Intraday Price Clustering in the Euronext Stock Market

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Abstract

In this paper, we examine the determinants of price clustering on the Euronext Stock Market using the tick-by-tick transaction price data. We find evidence of explanatory variables such as volume and asset price have a consistently positive and statistically significant effect on price clustering, which is consistent with the price resolution/negotiation hypothesis to reduce the information costs. However, we find negative relationship between volatility and price clustering for three markets except for Lisbon, which shows that higher volatility does not lead to the higher degree of price clustering for large markets such as Amsterdam and Paris, where it is dominated by informed traders, as they could improve the price discovery process, reducing the uncertainty since they are better informed. However, for smaller market such as Lisbon, there are smaller uninformed investors as evidenced by smaller trade size, and are more likely to be attracted to rounding to nearest number due to preference or other behavioural bias. Liquidity also have a negative relationship with price clustering, which means higher the liquidity, lower the price clustering. Additionally, we also examine the intraday pattern of price clustering at 15-minute interval. We find that intraday clustering exhibits a two-humped shape with two peaks in the morning market open and around 3pm in the late afternoon. Coefficients of clustering is highest and significant at 1% level at the market opening. And near the market close, clustering tends to subside and remain at a low level.

Keywords: Intraday price clustering; trade volume; return volatility; Euronext Stock Exchange

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1. Introduction

Price clustering is the tendency of prices to deviate from a uniform distribution, centering around certain prices and avoiding others. This has been observed in various markets equities, forex and derivatives. Nevertheless, it is inconsistent with the market price following a simple random walk process. If the market discovery is uniform, realized trades should not cluster at certain prices.

Shiller (2000) claims that market participants in the absence of better knowledge may use the nearest round number as a proxy for the fundamental value. More precisely, the price resolution hypothesis indicates that if valuation is uncertain, traders may coordinate to restrict the price set so as to reduce search and cognitive costs (Harris, 1991). However, this explanation is more likely to exist in pure dealer markets, where limit orders do not exist. In order driven markets, limit order trader provides to other investors the ability to execute against his limit order. If a clustering pattern is obtained in this kind of market, it may stem from an intrinsic psychological preference for prominent numbers, or it may be the result of the tendency of stock markets participants to place their orders at "numbers with which they are accustomed to deal" (round numbers) according to Niederhoffer (1965).

In this paper, we investigate if the transaction prices in the order driven market such as Euronext stock market exhibit any degree of clustering and the factors which influences the price clustering to understand causation and reasons behind the evidence.

There are very few empirical studies on the microstructure of the Euronext stock market using intraday data due to limited availability of data. Previous empirical work is largely concentrated on the US market and although there are recent works on the non-US equity markets, there has been very few literature which has studied in the Euronext stock market, more specifically Lisbon, Amsterdam, Brussels and Paris markets. This could well be one of my first contribution by studying the unique market where literature is not abundant.

The second contribution to the literature is that we investigate in depth looking at all the possible nearest roundings which consist of 1000 mantissa in total, since the transaction price data contains up to 3 decimal places. Therefore, our analysis is more thorough by considering different clustering levels, while prior research has primarily focused on the last digit ending with 00 and 50 either round number or only up to 1 decimal place. In contrast to that, my research has gone beyond that and looked at all the mantissa of transaction price data. We find

evidence that there are some prominent price levels which acts as a psychosocial barrier and aggregate frequency of prices rounded nearest to 0.025 of a Euro made up a huge proportion of trades, with second being rounding nearest to 0.0125 of a Euro. We find that whole number and halves made up only a small proportion of trades, which is different from prior literature which has studied different markets. Our paper is the first to document this unique clustering level evidenced in the Euronext market. The presence of clustering is inconsistent with the random walk hypothesis. Other possible reasons for this clustering other than the price resolution/negotiation hypothesis, could be attributed to attraction hypothesis or psychological preference for a particular rounding by the investors.

The third contribution to the literature is that we investigate further concerning the intraday patterns of price clustering. We find evidence of different degrees of clustering exhibit for different trading mechanisms. Euronext market practiced two call auctions at the market open in the morning and at the market close, while the rest of the day is continuous trading. The call auctions mechanism is supposed to help improve the price discovery and reduce uncertainty at the morning market open. Nevertheless, we still find evidence of very high clustering level at the first quarter of an hour after the market open. In addition, we also find that coefficients of intraday clustering exhibit a two-humped shape pattern with peaks at market open and late afternoon around 3pm. However, near the market close, the degree of clustering subsided and remain at very low level, which is consistent with the findings of Gwilym et al (1998). Finally, our findings also suggest that higher volatility and high volume does not lead to the higher price clustering at the market close, instead we find the opposite i.e negative relationship for three markets, which is inconsistent with the price negotiation hypothesis. Moreover, we find that this is particularly true for bigger markets such as Amsterdam and Paris since more informed traders are present in those markets which help to improve the price discovery process and reduce the clustering, whereas in smaller markets such as Lisbon, smaller uninformed investors dominate the market whose trading decisions are more likely to be prone to behavioral bias.

The motivation for this paper stems from the market efficiency hypothesis, which states that it would be impossible to predict the prices, if markets were efficient as it would quickly react and fully reflect all available information. However, according to the previous literature, price clustering was widely observed in share market, which proved that there are preferences for prices ending with a digit. This renders the markets inefficient and prices predictable. We use the standard probit model to estimate the determinants of share price clustering and find out the impact of volume, price and volatility has on the price clustering.

The next section provides previous empirical evidence and theoretical explanations for price clustering. Our hypotheses, data and research methodology are outlined in section 3. In section 4, we present the summary statistics of clustering over 15-min intervals and other explanatory variables, and test each hypothesis and present our regression results. Section 5 contains our conclusion.

2. Theory and Previous Evidence

In standard pricing theories, asset prices could take any value over available units of account. In reality, however, certain prices are preferred to others. This tendency for asset prices to appear more often at certain fractions or integers is called price clustering. Studies on this stylized fact have both a long history and an extensive coverage. Probably the first rigorous investigation on this issue will be the series of work by Niederhoffer (1965, 1966) and Osborne (1962) in the sixties. Since then, a number of papers have documented price clustering for equity, foreign exchange, gold, equity index options and futures, government bond futures contracts, residential real estate, and bank deposit rate markets.

2.1 Explanations of Price Clustering

Several explanations of price clustering are considered in the literature.

Price Resolution/Negotiation Hypothesis

Firstly, the negotiation theory (Harris, 1991) states that investors tend to reduce their terms of trading when there is an increased need to execute trades. The negotiation hypothesis implies that price clustering will increase in periods of abnormally heavy trading.

