los inversores. Este efecto disposición más fuerte en los mercados a la baja debería reducir el riesgo (a través de su efecto en el facilitar la volatilidad según defiende *Goetzmann and Massa* (2006)), lo cual sería un efecto secundario positivo del sesgo de la disposición en las recesiones que se caracterizan, precisamente, por ser periodos de altos niveles de volatilidad. Ulterior investigación en esta área sería de gran interés.

La mayoría de los estudios muestran que las mujeres poseen mayor aversión al riesgo que los hombres, p. ej. *Charness & Gneezy* (2012). Sin embargo, el marco ofrecido por la Teoría de las Perspectivas para explicar el efecto disposición, se basa en la conclusión empírica de que los inversores solo tienen aversión al riesgo del lado de las ganancias, mientras que muestran comportamiento favorable al riesgo del lado de las pérdidas. Sorprendentemente la literatura sobre el efecto disposición ha omitido el análisis del comportamiento de género. Una excepción es *Cheng, Lee & Lin* (2013), quienes encontraron un efecto disposición más agudo para las mujeres que para los hombres. En Bélgica, las mujeres también exhiben un

efecto disposición significativamente más fuerte que los hombres. (Hipótesis 4) lo cual coincide con la literatura sobre sociología, psicología y la toma de decisiones en base al género.

Dado el impacto negativo del efecto disposición en el rendimiento de las inversiones, este comportamiento no ayudaría a estrechar la brecha de riqueza entre sexos reflejada en la literatura que es resultado de una vida de ingresos más bajos para las mujeres, véase *Neelakantan & Chang (2010)* y *Cha & Weeden (2014)*.

El nivel educativo obtenido más alto del inversor y el tamaño comercial medio por inversor se emplean aquí como indicador de sofisticación. A pesar de que numerosos estudios han mostrado que más sofisticación conduce a un efecto disposición más bajo, no se ha encontrado apoyo para esto en el mercado belga (Hipótesis 5). El hecho de que el nivel educativo parece no tener influencia alguna en el efecto disposición significa que no podríamos corregir este comportamiento dañino para las personas mediante el aumento de su nivel educativo.

De forma global nuestros resultados apoyan la existencia del efecto disposición en el mercado belga, a pesar de que no todos los agentes financieros que participan en el mercado muestran el mismo grado de este sesgo de comportamiento, lo cual probablemente sea la conclusión más interesante del presente trabajo. Incluso cuando a nivel agregado el efecto disposición induciría algunas consecuencias positivas para el mercado en su conjunto, reduciendo la volatilidad y por lo tanto el riesgo facilitando los movimientos de precios, está claro que a nivel individual, el efecto es

perjudicial para aquellos inversores que lo sufren, obstaculizando su rendimiento de inversiones y desalentándoles de invertir. Adicionalmente, mientras que la mayoría de los inversores privados estarían sufriendo el efecto disposición y sus consecuencias, los inversores institucionales estarían quizás beneficiándose de estrategias basadas en el efecto impulso generado por el efecto disposición. Vale la pena la ulterior investigación en esta área.

8. References

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Appendix 1: Software codes

Appendix 1.1 Matlab code

I have written the code in Matlab (p 112 - 183) below for the calculation of the Odean method and it also generates the input for the regression analysis.

At the start of the Matlab code (p 112 - 115), input is asked about the specific analysis to perform (market capitalisation, selection of stocks, type of traders, etc.).

This input is processed and the loop over the requested number of stocks commences. The data is prepared for the active accounts of the specific stock (p 115 - 123). Only roundtrip accounts are for example considered.

The iteration over the active accounts per stock starts with a compulsory buy. The paper gains and losses are calculated until the next action (p 123 - 126).

For each following iterate we check if it is a buy or sell, if it is still the same account, if it is the last iterate etcetera (p 126 - 180). Each of these combinations is treated differently. Suppose it is a buy within the same account, then the new aggregate price is calculated and the number of paper gains and losses are calculated until the next action. Results of the previous iterate are handed on to the next if it is still within the same account. Each last action within an account ends for example with the calculation of the PGR and

PLR of the account. The regression data is collected for each sell (gain/loss, days until sell, type of investor etc.).

When the nested loops are finished, the results are summarised and the regression data is exported (p 180 - 183).

```

clc
clear all
load('Petercam_research_2_noAGS_divs.mat') % now you know for sure old data is
% not messing with the results
tic

%% Choose which stock and category we will analyse (ask INPUT)
% stocks = ['ACK';'AGS';'ABI';'BEK';'BEL';'COF';'COL';'DIE';'DEL';'GBL';'KBC'...
%   ;'SOL';'UCB';'UMI';'TOT']; % in this order the values will be assigned
% % to the stocks, easier to save with other data than words...
stocks = ['ABI';'KBC';'UCB';'GBL';'BEL';'DEL';'SOL';'COL';'ACK'...
; 'UMI';'COF';'DIE';'BEK';'TOT']; % we changed the order of the stocks, from
% high market capitalisation to low. Makes it easier to research that part
stock_idx = 0;

% Ask input about market capitalisation
prompt = 'Do you want to analyse the stocks on market capitalisation? (Y/N) : ';
antw = ['Y';'N'];
str3 = input(prompt,'s');
x = strmatch(str3, antw);
if isempty(x)
    while isempty(x)
        prompt = 'Do you want to analyse the stocks on market capitalisation? (Y/N) : ';
        str3 = input(prompt,'s');
        x = strmatch(str3, antw);
    end
end
if str3 == 'Y'
    prompt = 'On High market capitalisation or Low market capitalisation? (H/L) : ';
    antw = ['H';'L'];
    str4 = input(prompt,'s');
    x = strmatch(str4, antw);
    if isempty(x)
        while isempty(x)
            disp('Wrong entry, try again')
            prompt = 'On High market capitalisation or Low market capitalisation? (H/L) : ';
            str4 = input(prompt,'s');
            x = strmatch(str4, antw);
        end
    end
end
elseif str3 == 'N'
    % Ask input about the to research stocks
    disp('Which of the following stocks are we going to analyse first?')
    disp(stocks)
    disp('TOT means all stocks')
    prompt = 'Please enter one of these stocks with capital letters: ';
    str1 = input(prompt,'s');

```

```

x = strmatch(str1, stocks);
if isempty(x)
    while isempty(x)
        disp('Wrong entry, try again')
        prompt = 'Please enter one of these stocks with capital letters: ';
        str1 = input(prompt,'s');
        x = strmatch(str1, stocks);
    end
end
% what is the index of the stock...
stock_idx = find(all(ismember(stocks,str1),2));
end

% Ask input about the to research category
categorie = ['Total';'insti';'by_in';'no_ad';'wt_ad'];
disp('Which of the following categories are we going to analyse?')
disp(categorie)
prompt = 'Please enter one of these categories : ';
str2 = input(prompt,'s');
x = strmatch(str2, categorie);
if isempty(x)
    while isempty(x)
        disp('Wrong entry, try again')
        prompt = 'Please enter one of these categories : ';
        str2 = input(prompt,'s');
        x = strmatch(str2, categorie);
    end
end

% Investigate per month?
prompt = 'Do you want to analyse the categories per month? (Y/N) : ';
antw = ['Y';'N'];
str8 = input(prompt,'s');
x = strmatch(str8, antw);
if isempty(x)
    while isempty(x)
        disp('Wrong entry, try again')
        prompt = 'Do you want to analyse the categories per month? (Y/N) : ';
        str8 = input(prompt,'s');
        x = strmatch(str8, antw);
    end
end

% incorporate dividends?
prompt = 'Do you want to incorporate dividends in the analysis? (Y/N) : ';
antw = ['Y';'N'];
str5 = input(prompt,'s');
x = strmatch(str5, antw);
if isempty(x)
    while isempty(x)
        disp('Wrong entry, try again')
        prompt = 'Do you want to incorporate dividends in the analysis? (Y/N) : ';
        str5 = input(prompt,'s');
        x = strmatch(str5, antw);
    end
end

% Investigate time interval?
prompt = 'Do you want to analyse a certain time interval? (Y/N) : ';
antw = ['Y';'N'];

```

```

str9 = input(prompt,'s');
x = strcmp(str9, antw);
if isempty(x)
    while isempty(x)
        disp('Wrong entry, try again')
        prompt = 'Do you want to analyse a certain time interval? (Y/N) : ';
        str9 = input(prompt,'s');
        x = strcmp(str9, antw);
    end
end
if strcmp(str9,'Y')
    disp('So for the first date of the time period: ')
    first_date = fetchdate();
    first_date = [first_date(1,3) first_date(1,2) first_date(1,1)];
    disp('And for the final date of the time period: ')
    final_date = fetchdate();
    final_date = [final_date(1,3) final_date(1,2) final_date(1,1)];
end

% Investigate Bull/Bear period?
prompt = 'Do you want to analyse the Bull/Bear periods? (Y/N) : ';
antw = ['Y';'N'];
str12 = input(prompt,'s');
x = strcmp(str12, antw);
if isempty(x)
    while isempty(x)
        disp('Wrong entry, try again')
        prompt = 'Do you want to analyse the Bull/Bear periods? (Y/N) : ';
        str12 = input(prompt,'s');
        x = strcmp(str12, antw);
    end
end

% Collect regression data
prompt = 'Do you want to collect data for regression? (Y/N) : ';
antw = ['Y';'N'];
str10 = input(prompt,'s');
x = strcmp(str10, antw);
if isempty(x)
    while isempty(x)
        disp('Wrong entry, try again')
        prompt = 'Do you want to collect data for regression? (Y/N) : ';
        str10 = input(prompt,'s');
        x = strcmp(str10, antw);
    end
end
if strcmp(str10,'Y')
    prompt = 'What is the percentual decrease/increase of a small loss/gain? : ';
    small = input(prompt);
    small = small/100;
    prompt = 'What is the percentual decrease/increase of a moderate loss/gain? : ';
    moderate = input(prompt);
    moderate = moderate/100;
    fprintf('A high gain/loss will thus be a percentage higher than %d %%\n',100*moderate);
end

%% INPUT verwerken
% We make a division between going through one stock or multiple

```

```

if str3 == 'N' && stock_idx < 14
    z = 1; % going through one stock
    d = 1;
elseif str3 == 'N' && stock_idx == 14
    z = 13; % going through all stocks
    d = 1;
elseif str3 == 'Y' && str4 == 'L'
    z = 13; % going through stocks with low market capitalisation
    d = 10;
elseif str3 == 'Y' && str4 == 'H'
    z = 4; % going through stocks with high market capitalisation
    d = 1;
end
% Does the following big if-else loop cover all possibilities?
% the unclassified counter gives insight into this..
unclassified = 0;

for k = d:z
    % now that the stock(s) to research are entered correctly, we continue...
    if z == 1 % we research one stock
        filename = strcat('Market/',str1,'.xlsx');
        stock = xlsread(filename,'A:E');
        stock = stock(:,[1 5]);
    elseif z>1 % we research multiple
        filename = strcat('Market/',stocks(k,1:3),'.xlsx');
        stock = xlsread(filename,'A:E');
        stock = stock(:,[1 5]);
    end

    % If the date should be a string again, the code below should be used
    % formatout = 'dd/mm/yy';
    % datearray = datestr(stock(:,1),formatout);

    %% Sort dates & accounts
    stock = sortrows(stock,1); % put dates in chronological order of the stock
    formatin = 'dd/mm/yyyy'; % format data petercam database
    formatout = 'dd/mm/yy'; % format data market_stock
    operations = datevec(Operatiodate,formatin); % make a time array, Y M D
    operations = operations(:,1:3); % time in day can be removed, only 0's anyway
    operations = [operations(:,3) operations(:,2) operations(:,1)]; % D M Y
    stock_date = datestr(stock(:,1),formatout); % make a time array with correct format
    stock_date = datevec(stock_date,formatout); % make a time array, Y M D
    stock_date = stock_date(:,1:3); % remove last three rows, only 0's anyway
    stock_date = [stock_date(:,3) stock_date(:,2) stock_date(:,1)]; % D M Y
    stock = stock(:,2); % remove time column, already in stock_date
    stock = [stock stock_date];
    % Watch out, the order is now already correct, don't try sortin this!!
    % the two arrays are independent

    %% This code is used in petercam.m, but was needed again, although
    %% with some alterations. No absolute value anymore for quantity,
    %% etc.. Run it once and save in the workspace..
    % prive_with_advice = zeros(length(Account),7);
    % prive_no_advice = zeros(length(Account),7);
    % prive_by_institution = zeros(length(Account),7);
    % institutional = zeros(length(Account),7);
    % for i = 1:length(Clienttype)
    %     if (strcmp(Catgor(i),'Private')) && (strcmp(Clienttype(i),'Execution'))...

```

```

% ||strcmp(Clienttype(i),'N/A')
%   prive_no_advice(i,1) = Account(i);
%   prive_no_advice(i,2) = Quantity(i); % (1) only interested
% %   in the size, not if it's buy or sell yet
%   prive_no_advice(i,3) = Bruteuro(i); % (1)
%   prive_no_advice(i,4) = operations(i,1);
%   prive_no_advice(i,5) = operations(i,2);
%   prive_no_advice(i,6) = operations(i,3);
%   prive_no_advice(i,7) = ISN_num(i,1);
%
%   elseif (strcmp(Catgor(i),'Private')) && (strcmp(Clienttype(i),'Advisory'))
%     prive_with_advice(i,1) = Account(i);
%     prive_with_advice(i,2) = Quantity(i); % (1)
%     prive_with_advice(i,3) = Bruteuro(i); % (1)
%     prive_with_advice(i,4) = operations(i,1);
%     prive_with_advice(i,5) = operations(i,2);
%     prive_with_advice(i,6) = operations(i,3);
%     prive_with_advice(i,7) = ISN_num(i,1);;
%
%   elseif (strcmp(Catgor(i),'Private')) && (strcmp(Clienttype(i)...
%     , 'Discretionary'))
%     prive_by_institution(i,1) = Account(i);
%     prive_by_institution(i,2) = Quantity(i); % (1)
%     prive_by_institution(i,3) = Bruteuro(i); % (1)
%     prive_by_institution(i,4) = operations(i,1);
%     prive_by_institution(i,5) = operations(i,2);
%     prive_by_institution(i,6) = operations(i,3);
%     prive_by_institution(i,7) = ISN_num(i,1);;
%
%   elseif strcmp(Catgor(i),'Home Funds')...
%     institutional(i,1) = Account(i);
%     institutional(i,2) = Quantity(i); % (1)
%     institutional(i,3) = Bruteuro(i); % (1)
%     institutional(i,4) = operations(i,1);
%     institutional(i,5) = operations(i,2);
%     institutional(i,6) = operations(i,3);
%     institutional(i,7) = ISN_num(i,1);;
%   end
% end% now we are going to delete all zero rows
% prive_no_advice( ~any(prive_no_advice,2), : ) = [];
% prive_with_advice( ~any(prive_with_advice,2), : ) = [];
% prive_by_institution( ~any(prive_by_institution,2), : ) = [];
% institutional( ~any(institutional,2), : ) = [];
% Total = [institutional; prive_no_advice; prive_with_advice; ...
%   prive_by_institution];
% Total = sortrows(Total,[1 6 5 4]);
% Adding indices for the types

% Total_regr = Total;
% assign_insti = unique(institutional(:,1));
% assign_by_in = unique(prive_by_institution(:,1));
% assign_no_adv = unique(prive_no_advice(:,1));
% assign_wt_adv = unique(prive_with_advice(:,1));
% for i =1:length(Total_regr)
%   index_i = find(Total_regr(i,1)==assign_insti);
%   index_bi = find(Total_regr(i,1)==assign_by_in);
%   index_na = find(Total_regr(i,1)==assign_no_adv);
%   index_wa = find(Total_regr(i,1)==assign_wt_adv);

```

```

% if isempty(index_i)
% ;
% else
%     Total_regr(i,8) = 1;
% end
% if isempty(index_bi)
% ;
% else
%     Total_regr(i,8) = 2;
% end
% if isempty(index_na)
% ;
% else
%     Total_regr(i,8) = 3;
% end
% if isempty(index_wa)
% ;
% else
%     Total_regr(i,8) = 4;
% end
% end
%% Categorien filteren op juiste aandeel
% now we are going to filter on the right stock
j = 1;
to_analyse = zeros(length(Total),8);
if strcmp(str2,'Total')
    if z == 1 % (i) we analyse one stock
        for i = 1:length(Total)
            if strcmp(str9,'N') % we don't analyse a time interval
                if stock_idx == Total(i,7)
                    to_analyse(j,:) = Total(i,:);
                    j = j+1;
                end
            else % we will analyse a time interval
                if stock_idx == Total(i,7)&& ...
                    datetime(Total(i,6),Total(i,5),Total(i,4))...
                    <= datetime(final_date(1,3),final_date(1,2),final_date(1,1))...
                    && datetime(Total(i,6),Total(i,5),Total(i,4)) >= ...
                    datetime(first_date(1,3),first_date(1,2),first_date(1,1))
                    to_analyse(j,:) = Total(i,:);
                    j = j+1;
                end
            end
        end
    elseif z > 1 % (ii) we analyse multiple stocks
        for i = 1:length(Total)
            if strcmp(str9,'N') % we don't analyse a time interval
                if k == Total(i,7)
                    to_analyse(j,:) = Total(i,:);
                    j = j+1;
                end
            else % we will analyse a time interval
                if k == Total(i,7)&& ...
                    datetime(Total(i,6),Total(i,5),Total(i,4))...
                    <= datetime(final_date(1,3),final_date(1,2),final_date(1,1))...
                    && datetime(Total(i,6),Total(i,5),Total(i,4)) >= ...
                    datetime(first_date(1,3),first_date(1,2),first_date(1,1))
                    to_analyse(j,:) = Total(i,:);
                end
            end
        end
    end
end

```

```

        j = j+1;
    end
end
end
end
elseif strcmp(str2,'no_ad')
    if z == 1 % (i)
        for i = 1:length(priv_e_no_advice)
            if strcmp(str9,'N') % we don't analyse a time interval
                if stock_idx == priv_e_no_advice(i,7)
                    to_analyse(j,:) = priv_e_no_advice(i,:);
                    j = j+1;
                end
            else % we will analyse a time interval
                if stock_idx == priv_e_no_advice(i,7) && ...
                    datetime(Total(i,6),Total(i,5),Total(i,4))...
                    <= datetime(final_date(1,3),final_date(1,2),final_date(1,1))...
                    && datetime(Total(i,6),Total(i,5),Total(i,4)) >= ...
                    datetime(first_date(1,3),first_date(1,2),first_date(1,1))
                    to_analyse(j,:) = priv_e_no_advice(i,:);
                    j = j+1;
                end
            end
        end
    end
elseif z > 1 % (ii)
    for i = 1:length(priv_e_no_advice)
        if strcmp(str9,'N') % we don't analyse a time interval
            if k == priv_e_no_advice(i,7)
                to_analyse(j,:) = priv_e_no_advice(i,:);
                j = j+1;
            end
        else % we will analyse a time interval
            if k == priv_e_no_advice(i,7) && ...
                datetime(Total(i,6),Total(i,5),Total(i,4))...
                <= datetime(final_date(1,3),final_date(1,2),final_date(1,1))...
                && datetime(Total(i,6),Total(i,5),Total(i,4)) >= ...
                datetime(first_date(1,3),first_date(1,2),first_date(1,1))
                to_analyse(j,:) = priv_e_no_advice(i,:);
                j = j+1;
            end
        end
    end
end
elseif strcmp(str2,'insti')
    if z == 1 % (i)
        for i = 1:length(institutional)
            if strcmp(str9,'N') % we don't analyse a time interval
                if stock_idx == institutional(i,7)
                    to_analyse(j,:) = institutional(i,:);
                    j = j+1;
                end
            else % we will analyse a time interval
                if stock_idx == institutional(i,7) && ...
                    datetime(Total(i,6),Total(i,5),Total(i,4))...
                    <= datetime(final_date(1,3),final_date(1,2),final_date(1,1))...
                    && datetime(Total(i,6),Total(i,5),Total(i,4)) >= ...
                    datetime(first_date(1,3),first_date(1,2),first_date(1,1))
                    to_analyse(j,:) = institutional(i,:);
                end
            end
        end
    end
end

```

```

        j = j+1;
    end
end
end
elseif z > 1 % (ii)
    for i = 1:length(institutional)
        if strcmp(str9,'N') % we don't analyse a time interval
            if k == institutional(i,7)
                to_analyse(j,:) = institutional(i,:);
                j = j+1;
            end
        else % we will analyse a time interval
            if k == institutional(i,7)&& ...
                datetime(Total(i,6),Total(i,5),Total(i,4))...
                <= datetime(final_date(1,3),final_date(1,2),final_date(1,1))...
                && datetime(Total(i,6),Total(i,5),Total(i,4)) >= ...
                datetime(first_date(1,3),first_date(1,2),first_date(1,1))
                to_analyse(j,:) = institutional(i,:);
                j = j+1;
            end
        end
    end
end
elseif strcmp(str2,'wt_ad')
    if z == 1 % (i)
        for i = 1:length(privive_with_advice)
            if strcmp(str9,'N') % we don't analyse a time interval
                if stock_idx == privive_with_advice(i,7)
                    to_analyse(j,:) = privive_with_advice(i,:);
                    j = j+1;
                end
            else % we will analyse a time interval
                if stock_idx == privive_with_advice(i,7)&& ...
                    datetime(Total(i,6),Total(i,5),Total(i,4))...
                    <= datetime(final_date(1,3),final_date(1,2),final_date(1,1))...
                    && datetime(Total(i,6),Total(i,5),Total(i,4)) >= ...
                    datetime(first_date(1,3),first_date(1,2),first_date(1,1))
                    to_analyse(j,:) = privive_with_advice(i,:);
                    j = j+1;
                end
            end
        end
    elseif z > 1 % (ii)
        for i = 1:length(privive_with_advice)
            if strcmp(str9,'N') % we don't analyse a time interval
                if k == privive_with_advice(i,7)
                    to_analyse(j,:) = privive_with_advice(i,:);
                    j = j+1;
                end
            else % we will analyse a time interval
                if k == privive_with_advice(i,7)&& ...
                    datetime(Total(i,6),Total(i,5),Total(i,4))...
                    <= datetime(final_date(1,3),final_date(1,2),final_date(1,1))...
                    && datetime(Total(i,6),Total(i,5),Total(i,4)) >= ...
                    datetime(first_date(1,3),first_date(1,2),first_date(1,1))
                    to_analyse(j,:) = privive_with_advice(i,:);
                    j = j+1;
                end
            end
        end
    end
end
end

```

```

        end
    end
end
elseif strcmp(str2,'by_in')
    if z == 1 % (i)
        for i = 1:length(priv_e_by_institution)
            if strcmp(str9,'N') % we don't analyse a time interval
                if stock_idx == priv_e_by_institution(i,7)
                    to_analyse(j,:) = priv_e_by_institution(i,:);
                    j = j+1;
                end
            else % we will analyse a time interval
                if stock_idx == priv_e_by_institution(i,7)&& ...
                    datetime(Total(i,6),Total(i,5),Total(i,4))...
                    <= datetime(final_date(1,3),final_date(1,2),final_date(1,1))...
                    && datetime(Total(i,6),Total(i,5),Total(i,4)) >= ...
                    datetime(first_date(1,3),first_date(1,2),first_date(1,1))
                    to_analyse(j,:) = priv_e_by_institution(i,:);
                    j = j+1;
                end
            end
        end
    end
elseif z > 1 % (ii)
    for i = 1:length(priv_e_by_institution)
        if strcmp(str9,'N') % we don't analyse a time interval
            if k == priv_e_by_institution(i,7)
                to_analyse(j,:) = priv_e_by_institution(i,:);
                j = j+1;
            end
        else % we will analyse a time interval
            if k == priv_e_by_institution(i,7)&& ...
                datetime(Total(i,6),Total(i,5),Total(i,4))...
                <= datetime(final_date(1,3),final_date(1,2),final_date(1,1))...
                && datetime(Total(i,6),Total(i,5),Total(i,4)) >= ...
                datetime(first_date(1,3),first_date(1,2),first_date(1,1))
                to_analyse(j,:) = priv_e_by_institution(i,:);
                j = j+1;
            end
        end
    end
end
to_analyse( ~any(to_analyse,2), : ) = []; % delete the zero rows

%%% Analyses gaan uitvoeren
% Initialisation of variables
quant_cumul = zeros(size(to_analyse,1),2);
if str10 == 'N'
    negatives = zeros(size(to_analyse,1),1); % We are going to determine all accounts
    % that have a negative cumulative quantity of a stock
elseif str10 == 'Y'
    non_roundtrips = zeros(size(to_analyse,1),1); % We are going to determine
    % all accounts that have no roundtrips
end
j = 1;

% the cumulative quantity is determined here
for i=1:size(to_analyse,1)

```

```

if str10 == 'N'
    if i == 1
        quant_cumul(i,1) = to_analyse(i,1);
        quant_cumul(i,2) = to_analyse(i,2);
    elseif i > 1 && to_analyse(i,1) == to_analyse(i-1,1)
        quant_cumul(i,1) = to_analyse(i,1);
        quant_cumul(i,2) = to_analyse(i,2)+quant_cumul(i-1,2);
    elseif i > 1 && to_analyse(i,1) ~= to_analyse(i-1,1)
        quant_cumul(i,1) = to_analyse(i,1);
        quant_cumul(i,2) = to_analyse(i,2);
    end
elseif str10 == 'Y'
    if i == 1
        quant_cumul(j,1) = to_analyse(i,1);
        quant_cumul(j,2) = to_analyse(i,2);
        if to_analyse(i,2)<0
            non_roundtrips(j,1) = quant_cumul(j,1);
        end
    elseif i > 1 && to_analyse(i,1) == to_analyse(i-1,1)
        quant_cumul(j,2) = to_analyse(i,2)+quant_cumul(j,2);
        if quant_cumul(j,2)<0
            non_roundtrips(j,1) = quant_cumul(j,1); % if it is negative
            % somewhere in between
        end
    elseif i > 1 && to_analyse(i,1) ~= to_analyse(i-1,1)
        if quant_cumul(j,2)~=0
            non_roundtrips(j,1) = quant_cumul(j,1);
        end
        j = j+1;
        quant_cumul(j,1) = to_analyse(i,1);
        quant_cumul(j,2) = to_analyse(i,2);
        if quant_cumul(j,2)<0
            non_roundtrips(j,1) = quant_cumul(j,1); % if it starts
            % with a sell
        end
    end
end
end
if str10 == 'N' && quant_cumul(i,2) < 0
    negatives(j,1) = quant_cumul(i,1);
    j = j+1;
end
end
if quant_cumul(j,2)~=0
    non_roundtrips(j,1) = quant_cumul(j,1);
end
if str10 == 'N'
    negatives = negatives(1:j-1,1);
    negatives = unique(negatives); % these are now all accounts with negative
    % cumulative quantities
elseif str10 == 'Y'
    non_roundtrips = non_roundtrips(1:j,1);
    non_roundtrips = unique(non_roundtrips); % these are now all accounts
    % that have no roundtrips
    non_roundtrips = non_roundtrips(non_roundtrips~=0);
end

% remove accounts with negative cumulative quantities
j = 1;

```

```

idx = zeros(size(to_analyse,1),1);
dismiss_negatives = 1;
% adjust this parameter if we do not want to remove this
dismiss_nonroundtrips = 1;
% adjust this parameter if we do not want to remove this
if str10 == 'N' && dismiss_negatives == 1
    for i = 1:(length(to_analyse(:,1)))
        if any((to_analyse(i,1)==negatives))
            idx(j,1) = i;
            j = j+1;
        end
    end
    idx=idx(1:j-1,1);
    idx = uint64(idx);
    to_analyse(idx, :) = [];
elseif str10 == 'Y' && dismiss_nonroundtrips == 1
    for i = 1:(length(to_analyse(:,1)))
        if any((to_analyse(i,1)==non_roundtrips))
            idx(j,1) = i;
            j = j+1;
        end
    end
    idx=idx(1:j-1,1);
    idx = uint64(idx);
    to_analyse(idx, :) = [];
end

%Initialisation variables
l = 1;
PGR = zeros(length(unique(to_analyse(:,1))),2);
PLR = zeros(length(unique(to_analyse(:,1))),2);
if str12 == 'Y'
    PGR_Bull = zeros(3*length(unique(to_analyse(:,1))),2);
    PLR_Bull = zeros(3*length(unique(to_analyse(:,1))),2);
    PGR_Bear = zeros(3*length(unique(to_analyse(:,1))),2);
    PLR_Bear = zeros(3*length(unique(to_analyse(:,1))),2);
    paper_gain_Bull = 0;
    paper_loss_Bull = 0;
    paper_gain_Bear = 0;
    paper_loss_Bear = 0;
    realized_gain_Bull = 0;
    realized_loss_Bull = 0;
    realized_gain_Bear = 0;
    realized_loss_Bear = 0;
    bull_i = 1;
    bear_i = 1;
end
paper_gain = 0;
paper_loss = 0;
realized_gain = 0;
realized_loss = 0;
quantity = 0;
price = 0;
start_date = 0;
end_date = 0;
endmonth_trigger = 0;
month_trigger = 0;

```

```

% If it is to be analysed per month, keep PGR and PLR per month
if str8 == 'Y'
    months_PGR = PR_init(to_analyse);
    months_PLR = PR_init(to_analyse);
    months_RG = struct('months',{0,0,0,0,0,0,0,0,0,0,0});
    months_RL = struct('months',{0,0,0,0,0,0,0,0,0,0,0});

    month_trigger = 0; % there is a realisation in a month
    % this shall be used to initialize the wait for the end of the month
    % after which the PGR+PLR of that month will be calculated
end
if str10 == 'Y'
    regression = zeros(size(to_analyse,1),12);
    regr_iteration = 1;
end

% PGR and PLR calculations
for i=1:size(to_analyse,1)
    if i == 1
        % we have to insert this otherwise we have an error, we assume
        % first actions is always a buy
        % Because we have stock splits in certain accounts, those prices
        % will have to be corrected
        if (k == 4 || stock_idx == 4) &&
            (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
                < datetime(2001,4,27))% case GBL
            price = 1/3*to_analyse(i,3)/to_analyse(i,2); % save first buy price
            quantity = to_analyse(i,2); % save quantity
        elseif (k == 8 || stock_idx == 8) &&
            (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
                < datetime(2010,10,15)) % case COL
            price = 1/5*to_analyse(i,3)/to_analyse(i,2); % save first buy price
            quantity = to_analyse(i,2); % save quantity
        elseif (k == 10 || stock_idx == 10) &&
            (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
                < datetime(2008,2,29)) % case UMI
            price = 1/5*to_analyse(i,3)/to_analyse(i,2); % save first buy price
            quantity = to_analyse(i,2); % save quantity
        elseif (k == 12 || stock_idx == 12) &&
            (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
                < datetime(2010,12,27)) % case DIE
            price = 1/10*to_analyse(i,3)/to_analyse(i,2); % save first buy price
            quantity = to_analyse(i,2); % save quantity
        elseif (k == 13 || stock_idx == 13) &&
            (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
                < datetime(2010,10,11)) % case BEK
            price = 1/3*to_analyse(i,3)/to_analyse(i,2); % save first buy price
            quantity = to_analyse(i,2); % save quantity
        else
            price = to_analyse(i,3)/to_analyse(i,2); % save first buy price
            quantity = to_analyse(i,2); % save quantity
        end

        % We are looking for the time before the next action and
        % we register the paper gains and losses

        % we put the data in 1x3 arrays
        start_date = [to_analyse(i,4) to_analyse(i,5) to_analyse(i,6)]; % date buy
    end
end

```

```

end_date = [to_analyse(i+1,4) to_analyse(i+1,5) to_analyse(i+1,6)]; % date next action
if str12 == 'Y'
    [now_b,j_bperiod] = isitbull2(start_date); % current bull/bear
    % period and indicator
    next_b = nextbperiod(j_bperiod);
    bool_b = 0;
    if datetime(next_b(1,3),next_b(1,2),next_b(1,1))...
        <= datetime(end_date(1,3),end_date(1,2),end_date(1,1))
        bool_b = 1;
        x_b = find(ismember(stock(:,2:4),next_b,'rows')); % end stock
    end
end
y = find(ismember(stock(:,2:4),start_date,'rows')); % start stock
x = find(ismember(stock(:,2:4),end_date,'rows')); % end stock
u = 1;
while isempty(x) % it could land on a sunday, saturday,...
    x = find(ismember(stock(:,2:4),[end_date(1,1)+u end_date(1,2) end_date(1,3)],'rows'));
    u = u+1;
    if end_date(1,1)+u>31
        u=1;
        while isempty(x)
            if end_date(1,2)+1 <= 12
                x = find(ismember(stock(:,2:4),[0+u end_date(1,2)+1 end_date(1,3)],'rows'));
                u = u+1;
            else % find in next year
                x = find(ismember(stock(:,2:4),[0+u 0+1 end_date(1,3)+1], 'rows'));
                u = u+1;
            end
        end
    end
end
if str12 == 'Y' && bool_b == 1 % suppose the b period ends before next action, then we
calculate the paper g/l's until then
    u = 1;
    while isempty(x_b) % it could land on a sunday, saturday,...
        x_b = find(ismember(stock(:,2:4),[end_date(1,1)+u end_date(1,2)
end_date(1,3)],'rows'));
        u = u+1;
        if end_date(1,1)+u>31
            u=1;
            while isempty(x_b)
                if end_date(1,2)+1 <= 12
                    x_b = find(ismember(stock(:,2:4),[0+u end_date(1,2)+1
end_date(1,3)],'rows'));
                    u = u+1;
                else % find in next year
                    x_b = find(ismember(stock(:,2:4),[0+u 0+1 end_date(1,3)+1], 'rows'));
                    u = u+1;
                end
            end
        end
    end
end
u = 1;
while isempty(y) % it could land on a sunday, saturday,...
    y = find(ismember(stock(:,2:4),[start_date(1,1)+u start_date(1,2)
start_date(1,3)],'rows'));
    u = u+1;

```

```

if start_date(1,1)+u>31
    u=1;
    while(isempty(y))
        if start_date(1,2)+1 <= 12
            y = find(ismember(stock(:,2:4),[0+u start_date(1,2)+1 start_date(1,3)],'rows'));
            u = u+1;
        else % find in next year
            y = find(ismember(stock(:,2:4),[0+u 0+1 start_date(1,3)+1], 'rows'));
            u = u+1;
        end
    end
end
end
end
for j =y:(x-1) % the first buy day can also be a paper gain/loss
    if str5 == 'Y' % incorporate dividends
        date = [stock(j,2),stock(j,3),stock(j,4)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    if stock(j,1) > price % the closing price is higher than the purchase
        paper_gain = paper_gain+1;
    elseif stock(j,1) < price % the closing price is lower than the purchase
        paper_loss = paper_loss+1;
    end
end
if str10=='Y' %collect regression data
    regression(1,3)=x-y; % days from first buy to
    % next action
    q = quantity;
end
if str12 == 'Y' && bool_b ==1
    if now_b == 1
        PGR_Bull(bull_i,1) = to_analyse(i,1);
        PGR_Bull(bull_i,2) = 0;
        PLR_Bull(bull_i,1) = to_analyse(i,1);
        PLR_Bull(bull_i,2) = 0;
        bull_i = bull_i+1;
        paper_gain_Bull = 0;
        paper_loss_Bull = 0;
        realized_gain_Bull =0;
        realized_loss_Bull =0;
        for j =x_b:(x-1) % the first buy day can also be a paper gain/loss
            if str10 == 'Y' % incorporate dividends
                date = [stock(j,2),stock(j,3),stock(j,4)];
                price = dividend_adjust(k,stock_idx,date,price,divs);
            end
            if stock(j,1) > price % the closing price is higher than the purchase
                paper_gain_Bull = paper_gain_Bull+1;
            elseif stock(j,1) < price % the closing price is lower than the purchase
                paper_loss_Bull = paper_loss_Bull+1;
            end
        end
    end
else
    PGR_Bear(bear_i,1) = to_analyse(i,1);
    PGR_Bear(bear_i,2) = 0;
    PLR_Bear(bear_i,1) = to_analyse(i,1);
    PLR_Bear(bear_i,2) = 0;
    bear_i = bear_i+1;
    paper_gain_Bear = 0;
end

```

```

aper_loss_Bear = 0;
realized_gain_Bear =0;
realized_loss_Bear =0;
for j =x_b:(x-1) % the first buy day can also be a paper gain/loss
    if str10 == 'Y' % encorporate dividends
        date = [stock(j,2),stock(j,3),stock(j,4)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    if stock(j,1) > price % the closing price is higher than the purchase
        paper_gain_Bear = paper_gain_Bear+1;
    elseif stock(j,1) < price % the closing price is lower than the purchase
        paper_loss_Bear = paper_loss_Bear+1;
    end
end
end
elseif str12 == 'Y' && bool_b == 0
    if now_b == 1
        paper_gain_Bull = paper_gain;
        paper_loss_Bull = paper_loss;
    else
        paper_gain_Bear = paper_gain;
        paper_loss_Bear = paper_loss;
    end
end
end

elseif (to_analyse(i,1) ~= to_analyse(i-1,1)) && (to_analyse(i,2)>0)...
    && i<size(to_analyse,1) && (to_analyse(i,1) == to_analyse(i+1,1))
    % the first action in an account is always a buy and is in this
    % case not the last action in this account
    if (k == 4 || stock_idx == 4) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2001,4,27))% case GBL
        price = 1/3*to_analyse(i,3)/to_analyse(i,2); % save first buy price
        quantity = to_analyse(i,2); % save quantity
    elseif (k == 8 || stock_idx == 8) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2010,10,15)) % case COL
        price = 1/5*to_analyse(i,3)/to_analyse(i,2); % save first buy price
        quantity = to_analyse(i,2); % save quantity
    elseif (k == 10 || stock_idx == 10) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2008,2,29)) % case UMI
        price = 1/5*to_analyse(i,3)/to_analyse(i,2); % save first buy price
        quantity = to_analyse(i,2); % save quantity
    elseif (k == 12 || stock_idx == 12) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2010,12,27)) % case DIE
        price = 1/10*to_analyse(i,3)/to_analyse(i,2); % save first buy price
        quantity = to_analyse(i,2); % save quantity
    elseif (k == 13 || stock_idx == 13) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2010,10,11)) % case BEK
        price = 1/3*to_analyse(i,3)/to_analyse(i,2); % save first buy price
        quantity = to_analyse(i,2); % save quantity
    else
        price = to_analyse(i,3)/to_analyse(i,2); % save first buy price
        quantity = to_analyse(i,2); % save quantity
    end
end