Secondly, the price resolution hypothesis (Ball et al., 1985) proposes that there is a difference between the "true" price of the asset and its observable price which is determined by the amount of information about that asset, its price level and variability. As a result, the greater the level of information, the larger the available price set should be.

Attraction hypothesis

Thirdly, the attraction hypothesis (Goodhart and Curcio, 1991) asserts that the rounding of asset prices to integers reflects the basic attraction of each round number. They trace behavioural elements in price clustering, which might reflect a general tendency to use round numbers.

Collusion Hypothesis

Fourthly, Christie and Schultz (1994) propose the collusion hypothesis and present evidence that Nasdaq dealers avoid odd-eighth quotes to maintain wide spreads. Numerous empirical studies document price clustering in the equity, derivatives and foreign exchange markets (see Ahn et al., 2005, ap Gwilym and Verousis, 2010, Chung and Chiang, 2006, Narayan et al., 2011 and Sopranzetti and Datar, 2002).

2.2 Evidence on Price Clustering – Equity markets (UK and US)

The evidence on price clustering in equity markets have been documented by several authors, dating back to Osborne (1962), Niederhoffer (1965) and Harris (1991) who examined the determinants of price clustering on the NYSE. This is the first strand of literature where the authors mainly focused on studying the determinants of price clustering. The second strand of literature that has been recently studied by only a few authors is surrounding the issue on the impact of clustering on the quality of financial markets. The third strand of literature emerges from the influence of cultural factors, which affect the price clustering, and resistance levels in the Chinese and Asia- Pacific markets. The forth strand of literature is centred around the trading mechanism effects on the intraday price clustering.

Determinants of price clustering

Harris (1991) found the degree of clustering varied directly with the stock's volatility and price level, and inversely with firm size and trading frequency. Clustering was more pronounced in a dealer than a public auction market. Harris (1991) did not find support for the attraction hypothesis. The work of Osborne (1962) is amongst the most exhaustive to date. Sampling the closing prices of stocks, where stocks were selected on the basis of adequate trading activity, Osborne discovered a tendency for stocks to close at even eighths, with 60.8% of stocks closing on even eighths. Osborne (1962) suggests that share prices did not follow the uniform distributions that theorists would logically conclude they should. Osborne observes a pronounced tendency for share prices to cluster on whole numbers, halves, quarters and odd one eighths in descending preference.

Aitken et al. (1996) investigated clustering in the final digit of individual trade prices on the Australian Stock Exchange (ASX), using intraday transaction data from the ASX's SEATS database over the period from 1990 to 1993. Trading on the ASX exhibits a distinct gravitation towards prices ending in 0, followed by preferences for 5 and then the remaining even numbers

(2, 4, 6 and 8). Stock price clustering increased with the price level, trade size, market-wide volatility and individual stock volatility. Stocks on which options were traded, and stocks for which short selling was allowed, exhibited less clustering. A lower degree of clustering was found in the prices of more liquid stocks. Buyer-initiated trades displayed more clustering relative to seller-initiated trades. Similar to Harris (1991), Aitken et al. confirmed the price resolution hypothesis, but unlike Harris, they also found support for the attraction hypothesis. Aitken et al. (1996) had two unexpected results. First, a greater degree of clustering was exhibited for larger firms. Second, resource stocks exhibited less clustering relative to non-resource stocks.

Grossman et al. (1997) examined price clustering on the London Stock Exchange, using all inside quotes posted during October 1994 on the Stock Exchange Automated Quotation System (SEAQ) for liquid stocks. Quotes ending in 0 and 5 were the most frequent, followed by equal frequencies of quotes ending in 2, 3, 7 and 8. Quotes with a final digit of 1, 4, 6, or 9 were the least frequent. These findings are consistent with the attraction hypothesis.

Most recently, Blau and Griffith (2016) have studied the impact of price clustering on the stability of stock prices for NYSE and NASDAQ, and tested the hypothesis that clustering on round pricing increments will result in more volatile financial markets. The reason being is that clustering-induced volatility maybe that stocks with a greater degree of clustering will have less informative prices and thus exhibit greater volatility. They found strong and positive relation between price clustering and stock price volatility and additional robustness tests confirmed that causation flows from clustering to volatility instead of the other way around.

Other authors who have studied the US market price clustering includes Alexander and Peterson (2007) who examine the price impact of trade size clustering and find that medium sized, rounded trades have the largest price impact. Ikenberry and Weston (2008) find that price clustering is similar between the NASDAQ and NYSE markets, holding other firm-characteristics constant. In contrast, however Grossman, Miller, Cone, Fischel, and Ross (1997) argue that market structure plays a substantial role in explaining stock price clustering.

2.3 Evidence on Price Clustering – other markets

Hameed and Terry (1998) examined factors affecting price clustering on the Stock Exchange of Singapore (SES). Initial analysis showed clustering across all price ranges on the SES. Lower priced stocks clustered most frequently at multiples of 10 cents, followed by odd multiples of 5 cents, and lower priced stocks clustered more frequently at prices ending in even

numbers. As in other markets, price clustering on the SES increased with the price level and decreased with the stock's liquidity.

Other authors including ap Gwilym et al. (1998) also evidence a high level of clustering at the market opening on the LIFFE. Schwartz et al. (2004) find a similar phenomenon on the Chicago Mercantile Exchange. The findings of ap Gwilym et al. (1998) are inconsistent with the price resolution hypothesis, while Schwartz et al. (2004) reach the opposite conclusion. Ohta (2006) investigates this set of relations further on the Tokyo Stock Exchange (TSE) and finds that price clustering behaviour on the TSE is greatest at market opening, and gradually reduces as the dissemination of prices reduces uncertainty, to a point of saturation where clustering reduces no further, consistent with the price resolution theory.

Booth and Yuksel (2006) examine clustering in an emerging market setting, the Istanbul Stock Exchange, showing little to no evidence of clustering beyond the clustering that is a consequence of sequential transactions at the same price level. The study observes a positive relation between clustering and price changes in periods of higher uncertainty. Brown, Chua, and Mitchell (2002) examine the impact of Chinese culture and superstition on number preferences of share traders in Hong Kong, especially during auspicious festivals on the Chinese calendar. They hypothesize that markets in countries with relatively large ethnic Chinese diasporas in their population will exhibit 'lower' (higher) share price clustering than markets with relatively small diasporas, in relation to 'inauspicious' (auspicious) numbers. Brown et al. (2002) posit that the effect was observed to be weaker in Taiwan, and there was no discernable cultural effect within the Singaporean markets. He and Wu (2006) investigate clustering on the Shanghai and Shenzhen Stock Exchanges, observing that domestic securities are clustered at 10 and 5 for economic reasons while the last decimal clusters at 8 for culturally defined reasons. Moreover, they note foreign security clustering on the exchange at 10 and 5 but not 8.