```

```

% We are looking for the time before the next action and
% we register the paper gains and losses

% we put the data in 1x3 arrays
start_date = [to_analyse(i,4) to_analyse(i,5) to_analyse(i,6)]; % date buy
end_date = [to_analyse(i+1,4) to_analyse(i+1,5) to_analyse(i+1,6)]; % date next action
if str12 == 'Y'
    [now_b,j_bperiod] = isitbull2(start_date); % current bull/bear
    % period and indicator
    next_b = nextbperiod(j_bperiod);
    bool_b = 0;
    if datetime(next_b(1,3),next_b(1,2),next_b(1,1))...
        <= datetime(end_date(1,3),end_date(1,2),end_date(1,1))
        bool_b = 1;
        x_b = find(ismember(stock(:,2:4),next_b,'rows')); % end stock
    end
end
y = find(ismember(stock(:,2:4),start_date,'rows')); % start stock
x = find(ismember(stock(:,2:4),end_date,'rows')); % end stock
u = 1;
while(isempty(x)) % it could land on a sunday, saturday,...
    x = find(ismember(stock(:,2:4),[end_date(1,1)+u end_date(1,2) end_date(1,3)],'rows'));
    u = u+1;
    if end_date(1,1)+u>31
        u=1;
        while(isempty(x))
            if end_date(1,2)+1 <= 12
                x = find(ismember(stock(:,2:4),[0+u end_date(1,2)+1 end_date(1,3)],'rows'));
                u = u+1;
            else % find in next year
                x = find(ismember(stock(:,2:4),[0+u 0+1 end_date(1,3)+1], 'rows'));
                u = u+1;
            end
        end
    end
end
if str12 == 'Y' && bool_b == 1 % suppose the b period ends before next action, then we
calculate the paper g/l's until then
    u = 1;
    while(isempty(x_b)) % it could land on a sunday, saturday,...
        x_b = find(ismember(stock(:,2:4),[end_date(1,1)+u end_date(1,2)
end_date(1,3)], 'rows'));
        u = u+1;
        if end_date(1,1)+u>31
            u=1;
            while(isempty(x_b))
                if end_date(1,2)+1 <= 12
                    x_b = find(ismember(stock(:,2:4),[0+u end_date(1,2)+1
end_date(1,3)], 'rows'));
                    u = u+1;
                else % find in next year
                    x_b = find(ismember(stock(:,2:4),[0+u 0+1 end_date(1,3)+1], 'rows'));
                    u = u+1;
                end
            end
        end
    end
end

```

```

end
end
u = 1;
while isempty(y) % it could land on a sunday, saturday,...
    y = find(ismember(stock(:,2:4),[start_date(1,1)+u start_date(1,2)
start_date(1,3)],'rows'));
    u = u+1;
    if start_date(1,1)+u>31
        u=1;
        while isempty(y)
            if start_date(1,2)+1 <= 12
                y = find(ismember(stock(:,2:4),[0+u start_date(1,2)+1 start_date(1,3)],'rows'));
                u = u+1;
            else % find in next year
                y = find(ismember(stock(:,2:4),[0+u 0+1 start_date(1,3)+1],'rows'));
                u = u+1;
            end
        end
    end
end
end
for j = y:(x-1) % the first buy can also be a paper gain/loss
    if str5 == 'Y' % incorporate dividends
        date = [stock(j,2),stock(j,3),stock(j,4)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    if stock(j,1) > price % the closing price is higher than the purchase
        paper_gain = paper_gain+1;
    elseif stock(j,1) < price % the closing price is lower than the purchase
        paper_loss = paper_loss+1;
    end
end
if str12 == 'Y' && bool_b == 1
    if now_b == 1
        PGR_Bull(bull_i,1) = to_analyse(i,1);
        PGR_Bull(bull_i,2) = 0;
        PLR_Bull(bull_i,1) = to_analyse(i,1);
        PLR_Bull(bull_i,2) = 0;
        paper_gain_Bull = 0;
        paper_loss_Bull = 0;
        realized_gain_Bull = 0;
        realized_loss_Bull = 0;
        bull_i = bull_i+1;
    for j =x_b:(x-1) % the first buy day can also be a paper gain/loss
        if str10 == 'Y' % incorporate dividends
            date = [stock(j,2),stock(j,3),stock(j,4)];
            price = dividend_adjust(k,stock_idx,date,price,divs);
        end
        if stock(j,1) > price % the closing price is higher than the purchase
            paper_gain_Bull = paper_gain_Bull+1;
        elseif stock(j,1) < price % the closing price is lower than the purchase
            paper_loss_Bull = paper_loss_Bull+1;
        end
    end
end
else
    PGR_Bear(bear_i,1) = to_analyse(i,1);
    PGR_Bear(bear_i,2) = 0;
    PLR_Bear(bear_i,1) = to_analyse(i,1);
    PLR_Bear(bear_i,2) = 0;

```

```

paper_gain_Bear =0;
paper_loss_Bear =0;
realized_gain_Bear =0;
realized_loss_Bear =0;
bear_i = bear_i+1;
for j =x_b:(x-1) % the first buy day can also be a paper gain/loss
    if str10 == 'Y' % incorporate dividends
        date = [stock(j,2),stock(j,3),stock(j,4)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    if stock(j,1) > price % the closing price is higher than the purchase
        paper_gain_Bear = paper_gain_Bear+1;
    elseif stock(j,1) < price % the closing price is lower than the purchase
        paper_loss_Bear = paper_loss_Bear+1;
    end
end
end
elseif str12 == 'Y' && bool_b ==0
    if now_b == 1
        paper_gain_Bull = paper_gain;
        paper_loss_Bull = paper_loss;
    else
        paper_gain_Bear = paper_gain;
        paper_loss_Bear = paper_loss;
    end
end
end
if str10=='Y' %collect regression data
    regression(regr_iteration,3)= x-y;
    % days from first buy to next action
    q = quantity;
end

elseif (to_analyse(i,1) == to_analyse(i-1,1)) && (to_analyse(i,2)<0) ...
    && i<size(to_analyse,1) && (to_analyse(i,1) == to_analyse(i+1,1))
    % We have a sell and have not yet reached the end of this account
    start_date = [to_analyse(i,4) to_analyse(i,5) to_analyse(i,6)]; % date of sell
    end_date = [to_analyse(i+1,4) to_analyse(i+1,5) to_analyse(i+1,6)]; % date next action
    if str12 == 'Y'
        [now_b,j_bperiod] = isitbull2(start_date); % current bull/bear
        % period and indicator
        next_b = nextbperiod(j_bperiod);
        bool_b = 0;
        if datetime(next_b(1,3),next_b(1,2),next_b(1,1))...
            <= datetime(end_date(1,3),end_date(1,2),end_date(1,1))
            bool_b = 1;
            x_b = find(ismember(stock(:,2:4),next_b,'rows')); % end stock
        end
    end
end
if str5 == 'Y' % incorporate dividends
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    price = dividend_adjust(k,stock_idx,date,price,divs);
end
quantity = quantity + to_analyse(i,2); % + sign because quant is negative
if (k == 4 || stock_idx == 4) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
    < datetime(2001,4,27))% case GBL
    if 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
        realized_gain = realized_gain+1;
    end
end

```

```

if str12 == 'Y'
    if now_b ==1
        realized_gain_Bull = realized_gain_Bull+1;
    else
        realized_gain_Bear = realized_gain_Bear+1;
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>small...
        && abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
elseif 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    realized_loss = realized_loss+1;
    if str12 == 'Y'
        if now_b ==1
            realized_loss_Bull = realized_loss_Bull+1;
        else
            realized_loss_Bear = realized_loss_Bear+1;
        end
    end
    if str8 == 'Y' % So if we will analyze per month
        month_trigger = to_analyse(i,5); % is triggered when not 0
        months_RL(month_trigger).months = ...
        months_RL(month_trigger).months+1; % the correct
        % realized loss is added to the right month

```

```

end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price))...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))>small&& (abs(...
        1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))<=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
    end
end
elseif (k == 8 || stock_idx == 8) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,10,15)) % case COL
if 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
        months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...

```

```

        abs(to_analyse(i,2))>small && abs(1/5*abs(to_analyse(i,3)...
        /to_analyse(i,2))-price)*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate gain
elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>moderate
        regression(regr_iteration,6)= 1; %high gain
end
if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
end
bull = isitbull(date);
if bull == 1
        regression(regr_iteration,12)= 1; % bull period
else
        regression(regr_iteration,11)= 1; % bear period
end
end
elseif 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
        realized_loss = realized_loss+1;
if str12 == 'Y'
        if now_b ==1
                realized_loss_Bull = realized_loss_Bull+1;
        else
                realized_loss_Bear = realized_loss_Bear+1;
        end
end
if str8 == 'Y' % So if we will analyze per month
        month_trigger = to_analyse(i,5); % is triggered when not 0
        months_RL(month_trigger).months = ...
        months_RL(month_trigger).months+1; % the correct
        % realized loss is added to the right month
end
if str10=='Y' %collect regression data
        regression(regr_iteration,2)= 1; % realized loss
        date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
if (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small loss
elseif (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(1/5*abs(to_analyse(i,3)/...
        to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
elseif (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
end
if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
elseif to_analyse(i,8) == 2

```

```

        regression(regr_iteration,8)= 1; % prive by insti
elseif to_analyse(i,8) == 3
    regression(regr_iteration,9)= 1; % prive no advice
elseif to_analyse(i,8) == 4
    regression(regr_iteration,10)= 1; % prive with advice
end
bull = isitbull(date);
if bull == 1
    regression(regr_iteration,12)= 1; % bull period
else
    regression(regr_iteration,11)= 1; % bear period
end
end
end
elseif (k == 10 || stock_idx == 10) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2008,2,29)) % case UMI
if 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>small && abs(1/5*abs(...
        to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1

```



```

if str12 == 'Y'
    if now_b ==1
        realized_gain_Bull = realized_gain_Bull+1;
    else
        realized_gain_Bear = realized_gain_Bear+1;
    end
end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price)*abs(to_analyse(i,2)/to_analyse(i,3))>small && abs(1/10*...
        abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price)*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
elseif 1/10*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    realized_loss = realized_loss+1;
    if str12 == 'Y'
        if now_b ==1
            realized_loss_Bull = realized_loss_Bull+1;
        else
            realized_loss_Bear = realized_loss_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
    months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month

```

```

end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(1/10*abs(to_analyse(i,3)/...
        to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        >moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
end
elseif (k == 13 || stock_idx == 13) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,10,11)) % case BEK
if 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
        months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=small

```

```

        regression(regr_iteration,4)= 1; %small gain
elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
    *abs(to_analyse(i,2)/to_analyse(i,3))>small && abs(1/3*abs(...
    to_analyse(i,3)/to_analyse(i,2))-price)*...
    abs(to_analyse(i,2))<=moderate
    regression(regr_iteration,5)= 1; %moderate gain
elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
    *abs(to_analyse(i,2)/to_analyse(i,3))>moderate
    regression(regr_iteration,6)= 1; %high gain
end
if to_analyse(i,8) == 1
    regression(regr_iteration,7)= 1; % institutional
elseif to_analyse(i,8) == 2
    regression(regr_iteration,8)= 1; % prive by insti
elseif to_analyse(i,8) == 3
    regression(regr_iteration,9)= 1; % prive no advice
elseif to_analyse(i,8) == 4
    regression(regr_iteration,10)= 1; % prive with advice
end
bull = isitbull(date);
if bull == 1
    regression(regr_iteration,12)= 1; % bull period
else
    regression(regr_iteration,11)= 1; % bear period
end
end
elseif 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    realized_loss = realized_loss+1;
if str12 == 'Y'
    if now_b ==1
        realized_loss_Bull = realized_loss_Bull+1;
    else
        realized_loss_Bear = realized_loss_Bear+1;
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
    months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
    price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
    price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
    small&& (abs(1/3*abs(to_analyse(i,3)/...
    to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
    <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
    price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
if to_analyse(i,8) == 1

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```

        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
end
end
else
if abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>small && abs(abs(...
        to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1

```

```

        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
elseif abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    realized_loss = realized_loss+1;
    if str12 == 'Y'
        if now_b ==1
            realized_loss_Bull = realized_loss_Bull+1;
        else
            realized_loss_Bear = realized_loss_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
    months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(abs(to_analyse(i,3)/to_analyse(i,2))-price))*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(abs(to_analyse(i,3)/...
        to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
end
end
end

% Again registration of paper losses + gains
% data in 1x3 arrays
y = find(ismember(stock(:,2:4),start_date,'rows')); % start stock

```

```

x = find(ismember(stock(:,2:4),end_date,'rows')); % end stock
u = 1;
while(isempty(x)) % it could land on a sunday, saturday,...
    x = find(ismember(stock(:,2:4),[end_date(1,1)+u end_date(1,2) end_date(1,3)],'rows'));
    u = u+1;
    if end_date(1,1)+u>31
        u=1;
        while(isempty(x))
            if end_date(1,2)+1 <= 12
                x = find(ismember(stock(:,2:4),[0+u end_date(1,2)+1 end_date(1,3)],'rows'));
                u = u+1;
            else % find in next year
                x = find(ismember(stock(:,2:4),[0+u 0+1 end_date(1,3)+1],'rows'));
                u = u+1;
            end
        end
    end
end
end
end
if str12 == 'Y' && bool_b == 1 % suppose the b period ends before next action, then we
calculate the paper g/l's until then
    u = 1;
    while(isempty(x_b)) % it could land on a sunday, saturday,...
        x_b = find(ismember(stock(:,2:4),[end_date(1,1)+u end_date(1,2)
end_date(1,3)],'rows'));
        u = u+1;
        if end_date(1,1)+u>31
            u=1;
            while(isempty(x_b))
                if end_date(1,2)+1 <= 12
                    x_b = find(ismember(stock(:,2:4),[0+u end_date(1,2)+1
end_date(1,3)],'rows'));
                    u = u+1;
                else % find in next year
                    x_b = find(ismember(stock(:,2:4),[0+u 0+1 end_date(1,3)+1],'rows'));
                    u = u+1;
                end
            end
        end
    end
end
end
end
u = 1;
while(isempty(y)) % it could land on a sunday, saturday,...
    y = find(ismember(stock(:,2:4),[start_date(1,1)+u start_date(1,2)
start_date(1,3)],'rows'));
    u = u+1;
    if start_date(1,1)+u>31
        u=1;
        while(isempty(y))
            if start_date(1,2)+1 <= 12
                y = find(ismember(stock(:,2:4),[0+u start_date(1,2)+1 start_date(1,3)],'rows'));
                u = u+1;
            else % find in next year
                y = find(ismember(stock(:,2:4),[0+u 0+1 start_date(1,3)+1],'rows'));
                u = u+1;
            end
        end
    end
end
end
end

```

```

% Will the end of the month occur before the next action and thus
% in the increments for the paper gains and losses
if str8 == 'Y' && month_trigger~=0 % So if we will analyze per month
    % month_trigger can be zero if sell is neither a gain or loss
    if to_analyse(i+1,5) == month_trigger
        endmonth_trigger = 0; % we will not reach the end of the
        % month before the next action
    elseif to_analyse(i+1,5) ~= month_trigger && ...
        stock(x-1,3) ~= month_trigger % so we will reach end of
        % the month in the coming loop
        endmonth_trigger = 1; % we will reach the end of the month
        % before next action
    if month_trigger<12 % so the next month is month_trigger+1
        zz = month_trigger;
    elseif month_trigger == 12 % now next month is 1,
        % so month_trigger -12 +1
        zz = 0;
    end
    endmonth_idx = find(ismember(stock(:,3),zz+1,'rows'));
    % index of end of month, but here it gives all indices were
    % month is next and we only need the first one, so...
    endmonth_idx = endmonth_idx(1);
end
end
if str8 == 'Y' && month_trigger~=0 && endmonth_trigger == 1 ...
    && y == endmonth_idx-1 % minus one because
    % we don't include the next month. This means the day
    % of the sell is the last day in the month.. So
    % immediately calculate PGR & PLR
    months_PGR(month_trigger).months(l,1)=to_analyse(i,1);
    if paper_gain == 0 && months_RG(month_trigger).months ==0
        months_PGR(month_trigger).months(l,2)=0;
    else
        months_PGR(month_trigger).months(l,2)=...
            months_RG(month_trigger).months/...
            (months_RG(month_trigger).months+paper_gain);
    end
    months_PLR(month_trigger).months(l,1)=to_analyse(i,1);
    if paper_loss == 0 && months_RL(month_trigger).months == 0
        months_PLR(month_trigger).months(l,2)=0;
    else
        months_PLR(month_trigger).months(l,2)=...
            months_RL(month_trigger).months/...
            (months_RL(month_trigger).months+paper_loss);
    end
    endmonth_trigger = 0;
    month_trigger = 0;
end
if str12 == 'N'
    for j =(y+1):(x-1) % this skips the sell, one day is not both realised and paper
        if str5 == 'Y' % incorporate dividends
            date = [stock(j,2),stock(j,3),stock(j,4)];
            price = dividend_adjust(k,stock_idx,date,price,divs);
        end
        if stock(j,1) > price % closing price is higher than purchase
            paper_gain = paper_gain+1;
        elseif stock(j,1) < price % closing price is lower than purchase
            paper_loss = paper_loss+1;
        end
    end
end

```

```

end
end
elseif str12 == 'Y' && bool_b == 0 && now_b == 1
for j =(y+1):(x-1) % this skips the sell, one day is not both realised and paper
if str5 == 'Y' % encorporate dividends
date = [stock(j,2),stock(j,3),stock(j,4)];
price = dividend_adjust(k,stock_idx,date,price,divs);
end
if stock(j,1) > price % closing price is higher than purchase
paper_gain = paper_gain+1;
paper_gain_Bull = paper_gain_Bull+1;
elseif stock(j,1) < price % closing price is lower than purchase
paper_loss = paper_loss+1;
paper_loss_Bull = paper_loss_Bull+1;
end
end
elseif str12 == 'Y' && bool_b == 0 && now_b == 0
for j =(y+1):(x-1) % this skips the sell, one day is not both realised and paper
if str10 == 'Y' % encorporate dividends
date = [stock(j,2),stock(j,3),stock(j,4)];
price = dividend_adjust(k,stock_idx,date,price,divs);
end
if stock(j,1) > price % closing price is higher than purchase
paper_gain = paper_gain+1;
paper_gain_Bear = paper_gain_Bear+1;
elseif stock(j,1) < price % closing price is lower than purchase
paper_loss = paper_loss+1;
paper_loss_Bear = paper_loss_Bear+1;
end
end
elseif str12 == 'Y' && bool_b == 1 && now_b == 1
for j =(y+1):(x_b-1) % the first buy day can also be a paper gain/loss
if str5 == 'Y' % encorporate dividends
date = [stock(j,2),stock(j,3),stock(j,4)];
price = dividend_adjust(k,stock_idx,date,price,divs);
end
if stock(j,1) > price % the closing price is higher than the purchase
paper_gain = paper_gain+1;
paper_gain_Bull = paper_gain_Bull+1;
elseif stock(j,1) < price % the closing price is lower than the purchase
paper_loss = paper_loss+1;
paper_loss_Bull = paper_loss_Bull+1;
end
end
PGR_Bull(bull_i,1) = to_analyse(i,1);
PLR_Bull(bull_i,1) = to_analyse(i,1);
if paper_gain_Bull == 0 && realized_gain_Bull == 0
PGR_Bull(bull_i,2) = 0;
else
PGR_Bull(bull_i,2)= realized_gain_Bull/(realized_gain_Bull+paper_gain_Bull); %
PGR calculation
end
if paper_loss_Bull == 0 && realized_loss_Bull == 0
PLR_Bull(bull_i,2) = 0;
else
PLR_Bull(bull_i,2)= realized_loss_Bull/(realized_loss_Bull+paper_loss_Bull); %
PLR calculation
end
end

```

```

paper_gain_Bull =0;
paper_loss_Bull =0;
realized_gain_Bull =0;
realized_loss_Bull =0;
bull_i = bull_i+1;
for j =x_b:(x-1) % the first buy day can also be a paper gain/loss
    if str5 == 'Y' % incorporate dividends
        date = [stock(j,2),stock(j,3),stock(j,4)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    if stock(j,1) > price % the closing price is higher than the purchase
        paper_gain = paper_gain+1;
        paper_gain_Bull = paper_gain_Bull+1;
    elseif stock(j,1) < price % the closing price is lower than the purchase
        paper_loss = paper_loss+1;
        paper_loss_Bull = paper_loss_Bull+1;
    end
end
elseif str12 == 'Y' && bool_b ==1 && now_b == 0
    for j =(y+1):(x_b-1) % the first buy day can also be a paper gain/loss
        if str5 == 'Y' % incorporate dividends
            date = [stock(j,2),stock(j,3),stock(j,4)];
            price = dividend_adjust(k,stock_idx,date,price,divs);
        end
        if stock(j,1) > price % the closing price is higher than the purchase
            paper_gain = paper_gain+1;
            paper_gain_Bear = paper_gain_Bear+1;
        elseif stock(j,1) < price % the closing price is lower than the purchase
            paper_loss = paper_loss+1;
            paper_loss_Bear = paper_loss_Bear+1;
        end
    end
    PGR_Bear(bear_i,1) = to_analyse(i,1);
    PLR_Bear(bear_i,1) = to_analyse(i,1);
    if paper_gain_Bear == 0 && realized_gain_Bear == 0
        PGR_Bear(bear_i,2) = 0;
    else
        PGR_Bear(bear_i,2)=
realized_gain_Bear/(realized_gain_Bear+paper_gain_Bear); % PGR calculation
    end
    if paper_loss_Bear == 0 && realized_loss_Bear == 0
        PLR_Bear(bear_i,2) = 0;
    else
        PLR_Bear(bear_i,2)=
realized_loss_Bear/(realized_loss_Bear+paper_loss_Bear); % PLR calculation
    end
    paper_gain_Bear =0;
    paper_loss_Bear =0;
    realized_gain_Bear =0;
    realized_loss_Bear =0;
    bear_i = bear_i+1;
    for j =x_b:(x-1) % the first buy day can also be a paper gain/loss
        if str5 == 'Y' % incorporate dividends
            date = [stock(j,2),stock(j,3),stock(j,4)];
            price = dividend_adjust(k,stock_idx,date,price,divs);
        end
        if stock(j,1) > price % the closing price is higher than the purchase
            paper_gain = paper_gain+1;

```

```

        paper_gain_Bear = paper_gain_Bear+1;
    elseif stock(j,1) < price % the closing price is lower than the purchase
        paper_loss = paper_loss+1;
        paper_loss_Bear = paper_loss_Bear+1;
    end
end
end
if str10=='Y' %collect regression data
    regr_iteration = regr_iteration+1; % increment first
    % because the coming days are after the sell until next action
    q = q-to_analyse(i,2);
    if q ~= 0
        regression(regr_iteration,3)= regression(regr_iteration,3)+...
            x-y; % survival time until this action
    end
end
quantity = quantity-abs(to_analyse(i,2));
elseif (to_analyse(i,1) == to_analyse(i-1,1)) && (to_analyse(i,2)>0)...
    && i<size(to_analyse,1) && (to_analyse(i,1) == to_analyse(i+1,1))
    % we have a new buy and haven't reached the end
    if str5 == 'Y' % incorporate dividends
        date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    % we first calculate the new price, the average with respect to the
    % quantities
    if (k == 4 || stock_idx == 4) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2001,4,27))% case GBL
        price = (price*quantity+1/3*to_analyse(i,3))/(quantity+to_analyse(i,2));
        quantity = quantity + to_analyse(i,2); % and now save new quantity
    elseif (k == 8 || stock_idx == 8) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2010,10,15)) % case COL
        price = (price*quantity+1/5*to_analyse(i,3))/(quantity+to_analyse(i,2));
        quantity = quantity + to_analyse(i,2); % and now save new quantity
    elseif (k == 10 || stock_idx == 10) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2008,2,29)) % case UMI
        price = (price*quantity+1/5*to_analyse(i,3))/(quantity+to_analyse(i,2));
        quantity = quantity + to_analyse(i,2); % and now save new quantity
    elseif (k == 12 || stock_idx == 12) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2010,12,27)) % case DIE
        price = (price*quantity+1/10*to_analyse(i,3))/(quantity+to_analyse(i,2));
        quantity = quantity + to_analyse(i,2); % and now save new quantity
    elseif (k == 13 || stock_idx == 13) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2010,10,11)) % case BEK
        price = (price*quantity+1/3*to_analyse(i,3))/(quantity+to_analyse(i,2));
        quantity = quantity + to_analyse(i,2); % and now save new quantity
    else
        price = (price*quantity+to_analyse(i,3))/(quantity+to_analyse(i,2));
        quantity = quantity + to_analyse(i,2); % and now save new quantity
    end

    if str8 == 'Y' && month_trigger~=0 % So if our previous triggered
        % action was in the same month

```

```

if to_analyse(i+1,5) == month_trigger
    endmonth_trigger = 0; % we will not reach the end of the
    % month before the next action
elseif to_analyse(i+1,5) ~= month_trigger && ...
    stock(x-1,3) ~= month_trigger % so we will reach end of
    % the month in the coming loop
    endmonth_trigger = 1; % we will reach the end of the month
    % before next action
if month_trigger < 12 % so the next month is month_trigger+1
    zz = month_trigger;
elseif month_trigger == 12 % now next month is 1,
    % so month_trigger -12 +1
    zz = 0;
end
endmonth_idx = find(ismember(stock(:,3),zz+1,'rows'));
% index of end of month, but here it gives all indices were
% month is next and we only need the first one, so...
endmonth_idx = endmonth_idx(1);
end
end

% Again registration of paper losses + gains
% data in 1x3 arrays
start_date = [to_analyse(i,4) to_analyse(i,5) to_analyse(i,6)]; % date sell
end_date = [to_analyse(i+1,4) to_analyse(i+1,5) to_analyse(i+1,6)]; % date next action
if str12 == 'Y'
    [now_b,j_bperiod] = isitbull2(start_date); % current bull/bear
    % period and indicator
    next_b = nextbperiod(j_bperiod);
    bool_b = 0;
if datetime(next_b(1,3),next_b(1,2),next_b(1,1))...
    <= datetime(end_date(1,3),end_date(1,2),end_date(1,1))
    bool_b = 1;
    x_b = find(ismember(stock(:,2:4),next_b,'rows')); % end stock
end
end
y = find(ismember(stock(:,2:4),start_date,'rows')); % start stock
x = find(ismember(stock(:,2:4),end_date,'rows')); % end stock
u = 1;
while isempty(x) % it could land on a sunday, saturday,...
    x = find(ismember(stock(:,2:4),[end_date(1,1)+u end_date(1,2) end_date(1,3)],'rows'));
    u = u+1;
if end_date(1,1)+u > 31
    u = 1;
while isempty(x)
    if end_date(1,2)+1 <= 12
        x = find(ismember(stock(:,2:4),[0+u end_date(1,2)+1 end_date(1,3)],'rows'));
        u = u+1;
    else % find in next year
        x = find(ismember(stock(:,2:4),[0+u 0+1 end_date(1,3)+1], 'rows'));
        u = u+1;
    end
end
end
end
if str12 == 'Y' && bool_b == 1 % suppose the b period ends before next action, then we
calculate the paper g/l's until then
    u = 1;

```

```

while(isempty(x_b)) % it could land on a sunday, saturday,...
    x_b = find(ismember(stock(:,2:4),[end_date(1,1)+u end_date(1,2)
end_date(1,3)],'rows'));
    u = u+1;
    if end_date(1,1)+u>31
        u=1;
        while(isempty(x_b))
            if end_date(1,2)+1 <= 12
                x_b = find(ismember(stock(:,2:4),[0+u end_date(1,2)+1
end_date(1,3)],'rows'));
                u = u+1;
            else % find in next year
                x_b = find(ismember(stock(:,2:4),[0+u 0+1 end_date(1,3)+1],'rows'));
                u = u+1;
            end
        end
    end
end
end
end
u = 1;
while(isempty(y)) % it could land on a sunday, saturday,...
    y = find(ismember(stock(:,2:4),[start_date(1,1)+u start_date(1,2)
start_date(1,3)],'rows'));
    u = u+1;
    if start_date(1,1)+u>31
        u=1;
        while(isempty(y))
            if start_date(1,2)+1 <= 12
                y = find(ismember(stock(:,2:4),[0+u start_date(1,2)+1 start_date(1,3)],'rows'));
                u = u+1;
            else % find in next year
                y = find(ismember(stock(:,2:4),[0+u 0+1 start_date(1,3)+1],'rows'));
                u = u+1;
            end
        end
    end
end
end
if str12 == 'N'
    for j =y:(x-1) % buy can also be a pg or pl, one day is not both realised and paper
        if str5 == 'Y' % incorporate dividends
            date = [stock(j,2),stock(j,3),stock(j,4)];
            price = dividend_adjust(k,stock_idx,date,price,divs);
        end
        if stock(j,1) > price % closing price is higher than purchase
            paper_gain = paper_gain+1;
        elseif stock(j,1) < price % closing price is lower than purchase
            paper_loss = paper_loss+1;
        end
        if str8 == 'Y' && month_trigger~=0 && endmonth_trigger == 1 ...
            && j == endmonth_idx-1 % minus one because
                % we don't include the next month
                months_PGR(month_trigger).months(l,1)=to_analyse(i,1);
        if paper_gain == 0 && months_RG(month_trigger).months ==0
            months_PGR(month_trigger).months(l,2)=0;
        else
            months_PGR(month_trigger).months(l,2)=...
                months_RG(month_trigger).months/...
                (months_RG(month_trigger).months+paper_gain);
        end
    end
end

```

```

end
months_PLR(month_trigger).months(l,1)=to_analyse(i,1);
if paper_loss == 0 && months_RL(month_trigger).months == 0
    months_PLR(month_trigger).months(l,2)=0;
else
    months_PLR(month_trigger).months(l,2)=...
        months_RL(month_trigger).months/...
        (months_RL(month_trigger).months+paper_loss);
end
endmonth_trigger = 0;
month_trigger = 0;
end
end
elseif str12 == 'Y' && bool_b == 0 && now_b == 1
    for j =y:(x-1) % this skips the sell, one day is not both realised and paper
        if str5 == 'Y' % encorporate dividends
            date = [stock(j,2),stock(j,3),stock(j,4)];
            price = dividend_adjust(k,stock_idx,date,price,divs);
        end
        if stock(j,1) > price % closing price is higher than purchase
            paper_gain = paper_gain+1;
            paper_gain_Bull = paper_gain_Bull+1;
        elseif stock(j,1) < price % closing price is lower than purchase
            paper_loss = paper_loss+1;
            paper_loss_Bull = paper_loss_Bull+1;
        end
    end
elseif str12 == 'Y' && bool_b == 0 && now_b == 0
    for j =y:(x-1) % this skips the sell, one day is not both realised and paper
        if str5 == 'Y' % encorporate dividends
            date = [stock(j,2),stock(j,3),stock(j,4)];
            price = dividend_adjust(k,stock_idx,date,price,divs);
        end
        if stock(j,1) > price % closing price is higher than purchase
            paper_gain = paper_gain+1;
            paper_gain_Bear = paper_gain_Bear+1;
        elseif stock(j,1) < price % closing price is lower than purchase
            paper_loss = paper_loss+1;
            paper_loss_Bear = paper_loss_Bear+1;
        end
    end
elseif str12 == 'Y' && bool_b == 1 && now_b == 1
    for j =y:(x_b-1) % the first buy day can also be a paper gain/loss
        if str5 == 'Y' % encorporate dividends
            date = [stock(j,2),stock(j,3),stock(j,4)];
            price = dividend_adjust(k,stock_idx,date,price,divs);
        end
        if stock(j,1) > price % the closing price is higher than the purchase
            paper_gain = paper_gain+1;
            paper_gain_Bull = paper_gain_Bull+1;
        elseif stock(j,1) < price % the closing price is lower than the purchase
            paper_loss = paper_loss+1;
            paper_loss_Bull = paper_loss_Bull+1;
        end
    end
end
PGR_Bull(bull_i,1) = to_analyse(i,1);
PLR_Bull(bull_i,1) = to_analyse(i,1);
if paper_gain_Bull == 0 && realized_gain_Bull == 0

```

```

        PGR_Bull(bull_i,2) = 0;
    else
        PGR_Bull(bull_i,2)= realized_gain_Bull/(realized_gain_Bull+paper_gain_Bull); %
PGR calculation
    end
    if paper_loss_Bull == 0 && realized_loss_Bull == 0
        PLR_Bull(bull_i,2) = 0;
    else
        PLR_Bull(bull_i,2)= realized_loss_Bull/(realized_loss_Bull+paper_loss_Bull); %
PLR calculation
    end
    paper_gain_Bull =0;
    paper_loss_Bull =0;
    realized_gain_Bull =0;
    realized_loss_Bull =0;
    bull_i = bull_i+1;
    for j =x_b:(x-1) % the first buy day can also be a paper gain/loss
        if str5 == 'Y' % encorporate dividends
            date = [stock(j,2),stock(j,3),stock(j,4)];
            price = dividend_adjust(k,stock_idx,date,price,divs);
        end
        if stock(j,1) > price % the closing price is higher than the purchase
            paper_gain = paper_gain+1;
            paper_gain_Bull = paper_gain_Bull+1;
        elseif stock(j,1) < price % the closing price is lower than the purchase
            paper_loss = paper_loss+1;
            paper_loss_Bull = paper_loss_Bull+1;
        end
    end
    elseif str12 == 'Y' && bool_b ==1 && now_b == 0
        for j =y:(x_b-1) % the first buy day can also be a paper gain/loss
            if str5 == 'Y' % encorporate dividends
                date = [stock(j,2),stock(j,3),stock(j,4)];
                price = dividend_adjust(k,stock_idx,date,price,divs);
            end
            if stock(j,1) > price % the closing price is higher than the purchase
                paper_gain=paper_gain+1;
                paper_gain_Bear = paper_gain_Bear+1;
            elseif stock(j,1) < price % the closing price is lower than the purchase
                paper_loss=paper_loss+1;
                paper_loss_Bear = paper_loss_Bear+1;
            end
        end
        PGR_Bear(bear_i,1) = to_analyse(i,1);
        PLR_Bear(bear_i,1) = to_analyse(i,1);
        if paper_gain_Bear == 0 && realized_gain_Bear == 0
            PGR_Bear(bear_i,2) = 0;
        else
            PGR_Bear(bear_i,2)=
realized_gain_Bear/(realized_gain_Bear+paper_gain_Bear); % PGR calculation
        end
        if paper_loss_Bear == 0 && realized_loss_Bear == 0
            PLR_Bear(bear_i,2) = 0;
        else
            PLR_Bear(bear_i,2)=
realized_loss_Bear/(realized_loss_Bear+paper_loss_Bear); % PLR calculation
        end
        paper_gain_Bear =0;

```

```

paper_loss_Bear =0;
realized_gain_Bear =0;
realized_loss_Bear =0;
bear_i = bear_i+1;
for j =x_b:(x-1) % the first buy day can also be a paper gain/loss
    if str10 == 'Y' % incorporate dividends
        date = [stock(j,2),stock(j,3),stock(j,4)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    if stock(j,1) > price % the closing price is higher than the purchase
        paper_gain=paper_gain+1;
        paper_gain_Bear = paper_gain_Bear+1;
    elseif stock(j,1) < price % the closing price is lower than the purchase
        paper_loss=paper_loss+1;
        paper_loss_Bear = paper_loss_Bear+1;
    end
end
end
if str10=='Y' %collect regression data
    regression(regr_iteration,3)= regression(regr_iteration,3)+...
        x-y; % survival time until this action
    q = quantity;
end

elseif (to_analyse(i,1) == to_analyse(i-1,1)) && (to_analyse(i,2)<0) ...
    && i<size(to_analyse,1) && (to_analyse(i,1) ~= to_analyse(i+1,1))
    % We have another sell and have reached the end
    if str5 == 'Y' % incorporate dividends
        date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    start_date = [to_analyse(i,4) to_analyse(i,5) to_analyse(i,6)]; % date of sell
    end_date = [to_analyse(i+1,4) to_analyse(i+1,5) to_analyse(i+1,6)]; % date next action
    if str12 == 'Y'
        [now_b,j_bperiod] = isitbull2(start_date); % current bull/bear
        % period and indicator
        next_b = nextbperiod(j_bperiod);
        bool_b = 0;
        if datetime(next_b(1,3),next_b(1,2),next_b(1,1))...
            <= datetime(end_date(1,3),end_date(1,2),end_date(1,1))
            bool_b = 1;
            x_b = find(ismember(stock(:,2:4),next_b,'rows')); % end stock
        end
    end
end

% we do not calculate the quantity, we are going to make
% room for a next account, so are assigning it to 0 soon
if (k == 4 || stock_idx == 4) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
    < datetime(2001,4,27))% case GBL
    if 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
        realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end

```

```

end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
        months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>small...
        && abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
elseif 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    realized_loss = realized_loss+1;
    if str12 == 'Y'
        if now_b ==1
            realized_loss_Bull = realized_loss_Bull+1;
        else
            realized_loss_Bear = realized_loss_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
        months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price))...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=small