2.4 Institutional Settings

The Euronext trading system is full automatic and provides two trading regimes: trading at continuous for the more liquid securities and roll-calls mechanisms for the less liquid ones. In what concerns the continuous trading, there is an opening auction at 8am European time and a closing auction at 4.35pm. Members can enter, amend and cancel orders during the Pre-Opening period, from 7am up to 8am for the first auction, and between 4.30pm and 4.35 pm

for the second auction, though no orders are executed then. In both cases, the trading system will always display the equilibrium price between buy and sell sides, even if that price does not represent actual executions, as it is a simple indicative price. For the less liquid assets there can be either one single auction per day around the middle of the session, or two calls per day – in the morning and in the afternoon, depending on the type of security.

Additionally, for those securities that trade at continuous, there is an extra period of 5 minutes for trading after the closing auction, between 4.30pm and 4.35pm, called the 'Trading At Last (TAL)', where orders can be introduced and executed only at the Close price (i.e. only market orders or limit orders limited at the close price of that session). A similar 5-minute period is available after each auction for those securities traded though call system.

3. Hypotheses, data and method

3.1 Hypotheses

The attraction hypothesis

The attraction hypothesis, also known as the round number syndrome, builds on the tendency of prices to cluster at round numbers. Previous studies have found a systematic preference for quoting prices in whole numbers, then halves, even fractions, etc. Depending on the ''gravitational pull'' (Goodhart and Curcio, 1991) or salience of each number, clustering in the final digit of price will tend to occur, in a decimal system, most frequently at 0, followed by 5 and then by 2 = 8, 3 = 7 or 4 = 6. The least common will be 1 and 9.

Hypothesis 1: The distribution of the final digit of share prices on the market is not uniform.

Price resolution/negotiation hypothesis – share price, volatility and liquidity

Following Harris, 1991, the coarseness of the price grid is captured by the share price. As articulated by Ball et al. (1985) (in their price resolution hypothesis), the greater the uncertainty the higher the propensity of prices to cluster within a market. Firm size proxies for the richness of the firm's information environment: larger firms have larger analyst followings and their prices reflect value-relevant information more rapidly. Likewise, stock price volatility reflects the level of uncertainty about an asset's fundamental value and proxies for investors' ''spheres of haziness''.

Hypothesis 2: The greater the share price, the smaller the firm and the more volatile its stock, the greater the price clustering.

Next, liquidity is an important attribute of an efficient market. It may be proxied by trading frequency, trading volume or the rate of turnover on a market. Liquidity should affect price clustering because the greater the number of trades on the market, the higher the likelihood that the information possessed by different traders will be incorporated into share prices. Greater liquidity reduces information asymmetry and lowers uncertainty, thereby encouraging traders to use a finer price grid. Greater liquidity also facilitates immediacy. Both Harris (1991) and Aitken et al. (1996) found that clustering decreased with increasing transaction frequency.
Hypothesis 3: The less liquid the stock, the greater the price clustering.

3.2 Data and method

We examine price clustering at the level of the individual trade. In this section, we describe our data sources, establish two measures of price clustering, define our explanatory variables and indicate their expected relationship to the degree of price clustering that we observe.

3.2.1 Data Sample

Our sample contains transaction data of common stocks listed on the Euronext Stock Exchange from January 2009 to March 2009 i.e. for the first quarter of 2009. The data is obtained from Bloomberg and consists of the instrument name, trade date and time, transaction price, trading volume and turnover of stocks during the trading hours of four different Stock Exchanges, namely Amsterdam, Paris, Brussels, and Lisbon on Euronext. From tick-by-tick data, we construct the panel dataset.

3.2.2 Dependent variables

The dependent variable used for price clustering is based on the definitions by Goodhart and Curcio (1991) and Aiken at al (1996), whose attraction theory stated that clustering in the final digit of number 0, perhaps is more salient and is a stronger attracter than 5, which is stronger than the other even numbers. Hence, we look at further where 5 is found in the decimal place and if last digit ending in 5 is in 1^{st} or 2^{nd} decimal place.
The first measure of dependent variable is a binary variable taking the value one when prices cluster on rounding nearest to 0.5 of a Euro (mantissa of 500) and zero otherwise.

Second measure used is the clustering of nearest rounding to 0.1 of a Euro (i.e mantissa of 100, 200, 300, 400, 600, 700, 800, 900). Third measure is the clustering rounded to nearest 0.05 of a Euro (i.e mantissa of 050, 150, 250, 350, 450, 650, 750, 850, 950).

3.2.3 Explanatory variables

Harris (1991), Aitken et al. (1996) and others have identified several factors associated with price clustering such as volatility, and liquidity (they reflect uncertainty, or haziness about value), and the stock's price level (which reflects the coarseness of the price grid).

Return Volatility

Return volatility is calculated as the difference between the natural logarithms of each transaction prices. As the mid-quote prices are not available, we instead use transaction prices. They are then used to obtain returns over every fifteen minutes interval during the day, as follow:

$$r_i = ln\left[\frac{P_i - P_j}{P_j}\right] \quad where\ P_i\ is\ the\ price\ at\ time\ i\ and\ P_j\ is\ the\ price\ at\ j\ = (i-1)$$

These 1-minute logarithmic returns are summed to construct 15-minute returns. Only absolute returns are used as the volatility measure.

Harris (1991) reports the existence of a positive relation between clustering frequency and return volatility, although the results are not robust to each year in the observed sample period. More recent studies also document a positive relation between volatility and stock price clustering (see Chung et al., 2004; Alexander and Peterson, 2007; Ikenberry and Weston, 2008), and generally attribute the finding to the price resolution hypothesis of Ball et al. (1985), which assumes price clustering depends on how well known is the value of the security.

Transaction Price

Nominal share price will likely be positively related to clustering, because as the price increases, the minimum tick size becomes a smaller percentage of the trade value (Ball et al., 1985; Harris, 1991). Traders should be less concerned with placing frivolous bids when the marginal benefit is small as in the case of lower share priced stocks. Hence, lower share priced stocks could lead to smaller clustering.