```

```

        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))>small&& (abs(...
        1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))<=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
end
elseif (k == 8 || stock_idx == 8) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,10,15)) % case COL
if 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>small && abs(1/5*abs(to_analyse(i,3)...
        /to_analyse(i,2))-price)*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>moderate

```

```

    regression(regr_iteration,6)= 1; %high gain
end
if to_analyse(i,8) == 1
    regression(regr_iteration,7)= 1; % institutional
elseif to_analyse(i,8) == 2
    regression(regr_iteration,8)= 1; % prive by insti
elseif to_analyse(i,8) == 3
    regression(regr_iteration,9)= 1; % prive no advice
elseif to_analyse(i,8) == 4
    regression(regr_iteration,10)= 1; % prive with advice
end
bull = isitbull(date);
if bull == 1
    regression(regr_iteration,12)= 1; % bull period
else
    regression(regr_iteration,11)= 1; % bear period
end
end
elseif 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    realized_loss = realized_loss+1;
    if str12 == 'Y'
        if now_b ==1
            realized_loss_Bull = realized_loss_Bull+1;
        else
            realized_loss_Bear = realized_loss_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
        months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(1/5*abs(to_analyse(i,3)/...
        to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
end

```

```

bull = isitbull(date);
if bull == 1
    regression(regr_iteration,12)= 1; % bull period
else
    regression(regr_iteration,11)= 1; % bear period
end
end
end
elseif (k == 10 || stock_idx == 10) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2008,2,29)) % case UMI
if 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>small && abs(1/5*abs(...
        to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
end
elseif 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase

```

```

realized_loss = realized_loss+1;
if str12 == 'Y'
    if now_b ==1
        realized_loss_Bull = realized_loss_Bull+1;
    else
        realized_loss_Bear = realized_loss_Bear+1;
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
    months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(1/5*abs(to_analyse(i,3)/...
        to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
end
elseif (k == 12 || stock_idx == 12) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,12,27)) % case DIE
if 1/10*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end

```

```

end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
        months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price)*abs(to_analyse(i,2)/to_analyse(i,3))>small && abs(1/10*...
        abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price)*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
elseif 1/10*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    realized_loss = realized_loss+1;
    if str12 == 'Y'
        if now_b ==1
            realized_loss_Bull = realized_loss_Bull+1;
        else
            realized_loss_Bear = realized_loss_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
        months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small

```

```

        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(1/10*abs(to_analyse(i,3)/...
        to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        >moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
end
elseif (k == 13 || stock_idx == 13) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,10,11)) % case BEK
if 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>small && abs(1/3*abs(...
        to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain

```

```

elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
    *abs(to_analyse(i,2)/to_analyse(i,3))>moderate
    regression(regr_iteration,6)= 1; %high gain
end
if to_analyse(i,8) == 1
    regression(regr_iteration,7)= 1; % institutional
elseif to_analyse(i,8) == 2
    regression(regr_iteration,8)= 1; % prive by insti
elseif to_analyse(i,8) == 3
    regression(regr_iteration,9)= 1; % prive no advice
elseif to_analyse(i,8) == 4
    regression(regr_iteration,10)= 1; % prive with advice
end
bull = isitbull(date);
if bull == 1
    regression(regr_iteration,12)= 1; % bull period
else
    regression(regr_iteration,11)= 1; % bear period
end
end
elseif 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
realized_loss = realized_loss+1;
if str12 == 'Y'
    if now_b ==1
        realized_loss_Bull = realized_loss_Bull+1;
    else
        realized_loss_Bear = realized_loss_Bear+1;
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
    months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(1/3*abs(to_analyse(i,3)/...
        to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4

```

```

        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
end
else
if abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>small && abs(abs(...
        to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
elseif abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase

```

```

realized_loss = realized_loss+1;
if str12 == 'Y'
    if now_b ==1
        realized_loss_Bull = realized_loss_Bull+1;
    else
        realized_loss_Bear = realized_loss_Bear+1;
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
    months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(abs(to_analyse(i,3)/to_analyse(i,2))-price))*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(abs(to_analyse(i,3)/...
        to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
end
end
if str12 == 'Y'
    if now_b == 1
        PGR_Bull(bull_i,1) = to_analyse(i,1);
        PLR_Bull(bull_i,1) = to_analyse(i,1);
        if paper_gain_Bull == 0 && realized_gain_Bull == 0
            PGR_Bull(bull_i,2) = 0;
        else
            PGR_Bull(bull_i,2)= realized_gain_Bull/(realized_gain_Bull+paper_gain_Bull); %
PGR calculation
        end
    end
end

```

```

if paper_loss_Bull == 0 && realized_loss_Bull == 0
    PLR_Bull(bull_i,2) = 0;
else
    PLR_Bull(bull_i,2)= realized_loss_Bull/(realized_loss_Bull+paper_loss_Bull); %
PLR calculation
end
paper_gain_Bull =0;
paper_loss_Bull =0;
realized_gain_Bull =0;
realized_loss_Bull =0;
bull_i = bull_i+1;
else
    PGR_Bear(bear_i,1) = to_analyse(i,1);
    PLR_Bear(bear_i,1) = to_analyse(i,1);
    if paper_gain_Bear == 0 && realized_gain_Bear == 0
        PGR_Bear(bear_i,2) = 0;
    else
        PGR_Bear(bear_i,2)=
realized_gain_Bear/(realized_gain_Bear+paper_gain_Bear); % PGR calculation
    end
    if paper_loss_Bear == 0 && realized_loss_Bear == 0
        PLR_Bear(bear_i,2) = 0;
    else
        PLR_Bear(bear_i,2)=
realized_loss_Bear/(realized_loss_Bear+paper_loss_Bear); % PLR calculation
    end
    paper_gain_Bear =0;
    paper_loss_Bear =0;
    realized_gain_Bear =0;
    realized_loss_Bear =0;
    bear_i = bear_i+1;
end
end
PGR(l,1)= to_analyse(i,1); % assigning account number
if paper_gain == 0 && realized_gain == 0
    PGR(l,2)= 0;
else
    PGR(l,2)= realized_gain/(realized_gain+paper_gain); % PGR calculation
end

PLR(l,1)= to_analyse(i,1); % assigning account number
if paper_loss == 0 && realized_loss == 0
    PLR(l,2)= 0;
else
    PLR(l,2)= realized_loss/(realized_loss+paper_loss); % PLR calculation
end
% monthly PGR and PLR calculations
if str8 == 'Y' && month_trigger ~=0 % we don't need to take in
    % account rest of the month because activity in account ends
    % month_trigger can be zero at a sell if it is neither a gain
    % or a loss
    months_PGR(month_trigger).months(l,1)=to_analyse(i,1);
    if paper_gain == 0 && months_RG(month_trigger).months ==0
        months_PGR(month_trigger).months(l,2)=0;
    else
        months_PGR(month_trigger).months(l,2)=...
        months_RG(month_trigger).months/...
        (months_RG(month_trigger).months+paper_gain);
    end
end

```

```

end
months_PLR(month_trigger).months(l,1)=to_analyse(i,1);
if paper_loss == 0 && months_RL(month_trigger).months == 0
    months_PLR(month_trigger).months(l,2)=0;
else
    months_PLR(month_trigger).months(l,2)=...
    months_RL(month_trigger).months/...
    (months_RL(month_trigger).months+paper_loss);
end
end
if str10=='Y' %collect regression data
    regr_iteration = regr_iteration+1;
end
l = l+1; % increment to next account, so afterwards we can check
% with the total number of accounts

% initialising variables again for the next account
paper_gain = 0;
paper_loss = 0;
realized_gain = 0;
realized_loss = 0;
quantity = 0;
price = 0;
start_date = 0;
end_date = 0;
endmonth_trigger = 0;
month_trigger = 0;

% initialising RG & RL per month as well if str8 = Y because end
% account reached
if str8 == 'Y' % So if we will analyze per month
    months_RG = struct('months',{0,0,0,0,0,0,0,0,0,0,0});
    months_RL = struct('months',{0,0,0,0,0,0,0,0,0,0,0});
end

elseif (to_analyse(i,1) == to_analyse(i-1,1)) && (to_analyse(i,2)>0) ...
    && i<size(to_analyse,1) && (to_analyse(i,1) ~= to_analyse(i+1,1))
    % we have a buy and have reached the end
    % TEST: if we visit this in case of regression analysis, we then
    % only want roundtrips
    if str5 == 'Y' % incorporate dividends
        date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    if str12 == 'Y'
        start_date = [to_analyse(i,4) to_analyse(i,5) to_analyse(i,6)]; % date of buy
        [now_b,j_bperiod] = isitbull2(start_date); % current bull/bear
        % period and indicator
    end
    % a buy can be a paper gain/loss
    if (k == 4 || stock_idx == 4) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2001,4,27))% case GBL
        if 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
            paper_gain = paper_gain+1;
            if str12 == 'Y'
                if now_b ==1
                    paper_gain_Bull = paper_gain_Bull+1;
                end
            end
        end
    end
end

```

```

else
    paper_gain_Bear = paper_gain_Bear+1;
end
end
elseif 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    paper_loss = paper_loss+1;
    if str12 == 'Y'
        if now_b ==1
            paper_loss_Bull = paper_loss_Bull+1;
        else
            paper_loss_Bear = paper_loss_Bear+1;
        end
    end
end
end
elseif (k == 8 || stock_idx == 8) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,10,15)) % case COL
    if 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
        paper_gain = paper_gain+1;
        if str12 == 'Y'
            if now_b ==1
                paper_gain_Bull = paper_gain_Bull+1;
            else
                paper_gain_Bear = paper_gain_Bear+1;
            end
        end
    end
elseif 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    paper_loss = paper_loss+1;
    if str12 == 'Y'
        if now_b ==1
            paper_loss_Bull = paper_loss_Bull+1;
        else
            paper_loss_Bear = paper_loss_Bear+1;
        end
    end
end
elseif (k == 10 || stock_idx == 10) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2008,2,29)) % case UMI
    if 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
        paper_gain = paper_gain+1;
        if str12 == 'Y'
            if now_b ==1
                paper_gain_Bull = paper_gain_Bull+1;
            else
                paper_gain_Bear = paper_gain_Bear+1;
            end
        end
    end
elseif 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    paper_loss = paper_loss+1;
    if str12 == 'Y'
        if now_b ==1
            paper_loss_Bull = paper_loss_Bull+1;
        else
            paper_loss_Bear = paper_loss_Bear+1;
        end
    end
end
end
end

```

```

elseif (k == 12 || stock_idx == 12) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
 < datetime(2010,12,27)) % case DIE
if 1/10*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
paper_gain = paper_gain+1;
if str12 == 'Y'
if now_b ==1
paper_gain_Bull = paper_gain_Bull+1;
else
paper_gain_Bear = paper_gain_Bear+1;
end
end
elseif 1/10*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
paper_loss = paper_loss+1;
if str12 == 'Y'
if now_b ==1
paper_loss_Bull = paper_loss_Bull+1;
else
paper_loss_Bear = paper_loss_Bear+1;
end
end
end
elseif (k == 13 || stock_idx == 13) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
 < datetime(2010,10,11)) % case BEK
if 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
paper_gain = paper_gain+1;
if str12 == 'Y'
if now_b ==1
paper_gain_Bull = paper_gain_Bull+1;
else
paper_gain_Bear = paper_gain_Bear+1;
end
end
elseif 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
paper_loss = paper_loss+1;
if str12 == 'Y'
if now_b ==1
paper_loss_Bull = paper_loss_Bull+1;
else
paper_loss_Bear = paper_loss_Bear+1;
end
end
end
else
if abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
paper_gain = paper_gain+1;
if str12 == 'Y'
if now_b ==1
paper_gain_Bull = paper_gain_Bull+1;
else
paper_gain_Bear = paper_gain_Bear+1;
end
end
elseif abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
paper_loss = paper_loss+1;
if str12 == 'Y'
if now_b ==1

```

```

        paper_loss_Bull = paper_loss_Bull+1;
    else
        paper_loss_Bear = paper_loss_Bear+1;
    end
end
end
end
if str12 == 'Y'
    if now_b == 1
        PGR_Bull(bull_i,1) = to_analyse(i,1);
        PLR_Bull(bull_i,1) = to_analyse(i,1);
        if paper_gain_Bull == 0 && realized_gain_Bull == 0
            PGR_Bull(bull_i,2) = 0;
        else
            PGR_Bull(bull_i,2)= realized_gain_Bull/(realized_gain_Bull+paper_gain_Bull); %
PGR calculation
        end
        if paper_loss_Bull == 0 && realized_loss_Bull == 0
            PLR_Bull(bull_i,2) = 0;
        else
            PLR_Bull(bull_i,2)= realized_loss_Bull/(realized_loss_Bull+paper_loss_Bull); %
PLR calculation
        end
        paper_gain_Bull =0;
        paper_loss_Bull =0;
        realized_gain_Bull =0;
        realized_loss_Bull =0;
        bull_i = bull_i+1;
    else
        PGR_Bear(bear_i,1) = to_analyse(i,1);
        PLR_Bear(bear_i,1) = to_analyse(i,1);
        if paper_gain_Bear == 0 && realized_gain_Bear == 0
            PGR_Bear(bear_i,2) = 0;
        else
            PGR_Bear(bear_i,2)=
realized_gain_Bear/(realized_gain_Bear+paper_gain_Bear); % PGR calculation
        end
        if paper_loss_Bear == 0 && realized_loss_Bear == 0
            PLR_Bear(bear_i,2) = 0;
        else
            PLR_Bear(bear_i,2)=
realized_loss_Bear/(realized_loss_Bear+paper_loss_Bear); % PLR calculation
        end
        paper_gain_Bear =0;
        paper_loss_Bear =0;
        realized_gain_Bear =0;
        realized_loss_Bear =0;
        bear_i = bear_i+1;
    end
end

PGR(l,1)= to_analyse(i,1); % Assign account number
if paper_gain == 0 && realized_gain == 0
    PGR(l,2)= 0;
else
    PGR(l,2)= realized_gain/(realized_gain+paper_gain); % PGR calculation
end
end

```

```

PLR(l,1)= to_analyse(i,1); % Assign account number
if paper_loss == 0 && realized_loss == 0
    PLR(l,2)= 0;
else
    PLR(l,2)= realized_loss/(realized_loss+paper_loss); % PLR calculation
end
if str8 == 'Y' && month_trigger~=0 % we don't need to take in
    % account rest of the month because activity in account ends
    % AND ONLY in case there was a sell past month
    months_PGR(month_trigger).months(l,1)=to_analyse(i,1);
    if paper_gain == 0 && months_RG(month_trigger).months ==0
        months_PGR(month_trigger).months(l,2)=0;
    else
        months_PGR(month_trigger).months(l,2)=...
            months_RG(month_trigger).months/...
            (months_RG(month_trigger).months+paper_gain);
    end
    months_PLR(month_trigger).months(l,1)=to_analyse(i,1);
    if paper_loss == 0 && months_RL(month_trigger).months == 0
        months_PLR(month_trigger).months(l,2)=0;
    else
        months_PLR(month_trigger).months(l,2)=...
            months_RL(month_trigger).months/...
            (months_RL(month_trigger).months+paper_loss);
    end
end
l = l+1; % increment to next account, so afterwards we can check
% with the total number of accounts

% initialising variables again for the next account
paper_gain = 0;
paper_loss = 0;
realized_gain = 0;
realized_loss = 0;
quantity = 0;
price = 0;
start_date = 0;
end_date = 0;
endmonth_trigger = 0;
month_trigger = 0;
% initialising RG & RL per month as well if str8 = Y because end
% account reached
if str8 == 'Y' % So if we will analyze per month
    months_RG = struct('months',{0,0,0,0,0,0,0,0,0,0,0});
    months_RL = struct('months',{0,0,0,0,0,0,0,0,0,0,0});
end

elseif (to_analyse(i,1) ~= to_analyse(i-1,1)) && (to_analyse(i,2)>0)...
    && i<size(to_analyse,1) && (to_analyse(i,1) ~= to_analyse(i+1,1))
    % after first buy the activity in the account ends
    % TEST: also these accounts should not be visited in regression
    % analysis, so check this with breakpoints
    if str12 == 'Y'
        start_date = [to_analyse(i,4) to_analyse(i,5) to_analyse(i,6)]; % date of buy
        [now_b,j_bperiod] = isitbull2(start_date); % current bull/bear
        % period and indicator
    end
    if str12 == 'Y'

```

```

if now_b == 1
    PGR_Bull(bull_i,1) = to_analyse(i,1);
    PLR_Bull(bull_i,1) = to_analyse(i,1);
    PGR_Bull(bull_i,2) = 0;
    PLR_Bull(bull_i,2) = 0;
    paper_gain_Bull = 0;
    paper_loss_Bull = 0;
    realized_gain_Bull = 0;
    realized_loss_Bull = 0;
    bull_i = bull_i+1;
else
    PGR_Bear(bear_i,1) = to_analyse(i,1);
    PLR_Bear(bear_i,1) = to_analyse(i,1);
    PGR_Bear(bear_i,2) = 0;
    PLR_Bear(bear_i,2) = 0;
    paper_gain_Bear = 0;
    paper_loss_Bear = 0;
    realized_gain_Bear = 0;
    realized_loss_Bear = 0;
    bear_i = bear_i+1;
end
end
PGR(l,1)= to_analyse(i,1); % Assign account number
PGR(l,2)= 0; % useless account
PLR(l,1)= to_analyse(i,1); % Assign account number
PLR(l,2)= 0; % useless account
l = l+1; % increment to next account, so afterwards we can check
% with the total number of accounts

% initialising variables again for the next account
paper_gain = 0;
paper_loss = 0;
realized_gain = 0;
realized_loss = 0;
quantity = 0;
price = 0;
start_date = 0;
end_date = 0;
endmonth_trigger = 0;
month_trigger = 0;
% initialising RG & RL per month as well if str8 = Y because end
% account reached
if str8 == 'Y' % So if we will analyze per month
    months_RG = struct('months',{0,0,0,0,0,0,0,0,0,0,0});
    months_RL = struct('months',{0,0,0,0,0,0,0,0,0,0,0});
end

elseif i==size(to_analyse,1) && (to_analyse(i,2)>0)
    % the last in the whole array (exception otherwise error)
    % is a buy
    % TEST: also these accounts should not be visited in regression
    % analysis, so check this with breakpoints
    if str5 == 'Y' % incorporate dividends
        date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    if str12 == 'Y'
        start_date = [to_analyse(i,4) to_analyse(i,5) to_analyse(i,6)]; % date of buy
    end
end

```

```

[now_b,j_bperiod] = isitbull2(start_date); % current bull/bear
% period and indicator
end
% a buy is still a paper gain or loss
if (k == 4 || stock_idx == 4) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
 < datetime(2001,4,27))% case GBL
if 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
paper_gain = paper_gain+1;
if str12 == 'Y'
if now_b ==1
paper_gain_Bull = paper_gain_Bull+1;
else
paper_gain_Bear = paper_gain_Bear+1;
end
end
elseif 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
paper_loss = paper_loss+1;
if str12 == 'Y'
if now_b ==1
paper_loss_Bull = paper_loss_Bull+1;
else
paper_loss_Bear = paper_loss_Bear+1;
end
end
end
elseif (k == 8 || stock_idx == 8) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
 < datetime(2010,10,15)) % case COL
if 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
paper_gain = paper_gain+1;
if str12 == 'Y'
if now_b ==1
paper_gain_Bull = paper_gain_Bull+1;
else
paper_gain_Bear = paper_gain_Bear+1;
end
end
elseif 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
paper_loss = paper_loss+1;
if str12 == 'Y'
if now_b ==1
paper_loss_Bull = paper_loss_Bull+1;
else
paper_loss_Bear = paper_loss_Bear+1;
end
end
end
elseif (k == 10 || stock_idx == 10) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
 < datetime(2008,2,29)) % case UMI
if 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
paper_gain = paper_gain+1;
if str12 == 'Y'
if now_b ==1
paper_gain_Bull = paper_gain_Bull+1;
else
paper_gain_Bear = paper_gain_Bear+1;

```

```

        end
    end
elseif 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    paper_loss = paper_loss+1;
    if str12 == 'Y'
        if now_b ==1
            paper_loss_Bull = paper_loss_Bull+1;
        else
            paper_loss_Bear = paper_loss_Bear+1;
        end
    end
end
elseif (k == 12 || stock_idx == 12) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,12,27)) % case DIE
    if 1/10*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
        paper_gain = paper_gain+1;
        if str12 == 'Y'
            if now_b ==1
                paper_gain_Bull = paper_gain_Bull+1;
            else
                paper_gain_Bear = paper_gain_Bear+1;
            end
        end
    end
elseif 1/10*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    paper_loss = paper_loss+1;
    if str12 == 'Y'
        if now_b ==1
            paper_loss_Bull = paper_loss_Bull+1;
        else
            paper_loss_Bear = paper_loss_Bear+1;
        end
    end
end
elseif (k == 13 || stock_idx == 13) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,10,11)) % case BEK
    if 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
        paper_gain = paper_gain+1;
        if str12 == 'Y'
            if now_b ==1
                paper_gain_Bull = paper_gain_Bull+1;
            else
                paper_gain_Bear = paper_gain_Bear+1;
            end
        end
    end
elseif 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    paper_loss = paper_loss+1;
    if str12 == 'Y'
        if now_b ==1
            paper_loss_Bull = paper_loss_Bull+1;
        else
            paper_loss_Bear = paper_loss_Bear+1;
        end
    end
end
else
    if abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase

```

```

paper_gain = paper_gain+1;
if str12 == 'Y'
    if now_b ==1
        paper_gain_Bull = paper_gain_Bull+1;
    else
        paper_gain_Bear = paper_gain_Bear+1;
    end
end
elseif abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
paper_loss = paper_loss+1;
if str12 == 'Y'
    if now_b ==1
        paper_loss_Bull = paper_loss_Bull+1;
    else
        paper_loss_Bear = paper_loss_Bear+1;
    end
end
end
end
if str12 == 'Y'
    if now_b == 1
        PGR_Bull(bull_i,1) = to_analyse(i,1);
        PLR_Bull(bull_i,1) = to_analyse(i,1);
        if paper_gain_Bull == 0 && realized_gain_Bull == 0
            PGR_Bull(bull_i,2) = 0;
        else
            PGR_Bull(bull_i,2)= realized_gain_Bull/(realized_gain_Bull+paper_gain_Bull); %
PGR calculation
        end
        if paper_loss_Bull == 0 && realized_loss_Bull == 0
            PLR_Bull(bull_i,2) = 0;
        else
            PLR_Bull(bull_i,2)= realized_loss_Bull/(realized_loss_Bull+paper_loss_Bull); %
PLR calculation
        end
        paper_gain_Bull =0;
        paper_loss_Bull =0;
        realized_gain_Bull =0;
        realized_loss_Bull =0;
    else
        PGR_Bear(bear_i,1) = to_analyse(i,1);
        PLR_Bear(bear_i,1) = to_analyse(i,1);
        if paper_gain_Bear == 0 && realized_gain_Bear == 0
            PGR_Bear(bear_i,2) = 0;
        else
            PGR_Bear(bear_i,2)=
realized_gain_Bear/(realized_gain_Bear+paper_gain_Bear); % PGR calculation
        end
        if paper_loss_Bear == 0 && realized_loss_Bear == 0
            PLR_Bear(bear_i,2) = 0;
        else
            PLR_Bear(bear_i,2)=
realized_loss_Bear/(realized_loss_Bear+paper_loss_Bear); % PLR calculation
        end
        paper_gain_Bear =0;
        paper_loss_Bear =0;
        realized_gain_Bear =0;
        realized_loss_Bear =0;
    end
end

```

```

    end
end
PGR(l,1)= to_analyse(i,1); % Assign account number
if paper_gain == 0 && realized_gain == 0
    PGR(l,2)= 0;
else
    PGR(l,2)= realized_gain/(realized_gain+paper_gain); % PGR calculation
end

PLR(l,1)= to_analyse(i,1); % Assign account number
if paper_loss == 0 && realized_loss == 0
    PLR(l,2)= 0;
else
    PLR(l,2)= realized_loss/(realized_loss+paper_loss); % PLR calculation
end
% monthly PGR and PLR calculations
if str8 == 'Y' && month_trigger~=0 % we don't need to take in
    % account rest of the month because activity in account ends
    % AND ONLY in case there was a sell past month
    months_PGR(month_trigger).months(l,1)=to_analyse(i,1);
    if paper_gain == 0 && months_RG(month_trigger).months ==0
        months_PGR(month_trigger).months(l,2)=0;
    else
        months_PGR(month_trigger).months(l,2)=...
            months_RG(month_trigger).months/...
            (months_RG(month_trigger).months+paper_gain);
    end
    months_PLR(month_trigger).months(l,1)=to_analyse(i,1);
    if paper_loss == 0 && months_RL(month_trigger).months == 0
        months_PLR(month_trigger).months(l,2)=0;
    else
        months_PLR(month_trigger).months(l,2)=...
            months_RL(month_trigger).months/...
            (months_RL(month_trigger).months+paper_loss);
    end
end
end

elseif i==size(to_analyse,1) && (to_analyse(i,2)<0)
    % the last in the whole array (exception otherwise error)
    % is a sell
    if str5 == 'Y' % incorporate dividends
        date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
        price = dividend_adjust(k,stock_idx,date,price,divs);
    end
    if str12 == 'Y'
        start_date = [to_analyse(i,4) to_analyse(i,5) to_analyse(i,6)]; % date of buy
        [now_b,j_bperiod] = isitbull2(start_date); % current bull/bear
        % period and indicator
    end
    if (k == 4 || stock_idx == 4) &&
        (datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
            < datetime(2001,4,27))% case GBL
        if 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
            realized_gain = realized_gain+1;
            if str12 == 'Y'
                if now_b ==1
                    realized_gain_Bull = realized_gain_Bull+1;
                end
            end
        end
    end
end

```

```

else
    realized_gain_Bear = realized_gain_Bear+1;
end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
        months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>small...
        && abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
elseif 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    realized_loss = realized_loss+1;
    if str12 == 'Y'
        if now_b ==1
            realized_loss_Bull = realized_loss_Bull+1;
        else
            realized_loss_Bear = realized_loss_Bear+1;
        end
    end
    if str8 == 'Y' % So if we will analyze per month
        month_trigger = to_analyse(i,5); % is triggered when not 0
        months_RL(month_trigger).months = ...
            months_RL(month_trigger).months+1; % the correct
        % realized loss is added to the right month
    end
    if str10=='Y' %collect regression data
        regression(regr_iteration,2)= 1; % realized loss

```

```

date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
if (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price))...
    *abs(to_analyse(i,2)/to_analyse(i,3))<=small
    regression(regr_iteration,4)= 1; %small loss
elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))...
    -price))*abs(to_analyse(i,2)/to_analyse(i,3))>small&& (abs(...
    1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
    price))*abs(to_analyse(i,2)/to_analyse(i,3))<=moderate
    regression(regr_iteration,5)= 1; %moderate loss
elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
    price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
    regression(regr_iteration,6)= 1; %high loss
end
if to_analyse(i,8) == 1
    regression(regr_iteration,7)= 1; % institutional
elseif to_analyse(i,8) == 2
    regression(regr_iteration,8)= 1; % prive by insti
elseif to_analyse(i,8) == 3
    regression(regr_iteration,9)= 1; % prive no advice
elseif to_analyse(i,8) == 4
    regression(regr_iteration,10)= 1; % prive with advice
end
bull = isitbull(date);
if bull == 1
    regression(regr_iteration,12)= 1; % bull period
else
    regression(regr_iteration,11)= 1; % bear period
end
end
end
elseif (k == 8 || stock_idx == 8) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,10,15)) % case COL
if 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
if str12 == 'Y'
    if now_b ==1
        realized_gain_Bull = realized_gain_Bull+1;
    else
        realized_gain_Bear = realized_gain_Bear+1;
    end
end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>small && abs(1/5*abs(to_analyse(i,3)...
        /to_analyse(i,2))-price)*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate

```

```

    regression(regr_iteration,5)= 1; %moderate gain
elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
    abs(to_analyse(i,2))>moderate
    regression(regr_iteration,6)= 1; %high gain
end
if to_analyse(i,8) == 1
    regression(regr_iteration,7)= 1; % institutional
elseif to_analyse(i,8) == 2
    regression(regr_iteration,8)= 1; % prive by insti
elseif to_analyse(i,8) == 3
    regression(regr_iteration,9)= 1; % prive no advice
elseif to_analyse(i,8) == 4
    regression(regr_iteration,10)= 1; % prive with advice
end
bull = isitbull(date);
if bull == 1
    regression(regr_iteration,12)= 1; % bull period
else
    regression(regr_iteration,11)= 1; % bear period
end
end
elseif 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
realized_loss = realized_loss+1;
if str12 == 'Y'
    if now_b ==1
        realized_loss_Bull = realized_loss_Bull+1;
    else
        realized_loss_Bear = realized_loss_Bear+1;
    end
end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
    months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(1/5*abs(to_analyse(i,3)/...
        to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice

```

```

elseif to_analyse(i,8) == 4
    regression(regr_iteration,10)= 1; % prive with advice
end
bull = isitbull(date);
if bull == 1
    regression(regr_iteration,12)= 1; % bull period
else
    regression(regr_iteration,11)= 1; % bear period
end
end
end
elseif (k == 10 || stock_idx == 10) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2008,2,29)) % case UMI
if 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
        months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))>small && abs(1/5*abs(...
            to_analyse(i,3)/to_analyse(i,2))-price)*...
            abs(to_analyse(i,2))<=moderate
            regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end

```

```

end
end
elseif 1/5*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    realized_loss = realized_loss+1;
    if str12 == 'Y'
        if now_b ==1
            realized_loss_Bull = realized_loss_Bull+1;
        else
            realized_loss_Bear = realized_loss_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
    months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(1/5*abs(to_analyse(i,3)/...
        to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
        <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/5*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
end
elseif (k == 12 || stock_idx == 12) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,12,27)) % case DIE
if 1/10*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;

```

```

else
    realized_gain_Bear = realized_gain_Bear+1;
end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price)*abs(to_analyse(i,2)/to_analyse(i,3))>small && abs(1/10*...
        abs(to_analyse(i,3)/to_analyse(i,2))-price)*...
        abs(to_analyse(i,2))<=moderate
        regression(regr_iteration,5)= 1; %moderate gain
    elseif abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
        -price)*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high gain
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    elseif to_analyse(i,8) == 3
        regression(regr_iteration,9)= 1; % prive no advice
    elseif to_analyse(i,8) == 4
        regression(regr_iteration,10)= 1; % prive with advice
    end
    bull = isitbull(date);
    if bull == 1
        regression(regr_iteration,12)= 1; % bull period
    else
        regression(regr_iteration,11)= 1; % bear period
    end
end
elseif 1/10*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
    realized_loss = realized_loss+1;
    if str12 == 'Y'
        if now_b ==1
            realized_loss_Bull = realized_loss_Bull+1;
        else
            realized_loss_Bear = realized_loss_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
    months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss

```

```

date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
if (abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
    -price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small
    regression(regr_iteration,4)= 1; %small loss
elseif (abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
    -price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
    small&& (abs(1/10*abs(to_analyse(i,3)/...
    to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
    <=moderate
    regression(regr_iteration,5)= 1; %moderate loss
elseif (abs(1/10*abs(to_analyse(i,3)/to_analyse(i,2))...
    -price))*abs(to_analyse(i,2)/to_analyse(i,3))...
    >moderate
    regression(regr_iteration,6)= 1; %high loss
end
if to_analyse(i,8) == 1
    regression(regr_iteration,7)= 1; % institutional
elseif to_analyse(i,8) == 2
    regression(regr_iteration,8)= 1; % prive by insti
elseif to_analyse(i,8) == 3
    regression(regr_iteration,9)= 1; % prive no advice
elseif to_analyse(i,8) == 4
    regression(regr_iteration,10)= 1; % prive with advice
end
bull = isitbull(date);
if bull == 1
    regression(regr_iteration,12)= 1; % bull period
else
    regression(regr_iteration,11)= 1; % bear period
end
end
end
elseif (k == 13 || stock_idx == 13) &&
(datetime(to_analyse(i,6),to_analyse(i,5),to_analyse(i,4))...
< datetime(2010,10,11)) % case BEK
if 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) > price % sell is higher than purchase
    realized_gain = realized_gain+1;
    if str12 == 'Y'
        if now_b ==1
            realized_gain_Bull = realized_gain_Bull+1;
        else
            realized_gain_Bear = realized_gain_Bear+1;
        end
    end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RG(month_trigger).months = ...
    months_RG(month_trigger).months+1; % the correct
    % realized gain is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,1)= 1; % realized gain
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small gain
    elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
        *abs(to_analyse(i,2)/to_analyse(i,3))>small && abs(1/3*abs(...

```

```

    to_analyse(i,3)/to_analyse(i,2))-price)*...
    abs(to_analyse(i,2))<=moderate
    regression(regr_iteration,5)= 1; %moderate gain
elseif abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-price)...
    *abs(to_analyse(i,2)/to_analyse(i,3))>moderate
    regression(regr_iteration,6)= 1; %high gain
end
if to_analyse(i,8) == 1
    regression(regr_iteration,7)= 1; % institutional
elseif to_analyse(i,8) == 2
    regression(regr_iteration,8)= 1; % prive by insti
elseif to_analyse(i,8) == 3
    regression(regr_iteration,9)= 1; % prive no advice
elseif to_analyse(i,8) == 4
    regression(regr_iteration,10)= 1; % prive with advice
end
bull = isitbull(date);
if bull == 1
    regression(regr_iteration,12)= 1; % bull period
else
    regression(regr_iteration,11)= 1; % bear period
end
end
elseif 1/3*abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
realized_loss = realized_loss+1;
if str12 == 'Y'
    if now_b ==1
        realized_loss_Bull = realized_loss_Bull+1;
    else
        realized_loss_Bear = realized_loss_Bear+1;
    end
end
end
if str8 == 'Y' % So if we will analyze per month
    month_trigger = to_analyse(i,5); % is triggered when not 0
    months_RL(month_trigger).months = ...
    months_RL(month_trigger).months+1; % the correct
    % realized loss is added to the right month
end
if str10=='Y' %collect regression data
    regression(regr_iteration,2)= 1; % realized loss
    date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
    if (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))<=small
        regression(regr_iteration,4)= 1; %small loss
    elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
        small&& (abs(1/3*abs(to_analyse(i,3)/...
            to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
            <=moderate
        regression(regr_iteration,5)= 1; %moderate loss
    elseif (abs(1/3*abs(to_analyse(i,3)/to_analyse(i,2))-...
        price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
        regression(regr_iteration,6)= 1; %high loss
    end
    if to_analyse(i,8) == 1
        regression(regr_iteration,7)= 1; % institutional
    elseif to_analyse(i,8) == 2
        regression(regr_iteration,8)= 1; % prive by insti
    end
end

```



```

    end
  end
elseif abs(to_analyse(i,3)/to_analyse(i,2)) < price % sell is lower than purchase
  realized_loss = realized_loss+1;
  if str12 == 'Y'
    if now_b ==1
      realized_loss_Bull = realized_loss_Bull+1;
    else
      realized_loss_Bear = realized_loss_Bear+1;
    end
  end
end
if str8 == 'Y' % So if we will analyze per month
  month_trigger = to_analyse(i,5); % is triggered when not 0
  months_RL(month_trigger).months = ...
  months_RL(month_trigger).months+1; % the correct
  % realized loss is added to the right month
end
if str10=='Y' %collect regression data
  regression(regr_iteration,2)= 1; % realized loss
  date = [to_analyse(i,4),to_analyse(i,5),to_analyse(i,6)];
  if (abs(abs(to_analyse(i,3)/to_analyse(i,2))-price))*...
    abs(to_analyse(i,2))<=small
    regression(regr_iteration,4)= 1; %small loss
  elseif (abs(abs(to_analyse(i,3)/to_analyse(i,2))-...
    price))*abs(to_analyse(i,2)/to_analyse(i,3))>...
    small && (abs(abs(to_analyse(i,3)/...
    to_analyse(i,2))-price))*abs(to_analyse(i,2)/to_analyse(i,3))...
    <=moderate
    regression(regr_iteration,5)= 1; %moderate loss
  elseif (abs(abs(to_analyse(i,3)/to_analyse(i,2))-...
    price))*abs(to_analyse(i,2)/to_analyse(i,3))>moderate
    regression(regr_iteration,6)= 1; %high loss
  end
  if to_analyse(i,8) == 1
    regression(regr_iteration,7)= 1; % institutional
  elseif to_analyse(i,8) == 2
    regression(regr_iteration,8)= 1; % prive by insti
  elseif to_analyse(i,8) == 3
    regression(regr_iteration,9)= 1; % prive no advice
  elseif to_analyse(i,8) == 4
    regression(regr_iteration,10)= 1; % prive with advice
  end
  bull = isitbull(date);
  if bull == 1
    regression(regr_iteration,12)= 1; % bull period
  else
    regression(regr_iteration,11)= 1; % bear period
  end
end
end
end
if str12 == 'Y'
  if now_b == 1
    PGR_Bull(bull_i,1) = to_analyse(i,1);
    PLR_Bull(bull_i,1) = to_analyse(i,1);
    if paper_gain_Bull == 0 && realized_gain_Bull == 0
      PGR_Bull(bull_i,2) = 0;
    else