Share Volume

To measure the individual stock liquidity, we use the stock turnover calculated as the natural log of trading volume of 15-minute trading intervals for each company. We expect share turnover to be inversely correlated with clustering, because more information is likely to be impounded into stock prices as trading frequency increases. Higher trading frequency is inherently associated with greater return volatility.

Trade size

Recognisable information asymmetries initially should prompt greater price clustering. Larger orders are sometimes associated with informed agents (Easley and O'Hara, 1987) and their placement should lead to greater clustering. Furthermore, informed traders placing large orders may wish to hide their knowledge by quoting a more clustered price. We acknowledge three factors that weaken the predicted effect. One is the common strategy of large traders to split their orders across brokers to minimise the price impact of their trades, especially when they believe they are better informed. Another is the desire of uninformed, small value traders who, apart from any incentive to quote the clustered prices in order to hide in the crowd, are attracted to round numbers because they more frequently operate in a 'sphere of haziness' about value (Butler and Loomes, 1988). The third is that informed traders improve the efficiency of price discovery, which should reduce price clustering. Natural log of turnover is used to proxy for trade size.

Liquidity

Liquidity is associated with efficiency in price discovery; the more liquid the stock the more precisely its value is known, and the less likely its price will cluster. Liquidity is proxied by the natural logarithm of trading frequency, defined as the average number of trades per 15-minute interval for each stock over the three months sample period.

3.3 Methodology

To test the above hypotheses, a standard probit model is estimated for each market and for each clustering definition. The dependent dummy variable of price clustering is regressed on the independent variables outlined above, namely turnover volume, return volatility, price and

liquidity (trading frequency) on price clustering. We also included in the model the intraday 15-min time interval dummy variables. The trading day was divided into 34 separate fifteen minute intervals from 09:00 hours to 17:30 hours.

The statistical significance of the explanatory variables, trading volume, return volatility, price and liquidity are tested by running following regression of the form:

$$\boldsymbol{W = c_0 + c_1 Volume_{i,t} + c_2 Volatility_{i,t} + c_3 Price_{i,t} + c_4 Liquidity_{i,t} + \sum_{i=1}^{17} c_i D_i + \sum_{j=19}^{34} c_j D_j + e_{i,t}}$$

where W represents the clustering binary variables, taking a value of 1 for rounding nearest to 0.5 of a Euro and zero otherwise. Similarly, we look at two more clustering levels rounding to nearest 0.1 and 0.05 of a Euro. In the regression, c_0 is a constant, c_i are coefficients and D is the indicator variable taking the values {0,1} and e is the error term. D_i is equal to one if the observation lies in the ith quarter hour of the trading day, in total there are 34 quarters hour during the trading day, therefore, we constructed 34 dummy variables to represent each quarter hour, which will allow us to study the changes in the dependent variable at the beginning and at the close of the market, relative to activity during the middle of the day. The robust probit model is used for this purpose, and we test if the coefficients of these time dummies and explanatory variables are statistically significant at 1%, 5% and 10% confidence levels.

4. Results

4.1 The trend in price clustering

Hypothesis 1 – the presence of price clustering

In the absence of price clustering, the distribution of mantissa (last 3 digits) of the transaction price is expected to be uniform across all of the integers from 0 through 999 mantissa. The sample frequencies for four markets are shown in Table 1 below. All markets strongly reject the null hypothesis of a uniform distribution of the clustering digit.

Nearest Rounding to:	Percentage Frequency (%)			
	Lisbon	Brussels	Amsterdam	Paris
Integer	0.56	2.77	1.38	2.25
0.5 of a Euro	0.5	1.79	1	1.61
0.1 of a Euro	3.86	9.27	6.96	9.07
0.05 of a Euro	4.31	8.42	7.29	8.16
0.025 of a Euro	24.93	41.36	42.29	42.49
0.0125 of a Euro	10.85	23.36	26.25	29.43
Other	54.99	13.03	14.83	6.99
Total	100	100	100	100

Table 1: Percentage frequency of transaction prices mantissa around different reference points

As shown in the table 1, all four markets except Lisbon market, exhibit the highest proportion of trades which clusters at rounding nearest to 0.025 of a Euro, while the second highest proportion clusters at 0.0125 of a Euro. The figures in the table 1 has been obtained by aggregating the relevant transaction frequencies of mantissa for a particular rounding which can be detailed in the tables 2, 3, 4 and 5 of the Appendix. Graphs of each mantissa price frequencies have been plotted which have been displayed in the figures 1, 2, 3 and 4 of the Appendix for each of the four market. In terms of the frequencies, as you can see from the graphs, firstly, whole number clustering for mantissa of 0 rounded to nearest Euro, there are over 50,000 (2.77%) of those for Brussels, for Amsterdam over 80,000 (1.38%) and Paris over 350,000 (2.25%) of those. Secondly, the graphs also show the high peak at the mantissa of 500 which is a cost rounded to the nearest 0.5 of a Euro. There are nearly 40,000 of those in Brussels market (1.79%), over 60,000 in Amsterdam (1%) and over 250,000 in Paris market (1.61%). Third, if we look at rounding to nearest 0.1 of a Euro, for example mantissa of 100, 200, 300,

400, 600, 700, 800, 900, there are usually about 25,000 of each of these for Brussels (9.27% as aggregate %), about 55,000 of each of these for Amsterdam (6.96%) , and nearly 200,000 of each of these for Paris market (9.07% as aggregate after normalization).

Forth, the next clustering level we found from the data which have peaks in the graphs are those rounded to the nearest 0.05 of a Euro, which are mantissa of 050, 150, 250, 350, 450, 550, 650, 750, 850, 950. As aggregate frequency %, these clustering level shows 8.42% for Brussels, 7.29% for Amsterdam and 8.16% for Paris.

Analysing the graphs, we also find that there is strong tendency for prices to cluster at rounding nearest to 0.025 of a Euro, which are the mantissa of 010, 020, 030, 040, 060, 070, 080, 090, 110, 120, 130, 140, 160, 170, 180, 190, 210, 220, and so on, whose digits endings are only 2 decimal places instead of 3 decimal places, which shows that 2 decimal place endings are more popular than 3 decimal places. Clustering at 0.025 rounding is the highest across all four markets at 41%, 42% and 43% for Brussels, Amsterdam and Paris respectively except for Lisbon at 25%.

Similarly, we also find rounding to nearest 0.0125 of a Euro is a second highest clustering according to the aggregates frequency percentage of which 11%, 23%, 26% and 29% are observed for Lisbon, Brussels, Amsterdam and Paris respectively, although it is worth noting that in terms of frequency, it is small and we observed only about 5,000 of each of these for Brussels, 15,000 of each of those in Amsterdam market, and about 50,000 of each of those in Paris market. That is for mantissa of 005, 015, 025, 035, 045, 055, 065, 075, 085, 095, 105, 115, 125, and so on, whose digit endings are up to 3 decimal places normally with the last digit ending in 5.

4.2 Intraday patterns of price clustering

As shown in Table 4-7 of the Appendix, we investigate the intraday patterns of price clustering by dividing a trading day into 15-min intervals together with two call auctions that took place at the morning open and evening close.

Based on the statistics and interpretation of the graphs (see Figures 5-8, we find that the intraday patterns of price clustering exhibit U-shaped across all four markets, as higher clustering frequency percentage of transaction prices are observed at the morning opening and at the close of the trading day than any other time of the day. We investigate this at different clustering levels namely at whole number, at nearest 0.5 of a Euro rounding, at nearest 0.1 rounding and 0.05 of a Euro rounding and found consistency across all levels. At the morning

opening, the frequency percentage is around 5-6%, which shows a very high degree of clustering in a day as in comparison to the benchmark of intraday period of 13:00 to 13:30, where the clustering is the lowest in the day with frequency of 1.5-2%. That is about 3.5-4% increase in clustering demonstrated in the morning first quarter of an hour, compared to the afternoon benchmark hour. Following the opening auction, the continuous trading thereafter also exhibits a degree of clustering between the intraday hours 9:15 to 13:00., to be more specific, clustering drops after the first quarter of an hour of the morning session, after which it remains at a stable level around 2-3%. Throughout the afternoon session between 12:30 and 14:00 hour, the clustering is at the lowest level. However, after which the clustering intensified more than the morning sessions, with clustering level observed around 4-5%, and persist at this high level for more than an hour until the market close.

Intraday patterns of price clustering over 15-min intervals is plotted in Figure 5-8 of the Appendix, which shows a high degree of clustering at the opening and the closing can be attributed to the uncertainty effect and are consistent with the price resolution hypothesis.

Table 3: Summary statistics

Transaction Price	**Lisbon**	**Brussels**	**Amsterdam**	**Paris**
Mean	4.24	30.60	13.87	29.80
Std. Dev	2.46	102.59	8.65	24.50
Min	0.05	0.03	0.02	0.01
Max	30	9240	840	4000
Total Obs	706,498	2,018,628	6,133,427	16,518,539
Volume Turnover				
Mean	4326.66	5328.39	7666.03	7229.40
Std. Dev	17653.88	19158.11	22279.69	14601.98
Min	0.06	0.15	0.02	0.01
Max	3,160,000	15,000,000	41,700,000	7,380,000
Return Volatility				
Mean	0.1169	0.1135	0.2418	0.1337
Std. Dev	0.0023	0.0024	0.3215	0.0022
Min	0.00	0.00	0.00	0.00
Max	0.25	0.21	707	1

Mean volatility of the market = Total returns/(total no. of companies * 63 days)

In summary statistics in Table 3, we report the mean, standard deviation, minimum and maximum values of the explanatory variables of price clustering, namely transaction price, volume turnover and return volatility. Mean of transaction share price are 4.24, 30.60, 13.87,

and 29.80 Euros for Lisbon, Brussels, Amsterdam and Paris market respectively. Mean volume turnover ranges from 4,327 to 7,229 Euros, while the mean of absolute return volatility ranges from 0.11 to 0.24 across four markets at aggregate level.

Intraday level summary statistics are reported in Table 8-11 of the Appendix. The total number of transactions at every 15-min time interval indicates how frequency shares are traded at each interval, which act as a proxy for the liquidity. As expected, the percentage frequency of those are higher in the evening close than any other time of the day across all four markets, and Paris market exhibit higher transaction frequency than others, with over 500,000 observed at morning open session and over 950,000 in the last quarter of an hour of closing time. Next, total volume turnover in millions of euros aggregated for all transactions in the interval are calculated. The frequency and volume of transactions show U-shaped patterns and that a higher % of total volume occurs towards the closing call auction than at the opening auction.

The mean return volatility per 15-mins is calculated as the log difference of transaction prices which are summed to get the total volatility per 15-minute, which is then divided by the number of companies multiplied by the number of trading days in the sample period.

The mean volatility also displayed a U-shaped pattern with higher volatility observed at morning and closing time than any other time of the days across all four markets. The first quarter of an hour at morning open exhibits higher volatility than that at closing time. Throughout the afternoon trading between 12:00 and 14:00, the volatility is the lowest and most stable. For example, Paris market afternoon volatility is around 0.4-0.5% which is lower as compared to morning open volatility of 1.84% and closing volatility of 1.3%.

Hypotheses 2-5 – Determinants of price clustering

We investigate the determinants of price clustering by estimating a probit regression model. Three different levels of clustering are used as the dependent variable to examine price clustering. For each transaction, we create a dummy variable, which takes one if the prices are rounded to nearest 0.5 of a Euro (i.e mantissa of 500) and zero otherwise. Similarly, we create the dummy variable for the other clustering levels for those rounding to nearest 0.1 of a Euro and 0.05 of a Euro.

The model regresses the log turnover, price, volatility, liquidity and intraday 15-min time dummies on price clustering. Results are reported in the Table 12-15 of the Appendix for four markets at three different levels of clustering and we found that coefficients of explanatory

variables such as volume has a consistently positive and statistically significant effect on price clustering at 1% level across all four markets for all three levels of clustering. This is consistent with the price resolution hypothesis and the reason for the positive relationship can be explained by the fact that traders submit limit orders at clustered prices due to lack of precise information, in order that large transactions can easily be executed at those prices. It is also in support of price negotiation hypothesis proposed by Ball et al (1985) that if the underlying value of the asset is uncertain, investors may coordinate to restrict the price set (half or whole numbers) so as to reduce search and cognitive costs. Thus, the choice of the rounding used by traders depends on the willingness to reduce the negotiation costs (Harris, 1991). Our finding for volume is consistent with that of Ohta (2006), Ikenberry and Weston (2008) and He and Wu (2006).

Next, we examined the second hypothesis which is the relationship between the asset price and clustering level. We expect a positive relationship since the cost traders perceive from any rounding error decreases with price, clustering should be lower for low-priced stocks, and clustering more prevalent in high-price stocks.