```

```

        PGR_Bull(bull_i,2)= realized_gain_Bull/(realized_gain_Bull+paper_gain_Bull); %
PGR calculation
    end
    if paper_loss_Bull == 0 && realized_loss_Bull == 0
        PLR_Bull(bull_i,2) = 0;
    else
        PLR_Bull(bull_i,2)= realized_loss_Bull/(realized_loss_Bull+paper_loss_Bull); %
PLR calculation
    end
    paper_gain_Bull =0;
    paper_loss_Bull =0;
    realized_gain_Bull =0;
    realized_loss_Bull =0;
    else
        PGR_Bear(bear_i,1) = to_analyse(i,1);
        PLR_Bear(bear_i,1) = to_analyse(i,1);
        if paper_gain_Bear == 0 && realized_gain_Bear == 0
            PGR_Bear(bear_i,2) = 0;
        else
            PGR_Bear(bear_i,2)=
realized_gain_Bear/(realized_gain_Bear+paper_gain_Bear); % PGR calculation
        end
        if paper_loss_Bear == 0 && realized_loss_Bear == 0
            PLR_Bear(bear_i,2) = 0;
        else
            PLR_Bear(bear_i,2)=
realized_loss_Bear/(realized_loss_Bear+paper_loss_Bear); % PLR calculation
        end
        paper_gain_Bear =0;
        paper_loss_Bear =0;
        realized_gain_Bear =0;
        realized_loss_Bear =0;
    end
end
PGR(l,1)= to_analyse(i,1); % Assign account number
if paper_gain == 0 && realized_gain == 0
    PGR(l,2)= 0;
else
    PGR(l,2)= realized_gain/(realized_gain+paper_gain); % PGR calculation
end

PLR(l,1)= to_analyse(i,1); % Assign account number
if paper_loss == 0 && realized_loss == 0
    PLR(l,2)= 0;
else
    PLR(l,2)= realized_loss/(realized_loss+paper_loss); % PLR calculation
end
% monthly PGR and PLR calculations
if str8 == 'Y' && month_trigger~=0
    % we don't need to take in account rest of the month
    % because activity in account ends. month_trigger can be zero
    % if the sell is neither a gain or a loss
    months_PGR(month_trigger).months(l,1)=to_analyse(i,1);
    if paper_gain == 0 && months_RG(month_trigger).months ==0
        months_PGR(month_trigger).months(l,2)=0;
    else
        months_PGR(month_trigger).months(l,2)=...
        months_RG(month_trigger).months/...

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```

        (months_RG(month_trigger).months+paper_gain);
    end
    months_PLR(month_trigger).months(l,1)=to_analyse(i,1);
    if paper_loss == 0 && months_RL(month_trigger).months == 0
        months_PLR(month_trigger).months(l,2)=0;
    else
        months_PLR(month_trigger).months(l,2)=...
            months_RL(month_trigger).months/...
            (months_RL(month_trigger).months+paper_loss);
    end
end
end
else
    unclassified = unclassified+1; % unclassified counter
end
end
if str10=='Y'
    regression = regression(1:regr_iteration,:);
end
if str12=='Y'
    PGR_Bull = PGR_Bull(1:bull_i,:);
    PLR_Bull = PLR_Bull(1:bull_i,:);
    PGR_Bear = PGR_Bear(1:bear_i,:);
    PLR_Bear = PLR_Bear(1:bear_i,:);
end

if z > 1 && k==1 % case multiple stocks and we are at the first one
    PGR_tot = PGR;
    PLR_tot = PLR;
    if str12=='Y'
        PGR_Bull_tot = PGR_Bull;
        PLR_Bull_tot = PLR_Bull;
        PGR_Bear_tot = PGR_Bear;
        PLR_Bear_tot = PLR_Bear;
    end
    if str10=='Y'
        regression_tot = regression;
        regr_iteration = 1; %reset
    end
    if str8=='Y' % in case of monthly analysis
        PGR_tot_m = months_PGR;
        PLR_tot_m = months_PLR;
    end
elseif z > 1 && (d==10 && k == 10) % in the case we are going through
% stocks with low market capitalisation and we are at the first one
    PGR_tot = PGR;
    PLR_tot = PLR;
    if str12=='Y'
        PGR_Bull_tot = PGR_Bull;
        PLR_Bull_tot = PLR_Bull;
        PGR_Bear_tot = PGR_Bear;
        PLR_Bear_tot = PLR_Bear;
    end
    if str10=='Y'
        regression_tot = regression;
        regr_iteration = 1; %reset
    end
    if str8=='Y' % in case of monthly analysis
        PGR_tot_m = months_PGR;

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```

    PLR_tot_m = months_PLR;
end
elseif z > 1 && k>1 % case multiple stocks and we are NOT at the first one
    PGR_tot = [PGR;PGR_tot]; % concatenate
    PLR_tot = [PLR;PLR_tot];
    if str12 == 'Y'
        PGR_Bull_tot = [PGR_Bull;PGR_Bull_tot];
        PLR_Bull_tot = [PLR_Bull;PLR_Bull_tot];
        PGR_Bear_tot = [PGR_Bear;PGR_Bear_tot];
        PLR_Bear_tot = [PLR_Bear;PLR_Bear_tot];
    end
    if str10=='Y'
        regression_tot = [regression;regression_tot];
        regr_iteration = 1; %reset
    end
    if str8 == 'Y' % in case of monthly analysis
        for i=1:12
            PGR_tot_m(i).months = [months_PGR(i).months(:);...
                PGR_tot_m(i).months(:)];
            PLR_tot_m(i).months = [months_PLR(i).months(:);...
                PLR_tot_m(i).months(:)];
        end
    end
end
end

end
%% Filtering for useful data and T-tail test
% x = PGR((PGR(:,2)~=0),2); % ditch zeroes
% y = PLR((PLR(:,2)~=0),2); % ditch zeroes

% calculate weighted average
% i = mean(x); % weighted average of PGR
% j = mean(y); % weighted average of PLR

if z == 1
    % the test can not be executed on arrays of different
    % length, so ditching zeroes can't be done (that's okay!)
    [h,p,ci,stats] = ttest(PGR(:,2),PLR(:,2))
    % h -> rejection null hypothesis (1 if that's the case)
    % p -> p value (should be below 5%)
    %
    disp('mean PGR = ')
    disp(mean(PGR(:,2)))
    disp('mean PLR = ')
    disp(mean(PLR(:,2)))

    if strcmp(str8,'Y') % case monthly analysis
        for i = 1:12
            disp('t-test of month ')
            disp(i)
            [h,p,ci,stats] = ttest(months_PGR(i).months(:,2),...
                months_PLR(i).months(:,2))
            disp('mean PGR of month')
            disp(i)
            disp('is = ')
            disp(mean(months_PGR(i).months(:,2)))
            disp('mean PLR of month')
            disp(i)
        end
    end
end

```

```

disp('is = ')
disp(mean(months_PLR(i).months(:,2)))
end
end
std_PGR = std(PGR(:,2));
std_PLR = std(PLR(:,2));
disp('std PGR = ')
disp(std_PGR)
disp('std PLR = ')
disp(std_PLR)
if strcmp(str10,'Y') % case monthly analysis
    dlmwrite('regression_petercam.txt',regression_tot)
    regression_alternate = regression_tot;
    regression_alternate(:,4) = regression(:,4)+...
        2*regression(:,5)+3*regression(:,6);
    regression_alternate(:,7) = regression(:,7)+...
        2*regression(:,8)+3*regression(:,9)+4*regression(:,10);
    regression_alternate = regression_alternate(:,[1:4 7 11]);
    i = find(regression_alternate(:,4)==0); %find irregularities
    regression_alternate(i,:) = []; % find irregularities
    regression(i,:) = []; % find irregularities
    regression = regression(:,[1:11]);
    dlmwrite('regression_dense.txt',regression_alternate)
    dlmwrite('regression_long.txt',regression_tot)
end
if str12 == 'Y'
    % the test can not be executed on arrays of different
    % length, so ditching zeroes can't be done (that's okay!)
    [h,p,ci,stats] = ttest(PGR_Bull_tot(:,2),PLR_Bull_tot(:,2))
    % h -> rejection null hypothesis (1 if that's the case)
    % p -> p value (should be below 5%)
    %
    disp('mean PGR Bull = ')
    disp(mean(PGR_Bull_tot(:,2)))
    disp('mean PLR = ')
    disp(mean(PLR_Bull_tot(:,2)))
    std_PGR_Bull = std(PGR_Bull(:,2));
    std_PLR_Bull = std(PLR_Bull(:,2));
    disp('std PGR Bull = ')
    disp(std_PGR_Bull)
    disp('std PLR Bull = ')
    disp(std_PLR_Bull)
    % the test can not be executed on arrays of different
    % length, so ditching zeroes can't be done (that's okay!)
    [h,p,ci,stats] = ttest(PGR_Bear_tot(:,2),PLR_Bear_tot(:,2))
    % h -> rejection null hypothesis (1 if that's the case)
    % p -> p value (should be below 5%)
    %
    disp('mean PGR Bear = ')
    disp(mean(PGR_Bear_tot(:,2)))
    disp('mean PLR Bear = ')
    disp(mean(PLR_Bear_tot(:,2)))
    std_PGR_Bear = std(PGR_Bear(:,2));
    std_PLR_Bear = std(PLR_Bear(:,2));
    disp('std PGR Bear = ')
    disp(std_PGR_Bear)
    disp('std PLR Bear = ')
    disp(std_PLR_Bear)
end

```

```

end
elseif z > 1
    % the test can not be executed on arrays of different
    % length, so ditching zeroes can't be done (that's okay!)
    [h,p,ci,stats] = ttest(PGR_tot(:,2),PLR_tot(:,2))
    % h -> rejection null hypothesis (1 if that's the case)
    % p -> p value (should be below 5%)
    %
    disp('mean PGR = ')
    disp(mean(PGR_tot(:,2)))
    disp('mean PLR = ')
    disp(mean(PLR_tot(:,2)))

    if strcmp(str8,'Y') % case monthly analysis
        for i = 1:12
            disp('t-test of month ')
            disp(i)
            [h,p,ci,stats] = ttest(PGR_tot_m(i).months(:,2),...
                PLR_tot_m(i).months(:,2))
            disp('mean PGR of month')
            disp(i)
            disp('is = ')
            disp(mean(PGR_tot_m(i).months(:,2)))
            disp('mean PLR of month')
            disp(i)
            disp('is = ')
            disp(mean(PLR_tot_m(i).months(:,2)))
        end
    end
    std_PGR = std(PGR_tot(:,2));
    std_PLR = std(PLR_tot(:,2));
    disp('std PGR = ')
    disp(std_PGR)
    disp('std PLR = ')
    disp(std_PLR)
    if strcmp(str10,'Y') % case monthly analysis
        dimwrite('regression_petercam.txt',regression_tot)
        regression_alternate = regression_tot;
        regression_alternate(:,4) = regression_tot(:,4)+...
            2*regression_tot(:,5)+3*regression_tot(:,6);
        regression_alternate(:,7) = regression_tot(:,7)+...
            2*regression_tot(:,8)+3*regression_tot(:,9)+4*regression_tot(:,10);
        regression_alternate = regression_alternate(:,[1:4 7 11]);
        i = find(regression_alternate(:,4)==0); %find irregularities
        regression_alternate(i,:) = []; % find irregularities
        regression_tot(i,:) = []; % find irregularities
        regression_tot = regression_tot(:,[1:11]);
        dimwrite('regression_dense.txt',regression_alternate)
        dimwrite('regression_long.txt',regression_tot)
    end
end
if str12 == 'Y'
    % the test can not be executed on arrays of different
    % length, so ditching zeroes can't be done (that's okay!)
    [h,p,ci,stats] = ttest(PGR_Bull_tot(:,2),PLR_Bull_tot(:,2))
    % h -> rejection null hypothesis (1 if that's the case)
    % p -> p value (should be below 5%)
    %
    disp('mean PGR Bull = ')

```

```

disp(mean(PGR_Bull_tot(:,2)))
disp('mean PLR = ')
disp(mean(PLR_Bull_tot(:,2)))
std_PGR_Bull = std(PGR_Bull_tot(:,2));
std_PLR_Bull = std(PLR_Bull_tot(:,2));
disp('std PGR Bull = ')
disp(std_PGR_Bull)
disp('std PLR Bull = ')
disp(std_PLR_Bull)
    % the test can not be executed on arrays of different
    % length, so ditching zeroes can't be done (that's okay!)
[h,p,ci,stats] = ttest(PGR_Bear_tot(:,2),PLR_Bear_tot(:,2))
    % h -> rejection null hypothesis (1 if that's the case)
    % p -> p value (should be below 5%)
    %
disp('mean PGR Bear = ')
disp(mean(PGR_Bear_tot(:,2)))
disp('mean PLR Bear = ')
disp(mean(PLR_Bear_tot(:,2)))
std_PGR_Bear = std(PGR_Bear_tot(:,2));
std_PLR_Bear = std(PLR_Bear_tot(:,2));
disp('std PGR Bear = ')
disp(std_PGR_Bear)
disp('std PLR Bear = ')
disp(std_PLR_Bear)
end

end

```

Appendix 1.2. RStudio codes

The output of the Matlab codes of Appendix 1.1. is put into the Rstudio codes below to do the LOGIT regressions with hazard ratios (p 185 - 196).

The analyses are separately performed for the investment bank (p 185 - 192) and the discount broker (p 192 - 196). These approaches are very similar so we only discuss the case of the investment bank.

The data is prepared for each type of analysis and the survival objects are initialised (p 185 - 188).

Cox proportional hazards regression is fitted for each object of interest and survival plots are made (p 188 - 192).

2.2.1. Code for investment bank

```
install.packages("rms")
library(survival)
library(rms)
## First import dataset regression_dense
## rm(regression_dense)
colnames(regression_dense) <-
c("TGI","TLI","Survival","Amount","Trader","Bear")
colnames(regression_long) <-
c("TGI","TLI","Survival","Small_Amount","Mod_Amount","Hi_Amount","Insti","
By_insti","No_adv","Wt_adv","Bear")
regression_dense$SurvObj <- with(regression_dense, Surv(Survival, TGI ==
1))
regression_dense$SurvObj2 <- with(regression_dense, Surv(Survival, TGI ==
0))
regression_dense$SurvObj3 <- with(regression_long, Surv(Survival))
regression_long$SurvObj4 <- with(regression_long, Surv(Survival))

regression_long_insti<-subset(regression_long, Insti==1)
```

```

regression_long_by_insti<-subset(regression_long, By_insti==1)
regression_long_no_adv<-subset(regression_long, No_adv==1)
regression_long_wt_adv<-subset(regression_long, Wt_adv==1)
regression_long_bear<-subset(regression_long, Bear==1)
regression_long_bull<-subset(regression_long, Bear==0)
regression_long_insti_bear<-subset(regression_long, Bear==1 & Insti==1)
regression_long_insti_bull<-subset(regression_long, Bear==0 & Insti==1)
regression_long_by_insti_bear<-subset(regression_long, Bear==1 &
By_insti==1)
regression_long_by_insti_bull<-subset(regression_long, Bear==0 &
By_insti==1)
regression_long_wt_adv_bear<-subset(regression_long, Bear==1 &
Wt_adv==1)
regression_long_wt_adv_bull<-subset(regression_long, Bear==0 &
Wt_adv==1)
regression_long_no_adv_bear<-subset(regression_long, Bear==1 &
No_adv==1)
regression_long_no_adv_bull<-subset(regression_long, Bear==0 &
No_adv==1)
regression_dense_insti_small<-subset(regression_dense, Amount==1 &
Trader==1)
regression_dense_insti_mod<-subset(regression_dense, Amount==2 &
Trader==1)
regression_dense_insti_hi<-subset(regression_dense, Amount==3 &
Trader==1)
regression_dense_by_insti_small<-subset(regression_dense, Amount==1 &
Trader==2)
regression_dense_by_insti_mod<-subset(regression_dense, Amount==2 &
Trader==2)
regression_dense_by_insti_hi<-subset(regression_dense, Amount==3 &
Trader==2)
regression_dense_no_adv_small<-subset(regression_dense, Amount==1 &
Trader==3)
regression_dense_no_adv_mod<-subset(regression_dense, Amount==2 &
Trader==3)
regression_dense_no_adv_hi<-subset(regression_dense, Amount==3 &
Trader==3)
regression_dense_wt_adv_small<-subset(regression_dense, Amount==1 &
Trader==4)
regression_dense_wt_adv_mod<-subset(regression_dense, Amount==2 &
Trader==4)
regression_dense_wt_adv_hi<-subset(regression_dense, Amount==3 &
Trader==4)
regression_long_insti$SurvObj5 <- with(regression_long_insti, Surv(Survival))
regression_long_by_insti$SurvObj6 <- with(regression_long_by_insti,
Surv(Survival))
regression_long_no_adv$SurvObj7 <- with(regression_long_no_adv,
Surv(Survival))

```

```

regression_long_wt_adv$SurvObj8 <- with(regression_long_wt_adv,
Surv(Survival))
regression_long_bear$SurvObj9 <- with(regression_long_bear,
Surv(Survival))
regression_long_bull$SurvObj10 <- with(regression_long_bull, Surv(Survival))
regression_long_insti_bear$SurvObj11 <- with(regression_long_insti_bear,
Surv(Survival))
regression_long_insti_bull$SurvObj12 <- with(regression_long_insti_bull,
Surv(Survival))
regression_long_by_insti_bear$SurvObj13 <-
with(regression_long_by_insti_bear, Surv(Survival))
regression_long_by_insti_bull$SurvObj14 <-
with(regression_long_by_insti_bull, Surv(Survival))
regression_long_wt_adv_bear$SurvObj15 <-
with(regression_long_wt_adv_bear, Surv(Survival))
regression_long_wt_adv_bull$SurvObj16 <-
with(regression_long_wt_adv_bull, Surv(Survival))
regression_long_no_adv_bear$SurvObj17 <-
with(regression_long_no_adv_bear, Surv(Survival))
regression_long_no_adv_bull$SurvObj18 <-
with(regression_long_no_adv_bull, Surv(Survival))
regression_dense_insti_small$SurvObj19 <-
with(regression_dense_insti_small, Surv(Survival))
regression_dense_insti_mod$SurvObj20 <-
with(regression_dense_insti_mod, Surv(Survival))
regression_dense_insti_hi$SurvObj21 <- with(regression_dense_insti_hi,
Surv(Survival))
regression_dense_by_insti_small$SurvObj22 <-
with(regression_dense_by_insti_small, Surv(Survival))
regression_dense_by_insti_mod$SurvObj23 <-
with(regression_dense_by_insti_mod, Surv(Survival))
regression_dense_by_insti_hi$SurvObj24 <-
with(regression_dense_by_insti_hi, Surv(Survival))
regression_dense_no_adv_small$SurvObj25 <-
with(regression_dense_no_adv_small, Surv(Survival))
regression_dense_no_adv_mod$SurvObj26 <-
with(regression_dense_no_adv_mod, Surv(Survival))
regression_dense_no_adv_hi$SurvObj27 <-
with(regression_dense_no_adv_hi, Surv(Survival))
regression_dense_wt_adv_small$SurvObj28 <-
with(regression_dense_wt_adv_small, Surv(Survival))
regression_dense_wt_adv_mod$SurvObj29 <-
with(regression_dense_wt_adv_mod, Surv(Survival))
regression_dense_wt_adv_hi$SurvObj30 <-
with(regression_dense_wt_adv_hi, Surv(Survival))