As shown in the Table 6, our findings are mixed for Lisbon and Brussels markets. Although the coefficients of own price for Lisbon market is a positive sign for nearest 0.1 and 0.05 rounding, it is negative for 0.5 rounding (see Panel A). Whereas for Brussels market, negative relationship between own price and clustering is observed if clustering used is based on rounding to nearest 0.05 of a Euro (see Panel C). However, we find more consistent result with Amsterdam and Paris markets whereby all coefficients of price variable are positive and statistically significant at 1% level throughout all clustering levels. This shows that the higher the value of assets, the higher the level of clustering to reduce the negotiation and information costs.

The third hypothesis relates to the impact of volatility on the price clustering. We expect that clustering increases with volatility, since an accurate evaluation is difficult when stock values are fluctuating. Thus, a positive relationship is expected. However, instead we find a negative relationship which is statistically significant at the 1% level in Brussels, Amsterdam for two clustering levels i.e nearest 0.5 and 0.1 rounding, except for clustering nearest to 0.05 rounding where we find no significance for Brussels and significant at 5% level for Amsterdam market. As for Paris market, we find mixed evidence for rounding nearest to 0.05 of a Euro (both +/-), while other clustering levels such as nearest 0.1 rounding shows very consistent negative volatility coefficient throughout which is statistically significant at 1% level. These findings are consistent with that of Brown et al (2002), Ahn et al (2005) and Narayan et al (2011).

As for Lisbon market, coefficients of volatility is positive, and also significant at 1% level, which is in line with our expectation and consistent with previous studies of Blau and Griffith (2016), Ohta (2006) and Aitken et al (1996). Therefore, the increase in volatility is considered to attribute towards the higher price clustering level as we observe more uncertainty related to heightened volatility in the smaller markets such as Lisbon, than that in bigger markets such as Paris, as evident by the fact that the coefficients of volatility in Lisbon market are larger than that of other markets. This result is consistent with the fact that clustering could result from imprecise beliefs (haziness) about firm value and a less efficient price discovery process. Broom (2004) indicates that when sudden unexpected events heighten the uncertainty within the markets, thereby making the underlying value of the stocks less known, one would expect clustering to increase. Overall, there is no consensus in the literature on the relationship between volatility and price clustering. Studies have found mixed results.

Moreover, thin trading can also be another factor which leads to higher transaction cost, hence it can limit the traders' incentive to make accurate asset valuation, therefore, more clustering is expected for thinly traded stocks. Based on this rationale, the coefficients of trading frequency proxy as liquidity is expected to be negative, since many traders have more accurate information about large and frequently traded stocks, hence less dispersion in trader's reservation price is expected. Therefore, we examine the forth hypothesis related to the frequency of trades. We find the negative relationship between liquidity and price clustering, which means that higher the liquidity, lower the clustering. Hence, our evidence suggests that liquidity plays an important role in reducing the price clustering level, as all coefficients of liquidity are statistically significant at 1% level across all four markets.

Hypothesis 6 – Intraday Patterns of price clustering

To test the significance of intraday pattern clustering, we run the regression with the intraday 15-min time interval dummy variables. There are 34 time dummy variables in total (namely d1 to d34) and we use the afternoon trading session 13:15 – 13:29 (namely d18) for a benchmark comparison, hence d18 dummy is omitted to avoid dummy variable trap. The probit regression coefficients of intraday price clustering are reported in Table 12-15 of the Appendix. The coefficients graphs can be found in the Figures 9-11 of the Appendix. These graphs indicate that the degree of clustering is very high at the morning call auction, with coefficients peaking at 0.4 for Lisbon, 0.3 for Brussels and over 0.2 for Amsterdam market, as compared to the rest of the trading day. We also find that clustering decline towards the end of the market closing

time for all four markets as evidenced by the low and negative coefficients observed at most levels of clustering mantissa. Studying the graphs, we find that most of the coefficients plots display a rather humped shape pattern with two peaks, that is one in the morning and another in the late afternoon. The mid-day lull can be explained by the need to have lunch and the hump in the middle of the afternoon building to a peak around 3pm can be explained by the opening of the US markets.

Compared with the benchmark afternoon interval 13:15 – 13:29, clustering in the final half hour before the close exhibits higher degree of stabilization and calm despite the large volatility and large trading volume observed, which is consistent across all markets except Lisbon, which reconfirmed our earlier findings, that higher volatility does not lead to higher price clustering.

The coefficients of time intervals dummy variables at morning open are positive and statistically significant at 1% level. The degree of coefficients are smaller than those of interval dummy variables for the first half hour of the morning session. This is consistent with the price resolution hypothesis since the uncertainty effect is expected to be greater for the morning session than for the afternoon session. Near the market closing of the day, clustering is very low which contradict our expectation as we find no evidence show that clustering increases near the market closing. The level of significances in the coefficients of the time dummy variables differ across different level of clustering definitions. But we find those coefficients near the market close are statistically significant at 1% level for the clustering level rounded to nearest 0.05 of a Euro across four markets.

Overall, the model is robust and fit the data well since the wald chi2 is significant at 1% level and Pseudo R-squared for nearest rounding to 0.5 of a Euro, are 0.024%, 0.015% and 0.012% for Lisbon, Brussels and Amsterdam markets respectively.

5. Conclusion

We examine the determinants of price clustering on the Euronext Stock Market using the tick-by-tick transaction price data. We find evidence of explanatory variables such as volume and asset price have a consistently positive and statistically significant effect on price clustering, which is consistent with the price resolution/negotiation hypothesis to reduce the information costs. However, we find negative relationship between volatility and price clustering for three markets except for Lisbon, which shows that higher volatility does not lead to the higher degree of price clustering for large markets such as Amsterdam and Paris, where it is dominated by informed traders, as they could improve the price discovery process, reducing the uncertainty since they are better informed. However, for smaller market such as Lisbon, there are smaller uninformed investors who are more likely to be attracted to rounding to nearest number due to preference or other behavioural bias.

Liquidity also have a negative relationship with price clustering, which means higher the liquidity, lower the price clustering. Additionally, we also examine the intraday pattern of price clustering at 15-minute interval. We find that intraday clustering exhibits a two-humped shape with two peaks in the morning market open and around 3pm in the late afternoon. Coefficients of clustering is highest and significant at 1% level at the market opening. And near the market close, clustering tends to subside and remain at a low level.

Our results have implications for the market quality, and stability of share prices by providing insights into price clustering behaviour of transaction prices at intraday level and the key factors concerning the price clustering phenomenon.

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APPENDIX:

Figure 1 : Transaction Prices Mantissa for Lisbon Market

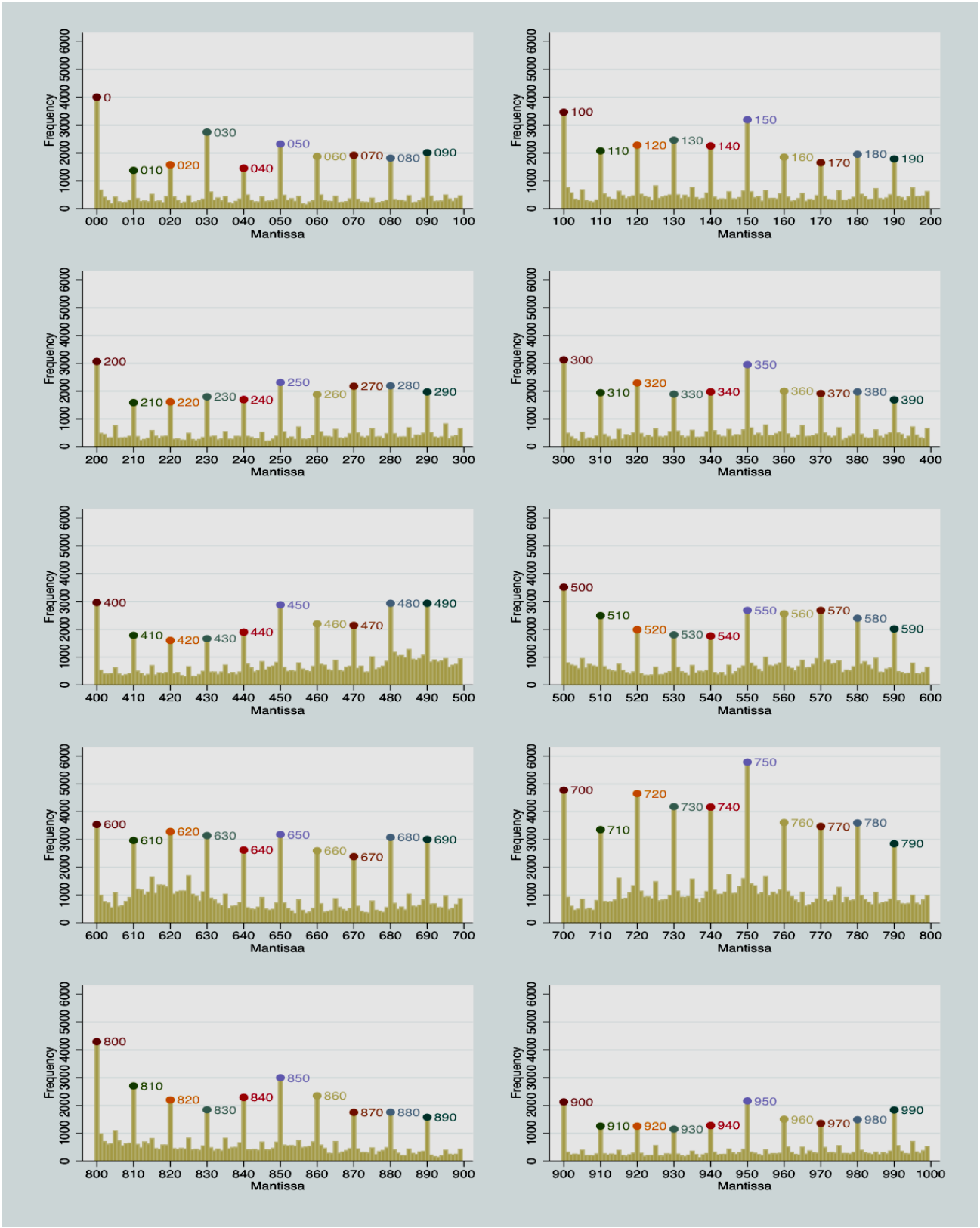


Table 2: Transaction Prices Mantissa frequency and percentage frequency for Lisbon Market

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
0	4,009	0.56	50	2,324	0.33	100	3,470	0.49
1	664	0.09	51	477	0.07	101	754	0.11
2	411	0.06	52	305	0.04	102	562	0.08
3	300	0.04	53	358	0.05	103	340	0.05
4	186	0.03	54	262	0.04	104	313	0.04
5	417	0.06	55	435	0.06	105	676	0.1
6	248	0.03	56	183	0.03	106	288	0.04
7	223	0.03	57	148	0.02	107	259	0.04
8	233	0.03	58	242	0.03	108	238	0.03
9	304	0.04	59	284	0.04	109	316	0.04
10	1,376	0.19	60	1,875	0.26	110	2,075	0.29
11	361	0.05	61	490	0.07	111	531	0.07
12	257	0.04	62	286	0.04	112	402	0.06
13	276	0.04	63	265	0.04	113	340	0.05
14	248	0.03	64	257	0.04	114	333	0.05
15	512	0.07	65	440	0.06	115	619	0.09
16	256	0.04	66	219	0.03	116	470	0.07
17	276	0.04	67	234	0.03	117	361	0.05
18	217	0.03	68	252	0.04	118	416	0.06
19	432	0.06	69	353	0.05	119	460	0.06
20	1,575	0.22	70	1,918	0.27	120	2,282	0.32
21	422	0.06	71	338	0.05	121	510	0.07
22	294	0.04	72	245	0.03	122	434	0.06
23	200	0.03	73	237	0.03	123	397	0.06
24	236	0.03	74	229	0.03	124	304	0.04
25	461	0.06	75	377	0.05	125	817	0.12
26	223	0.03	76	206	0.03	126	364	0.05
27	244	0.03	77	224	0.03	127	416	0.06
28	284	0.04	78	254	0.04	128	457	0.06
29	344	0.05	79	307	0.04	129	489	0.07
30	2,752	0.39	80	1,814	0.26	130	2,465	0.35
31	597	0.08	81	329	0.05	131	493	0.07
32	311	0.04	82	311	0.04	132	361	0.05
33	384	0.05	83	307	0.04	133	475	0.07
34	282	0.04	84	268	0.04	134	399	0.06
35	428	0.06	85	465	0.07	135	764	0.11
36	218	0.03	86	215	0.03	136	394	0.06
37	180	0.03	87	233	0.03	137	334	0.05
38	261	0.04	88	281	0.04	138	363	0.05
39	348	0.05	89	378	0.05	139	555	0.08
40	1,453	0.2	90	2,011	0.28	140	2,255	0.32
41	489	0.07	91	447	0.06	141	417	0.06
42	304	0.04	92	259	0.04	142	329	0.05
43	245	0.03	93	270	0.04	143	350	0.05
44	242	0.03	94	275	0.04	144	342	0.05
45	422	0.06	95	488	0.07	145	604	0.09
46	260	0.04	96	350	0.05	146	355	0.05
47	275	0.04	97	264	0.04	147	346	0.05
48	287	0.04	98	366	0.05	148	395	0.06