```

```
## Create a survfit object.
```

```

## Trader =1 is institutional, Trader =2 is by institutional, Trader = 3 is with no
advice and Trader =4 is with advice
## Amount =1 is low percentage, Amount =2 is moderate percentage, Amount
= 3 is high percentage
objNpsurv8 <- npsurv(formula = Surv(Survival) ~ TGI, Insti==1 ,data =
regression_long)
objNpsurv9 <- npsurv(formula = Surv(Survival) ~ TGI, By_insti==1 ,data =
regression_long)
objNpsurv10 <- npsurv(formula = Surv(Survival) ~ TGI, Wt_adv==1 ,data =
regression_long)
objNpsurv11 <- npsurv(formula = Surv(Survival) ~ TGI, No_adv==1 ,data =
regression_long)
class(objNpsurv8)
class(objNpsurv9)
class(objNpsurv10)
class(objNpsurv11)
survplot(objNpsurv8)
title(main = "TGI vs TLI - Institutional investors")
survplot(objNpsurv9)
title(main = "TGI vs TLI - private investors under management")
survplot(objNpsurv10)
title(main = "TGI vs TLI - private investors without advice")
survplot(objNpsurv11)
title(main = "TGI vs TLI - private investors with advice")
##res.cox1 <- coxph(SurvObj ~ Amount + Trader + Bear, data =
regression_dense)
##res.cox1
##res.cox2 <- coxph(SurvObj2 ~ Amount + Trader + Bear, data =
regression_dense)
##res.cox2
##res.cox3 <- coxph(SurvObj3 ~ TGI == 1, data = regression_dense)
##res.cox3
##res.cox4 <- coxph(SurvObj3 ~ TGI == 0, data = regression_dense)
##res.cox4
res.cox1 <- coxph(SurvObj3 ~ TGI == 1, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj3 ~ TGI == 0, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*No_adv, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*No_adv, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*Insti, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*Insti, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*By_insti, data = regression_long)
res.cox1

```

```

res.cox1 <- coxph(SurvObj4 ~ TLI*By_insti, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*Wt_adv, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*Wt_adv, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*No_adv + TGI*Insti, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*No_adv + TGI*By_insti, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*No_adv + TGI*Wt_adv, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*No_adv + TGI*Insti + TGI*Wt_adv +
TGI*By_insti, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*No_adv + TLI*Insti, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*No_adv + TLI*By_insti, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*No_adv + TLI*Wt_adv, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*No_adv + TLI*Insti + TLI*Wt_adv +
TLI*By_insti, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*By_insti + TGI*Insti, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*By_insti + TGI*Wt_adv, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*By_insti + TLI*Insti, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*By_insti + TLI*Wt_adv, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*Bear + TGI*Insti, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*Bear + TGI*By_insti, data =
regression_long)
res.cox1

```

```

res.cox1 <- coxph(SurvObj4 ~ TGI*Bear + TGI*No_adv, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TGI*Bear + TGI*Wt_adv, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*Bear + TLI*Insti, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*Bear + TLI*By_insti, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*Bear + TLI*No_adv, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj4 ~ TLI*Bear + TLI*Wt_adv, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj5 ~ TLI, data = regression_long_insti)
res.cox1
res.cox1 <- coxph(SurvObj5 ~ TGI, data = regression_long_insti)
res.cox1
res.cox1 <- coxph(SurvObj6 ~ TLI, data = regression_long_by_insti)
res.cox1
res.cox1 <- coxph(SurvObj6 ~ TGI, data = regression_long_by_insti)
res.cox1
res.cox1 <- coxph(SurvObj7 ~ TLI, data = regression_long_no_adv)
res.cox1
res.cox1 <- coxph(SurvObj7 ~ TGI, data = regression_long_no_adv)
res.cox1
res.cox1 <- coxph(SurvObj8 ~ TLI, data = regression_long_wt_adv)
res.cox1
res.cox1 <- coxph(SurvObj8 ~ TGI, data = regression_long_wt_adv)
res.cox1
res.cox1 <- coxph(SurvObj9 ~ TLI, data = regression_long_bear)
res.cox1
res.cox1 <- coxph(SurvObj9 ~ TGI, data = regression_long_bear)
res.cox1
res.cox1 <- coxph(SurvObj10 ~ TLI, data = regression_long_bull)
res.cox1
res.cox1 <- coxph(SurvObj10 ~ TGI, data = regression_long_bull)
res.cox1
res.cox1 <- coxph(SurvObj11 ~ TLI, data = regression_long_insti_bear)
res.cox1
res.cox1 <- coxph(SurvObj11 ~ TGI, data = regression_long_insti_bear)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TLI, data = regression_long_insti_bull)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TGI, data = regression_long_insti_bull)

```

```
res.cox1
res.cox1 <- coxph(SurvObj13 ~ TLI, data = regression_long_by_insti_bear)
res.cox1
res.cox1 <- coxph(SurvObj13 ~ TGI, data = regression_long_by_insti_bear)
res.cox1
res.cox1 <- coxph(SurvObj14 ~ TLI, data = regression_long_by_insti_bull)
res.cox1
res.cox1 <- coxph(SurvObj14 ~ TGI, data = regression_long_by_insti_bull)
res.cox1
res.cox1 <- coxph(SurvObj15 ~ TLI, data = regression_long_wt_adv_bear)
res.cox1
res.cox1 <- coxph(SurvObj15 ~ TGI, data = regression_long_wt_adv_bear)
res.cox1
res.cox1 <- coxph(SurvObj16 ~ TLI, data = regression_long_wt_adv_bull)
res.cox1
res.cox1 <- coxph(SurvObj16 ~ TGI, data = regression_long_wt_adv_bull)
res.cox1
res.cox1 <- coxph(SurvObj17 ~ TLI, data = regression_long_no_adv_bear)
res.cox1
res.cox1 <- coxph(SurvObj17 ~ TGI, data = regression_long_no_adv_bear)
res.cox1
res.cox1 <- coxph(SurvObj18 ~ TLI, data = regression_long_no_adv_bull)
res.cox1
res.cox1 <- coxph(SurvObj18 ~ TGI, data = regression_long_no_adv_bull)
res.cox1
res.cox1 <- coxph(SurvObj19 ~ TGI, data = regression_dense_insti_small)
res.cox1
res.cox1 <- coxph(SurvObj19 ~ TLI, data = regression_dense_insti_small)
res.cox1
res.cox1 <- coxph(SurvObj20 ~ TGI, data = regression_dense_insti_mod)
res.cox1
res.cox1 <- coxph(SurvObj20 ~ TLI, data = regression_dense_insti_mod)
res.cox1
res.cox1 <- coxph(SurvObj21 ~ TGI, data = regression_dense_insti_hi)
res.cox1
res.cox1 <- coxph(SurvObj21 ~ TLI, data = regression_dense_insti_hi)
res.cox1
res.cox1 <- coxph(SurvObj22 ~ TGI, data =
regression_dense_by_insti_small)
res.cox1
res.cox1 <- coxph(SurvObj22 ~ TLI, data = regression_dense_by_insti_small)
res.cox1
res.cox1 <- coxph(SurvObj23 ~ TGI, data = regression_dense_by_insti_mod)
res.cox1
res.cox1 <- coxph(SurvObj23 ~ TLI, data = regression_dense_by_insti_mod)
res.cox1
res.cox1 <- coxph(SurvObj24 ~ TGI, data = regression_dense_by_insti_hi)
res.cox1
```

```

res.cox1 <- coxph(SurvObj24 ~ TLI, data = regression_dense_by_insti_hi)
res.cox1
res.cox1 <- coxph(SurvObj25 ~ TGI, data =
regression_dense_no_adv_small)
res.cox1
res.cox1 <- coxph(SurvObj25 ~ TLI, data = regression_dense_no_adv_small)
res.cox1
res.cox1 <- coxph(SurvObj26 ~ TGI, data = regression_dense_no_adv_mod)
res.cox1
res.cox1 <- coxph(SurvObj26 ~ TLI, data = regression_dense_no_adv_mod)
res.cox1
res.cox1 <- coxph(SurvObj27 ~ TGI, data = regression_dense_no_adv_hi)
res.cox1
res.cox1 <- coxph(SurvObj27 ~ TLI, data = regression_dense_no_adv_hi)
res.cox1
res.cox1 <- coxph(SurvObj28 ~ TGI, data = regression_dense_wt_adv_small)
res.cox1
res.cox1 <- coxph(SurvObj28 ~ TLI, data = regression_dense_wt_adv_small)
res.cox1
res.cox1 <- coxph(SurvObj29 ~ TGI, data = regression_dense_wt_adv_mod)
res.cox1
res.cox1 <- coxph(SurvObj29 ~ TLI, data = regression_dense_wt_adv_mod)
res.cox1
res.cox1 <- coxph(SurvObj30 ~ TGI, data = regression_dense_wt_adv_hi)
res.cox1
res.cox1 <- coxph(SurvObj30 ~ TLI, data = regression_dense_wt_adv_hi)
res.cox1

```

2.2.2. Code for discount broker

```

install.packages("rms")
library(survival)
library(rms)
## First import dataset regression_dense
## Delete array : rm(regression_dense_no_unknowns)
colnames(regression_dense) <-
c("TGI","TLI","Survival","Amount","Sex","Education","Bear","Trans")
colnames(regression_dense_no_sex_unknowns) <-
c("TGI","TLI","Survival","Amount","Sex","Education","Bear","Trans")
colnames(regression_dense_no_edu_unknowns) <-
c("TGI","TLI","Survival","Amount","Sex","Education","Bear","Trans")
colnames(regression_long) <-
c("TGI","TLI","Survival","Small_Amount","Mod_Amount","Hi_Amount","Sex_un
k","Male","Female","Edu_unk","SeSch","Uni","Bear","Trans")

```

```

regression_dense$SurvObj <- with(regression_dense, Surv(Survival, TGI ==
1))
regression_dense$SurvObj2 <- with(regression_dense, Surv(Survival, TGI ==
0))
regression_dense$SurvObj3 <- with(regression_dense, Surv(Survival))
regression_dense_no_sex_unknowns$SurvObj4 <-
with(regression_dense_no_sex_unknowns, Surv(Survival, TGI == 1))
regression_dense_no_sex_unknowns$SurvObj5 <-
with(regression_dense_no_sex_unknowns, Surv(Survival, TGI == 0))
regression_dense_no_edu_unknowns$SurvObj6 <-
with(regression_dense_no_edu_unknowns, Surv(Survival, TGI == 1))
regression_dense_no_edu_unknowns$SurvObj7 <-
with(regression_dense_no_edu_unknowns, Surv(Survival, TGI == 0))
regression_dense_no_sex_unknowns$SurvObj8 <-
with(regression_dense_no_sex_unknowns, Surv(Survival, Sex == 2))
regression_dense_no_sex_unknowns$SurvObj9 <-
with(regression_dense_no_sex_unknowns, Surv(Survival, Sex ==3))
regression_dense_no_sex_unknowns$SurvObj10 <-
with(regression_dense_no_sex_unknowns, Surv(Survival))
regression_dense_no_edu_unknowns$SurvObj11 <-
with(regression_dense_no_edu_unknowns, Surv(Survival))
regression_long$SurvObj12 <- with(regression_long, Surv(Survival))
regression_long$SurvObj13 <- with(regression_long, Surv(Survival, Bear ==
1))
regression_long$SurvObj14 <- with(regression_long, Surv(Survival, Bear ==
0))
regression_dense$SurvObj15 <- with(regression_dense, Surv(Survival, Sex
== 2))
regression_dense$SurvObj16 <- with(regression_dense, Surv(Survival, Sex
== 3))
regression_dense$SurvObj17 <- with(regression_dense, Surv(Survival,
Education == 2))
regression_dense$SurvObj18 <- with(regression_dense, Surv(Survival,
Education == 3))
regression_long$SurvObj19 <- with(regression_long, Surv(Survival,
Small_Amount == 1))
regression_long$SurvObj20 <- with(regression_long, Surv(Survival,
Mod_Amount == 1))
regression_long$SurvObj21 <- with(regression_long, Surv(Survival,
Hi_Amount == 1))
regression_long$SurvObj22 <- with(regression_long, Surv(Survival, Trans ==
1))
regression_long$SurvObj23 <- with(regression_long, Surv(Survival, Trans ==
3))
regression_long$SurvObj24 <- with(regression_long, Surv(Survival, Trans ==
2))

## Sex = 1 = unknown, 2 = male, 3 = female

```

```

## Education = 1 = unknown, 2 = college/high school, 3 = university
## Create a survfit object.
objNpsurv <- npsurv(formula = Surv(Survival,TGI == 1) ~ Amount, data =
regression_dense)
objNpsurv2 <- npsurv(formula = Surv(Survival,TGI == 1) ~ Bear, data =
regression_dense)
objNpsurv3 <- npsurv(formula = Surv(Survival,TGI == 1) ~ Sex, data =
regression_dense_no_sex_unknowns)
objNpsurv4 <- npsurv(formula = Surv(Survival,TGI == 1) ~ Education, data =
regression_dense_no_edu_unknowns)
objNpsurv5 <- npsurv(formula = Surv(Survival,TGI == 0) ~ Amount, data =
regression_dense)
objNpsurv6 <- npsurv(formula = Surv(Survival,TGI == 0) ~ Bear, data =
regression_dense)
objNpsurv7 <- npsurv(formula = Surv(Survival,Sex == 2) ~ TGI, data =
regression_dense_no_sex_unknowns)
objNpsurv8 <- npsurv(formula = Surv(Survival,Sex == 3) ~ TGI, data =
regression_dense_no_sex_unknowns)
objNpsurv9 <- npsurv(formula = Surv(Survival,TGI == 0) ~ Education, data =
regression_dense_no_edu_unknowns)
objNpsurv10 <- npsurv(formula = Surv(Survival) ~ TGI, data =
regression_dense)
objNpsurv11 <- npsurv(formula = Surv(Survival,TGI == 0) ~ Sex, data =
regression_dense_no_sex_unknowns)
class(objNpsurv)
class(objNpsurv2)
class(objNpsurv3)
class(objNpsurv4)
class(objNpsurv5)
class(objNpsurv6)
class(objNpsurv7)
class(objNpsurv8)
class(objNpsurv9)
class(objNpsurv10)
class(objNpsurv11)
survplot(objNpsurv)
title(main = "Gains with different amount sizes")
survplot(objNpsurv2)
title(main = "Gains during certain periods")
survplot(objNpsurv3)
title(main = "Gains with different sexes")
survplot(objNpsurv4)
title(main = "Gains with different education levels")
survplot(objNpsurv5)
title(main = "Losses with different amount sizes")
survplot(objNpsurv6)
title(main = "Losses during certain periods")
survplot(objNpsurv9)

```

```

title(main = "Losses with different education levels")
survplot(objNpsurv11)
title(main = "Losses with different sexes")
survplot(objNpsurv7)
title(main = "Gains vs Losses \n Males")
survplot(objNpsurv8)
title(main = "Gains vs Losses \n Females")
survplot(objNpsurv10)
title(main = "TGI vs TLI on average \n Discount Broker")

##res.cox1 <- coxph(SurvObj ~ Amount + Sex + Education + Bear, data =
regression_dense)
##res.cox1
##res.cox2 <- coxph(SurvObj2 ~ Amount + Sex + Education + Bear, data =
regression_dense)
##res.cox2
##res.cox3 <- coxph(SurvObj3 ~ TGI == 1, data = regression_dense)
##res.cox3
##res.cox4 <- coxph(SurvObj3 ~ TGI == 0, data = regression_dense)
##res.cox4
##res.cox5 <- coxph(SurvObj4 ~ Sex==2, data =
regression_dense_no_sex_unknowns)
##res.cox5
##res.cox6 <- coxph(SurvObj5 ~ Sex==2, data =
regression_dense_no_sex_unknowns)
##res.cox6
##res.cox7 <- coxph(SurvObj4 ~ Sex ==3, data =
regression_dense_no_sex_unknowns)
##res.cox7
##res.cox8 <- coxph(SurvObj5 ~ Sex ==3, data =
regression_dense_no_sex_unknowns)
##res.cox8
##res.cox9 <- coxph(SurvObj6 ~ Education ==2, data =
regression_dense_no_edu_unknowns)
##res.cox9
##res.cox10 <- coxph(SurvObj7 ~ Education ==2, data =
regression_dense_no_edu_unknowns)
##res.cox10
##res.cox11 <- coxph(SurvObj6 ~ Education ==3, data =
regression_dense_no_edu_unknowns)
##res.cox11
##res.cox12 <- coxph(SurvObj7 ~ Education ==3, data =
regression_dense_no_edu_unknowns)
##res.cox12
##res.cox13 <- coxph(SurvObj8 ~ TGI == 1, data =
regression_dense_no_sex_unknowns)
##res.cox13

```

```

##res.cox14 <- coxph(SurvObj8 ~ TGI == 0, data =
regression_dense_no_sex_unknowns)
##res.cox14
##res.cox13 <- coxph(SurvObj9 ~ TGI == 1, data =
regression_dense_no_sex_unknowns)
##res.cox13
##res.cox14 <- coxph(SurvObj9 ~ TGI == 0, data =
regression_dense_no_sex_unknowns)
##res.cox14
res.cox1 <- coxph(SurvObj12 ~ TGI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TLI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TGI*Male +TGI*Female, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TLI*Male +TLI*Female, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~
TGI*Small_Amount+TGI*Mod_Amount+TGI*Hi_Amount, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~
TLI*Small_Amount+TLI*Mod_Amount+TLI*Hi_Amount, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TGI*SeSch +TGI*Uni, data =
regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TLI*SeSch +TLI*Uni, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TGI*Bear, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TLI*Bear, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TGI*Male
+TGI*Female+TGI*Small_Amount+TGI*Mod_Amount+TGI*Hi_Amount+TGI*S
eSch +TGI*Uni+TGI*Bear, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj12 ~ TLI*Male
+TLI*Female+TLI*Small_Amount+TLI*Mod_Amount+TLI*Hi_Amount+TLI*Se
Sch +TLI*Uni+TLI*Bear, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj13 ~ TLI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj13 ~ TGI, data = regression_long)
res.cox1

```

```
res.cox1 <- coxph(SurvObj14 ~ TLI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj14 ~ TGI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj15 ~ TLI, data = regression_dense)
res.cox1
res.cox1 <- coxph(SurvObj15 ~ TGI, data = regression_dense)
res.cox1
res.cox1 <- coxph(SurvObj16 ~ TLI, data = regression_dense)
res.cox1
res.cox1 <- coxph(SurvObj16 ~ TGI, data = regression_dense)
res.cox1
res.cox1 <- coxph(SurvObj17 ~ TLI, data = regression_dense)
res.cox1
res.cox1 <- coxph(SurvObj17 ~ TGI, data = regression_dense)
res.cox1
res.cox1 <- coxph(SurvObj18 ~ TLI, data = regression_dense)
res.cox1
res.cox1 <- coxph(SurvObj18 ~ TGI, data = regression_dense)
res.cox1
res.cox1 <- coxph(SurvObj19 ~ TLI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj19 ~ TGI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj20 ~ TLI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj20 ~ TGI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj21 ~ TLI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj21 ~ TGI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj22 ~ TLI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj22 ~ TGI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj23 ~ TLI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj24 ~ TGI, data = regression_long)
res.cox1
res.cox1 <- coxph(SurvObj24 ~ TLI, data = regression_long)
res.cox1
```