49	345	0.05	99	459	0.06	149	631	0.09
Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
150	3,198	0.45	200	3,065	0.43	250	2,312	0.33
151	605	0.09	201	484	0.07	251	543	0.08
152	391	0.06	202	445	0.06	252	308	0.04
153	427	0.06	203	326	0.05	253	356	0.05
154	271	0.04	204	331	0.05	254	268	0.04
155	655	0.09	205	755	0.11	255	709	0.1
156	364	0.05	206	318	0.04	256	282	0.04
157	370	0.05	207	328	0.05	257	272	0.04
158	351	0.05	208	332	0.05	258	295	0.04
159	534	0.08	209	381	0.05	259	410	0.06
160	1,851	0.26	210	1,589	0.22	260	1,877	0.26
161	416	0.06	211	368	0.05	261	543	0.08
162	270	0.04	212	232	0.03	262	375	0.05
163	294	0.04	213	268	0.04	263	373	0.05
164	361	0.05	214	307	0.04	264	347	0.05
165	544	0.08	215	584	0.08	265	624	0.09
166	267	0.04	216	389	0.05	266	321	0.05
167	332	0.05	217	301	0.04	267	301	0.04
168	315	0.04	218	373	0.05	268	338	0.05
169	466	0.07	219	390	0.05	269	473	0.07
170	1,652	0.23	220	1,616	0.23	270	2,177	0.31
171	438	0.06	221	277	0.04	271	503	0.07
172	332	0.05	222	289	0.04	272	367	0.05
173	320	0.05	223	246	0.03	273	329	0.05
174	301	0.04	224	239	0.03	274	381	0.05
175	651	0.09	225	486	0.07	275	646	0.09
176	312	0.04	226	265	0.04	276	354	0.05
177	303	0.04	227	223	0.03	277	365	0.05
178	340	0.05	228	267	0.04	278	303	0.04
179	409	0.06	229	337	0.05	279	474	0.07
180	1,953	0.28	230	1,797	0.25	280	2,191	0.31
181	512	0.07	231	366	0.05	281	473	0.07
182	428	0.06	232	387	0.05	282	344	0.05
183	334	0.05	233	256	0.04	283	359	0.05
184	341	0.05	234	289	0.04	284	360	0.05
185	717	0.1	235	548	0.08	285	683	0.1
186	363	0.05	236	281	0.04	286	311	0.04
187	332	0.05	237	274	0.04	287	422	0.06
188	383	0.05	238	377	0.05	288	416	0.06
189	497	0.07	239	369	0.05	289	491	0.07
190	1,786	0.25	240	1,699	0.24	290	1,970	0.28
191	436	0.06	241	378	0.05	291	515	0.07
192	391	0.06	242	342	0.05	292	355	0.05
193	300	0.04	243	291	0.04	293	326	0.05
194	426	0.06	244	293	0.04	294	362	0.05
195	741	0.1	245	528	0.07	295	823	0.12
196	432	0.06	246	209	0.03	296	293	0.04
197	432	0.06	247	212	0.03	297	372	0.05
198	452	0.06	248	282	0.04	298	409	0.06

199	611	0.09	249	388	0.05	299	653	0.09
Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
300	3,125	0.44	350	2,952	0.42	400	2,963	0.42
301	487	0.07	351	678	0.1	401	529	0.07
302	363	0.05	352	424	0.06	402	399	0.06
303	279	0.04	353	486	0.07	403	395	0.06
304	217	0.03	354	397	0.06	404	415	0.06
305	528	0.07	355	782	0.11	405	618	0.09
306	276	0.04	356	412	0.06	406	389	0.05
307	325	0.05	357	410	0.06	407	334	0.05
308	283	0.04	358	474	0.07	408	368	0.05
309	393	0.06	359	548	0.08	409	415	0.06
310	1,942	0.27	360	1,998	0.28	410	1,783	0.25
311	448	0.06	361	468	0.07	411	498	0.07
312	365	0.05	362	336	0.05	412	417	0.06
313	252	0.04	363	332	0.05	413	328	0.05
314	266	0.04	364	419	0.06	414	376	0.05
315	623	0.09	365	758	0.11	415	694	0.1
316	283	0.04	366	371	0.05	416	356	0.05
317	437	0.06	367	381	0.05	417	435	0.06
318	407	0.06	368	409	0.06	418	412	0.06
319	507	0.07	369	460	0.06	419	449	0.06
320	2,294	0.32	370	1,912	0.27	420	1,601	0.23
321	478	0.07	371	502	0.07	421	410	0.06
322	350	0.05	372	388	0.05	422	445	0.06
323	412	0.06	373	334	0.05	423	337	0.05
324	353	0.05	374	384	0.05	424	302	0.04
325	640	0.09	375	683	0.1	425	658	0.09
326	368	0.05	376	251	0.04	426	310	0.04
327	344	0.05	377	311	0.04	427	306	0.04
328	383	0.05	378	372	0.05	428	369	0.05
329	547	0.08	379	459	0.06	429	490	0.07
330	1,890	0.27	380	1,972	0.28	430	1,664	0.23
331	568	0.08	381	455	0.06	431	463	0.07
332	399	0.06	382	332	0.05	432	465	0.07
333	328	0.05	383	312	0.04	433	375	0.05
334	373	0.05	384	324	0.05	434	465	0.07
335	592	0.08	385	605	0.09	435	713	0.1
336	343	0.05	386	377	0.05	436	407	0.06
337	341	0.05	387	326	0.05	437	447	0.06
338	355	0.05	388	445	0.06	438	372	0.05
339	544	0.08	389	511	0.07	439	464	0.07
340	1,972	0.28	390	1,689	0.24	440	1,896	0.27
341	580	0.08	391	502	0.07	441	755	0.11
342	436	0.06	392	449	0.06	442	620	0.09
343	368	0.05	393	288	0.04	443	467	0.07
344	365	0.05	394	380	0.05	444	521	0.07
345	622	0.09	395	711	0.1	445	833	0.12
346	388	0.05	396	423	0.06	446	546	0.08
347	438	0.06	397	328	0.05	447	650	0.09
348	429	0.06	398	298	0.04	448	679	0.1
349	608	0.09	399	654	0.09	449	805	0.11

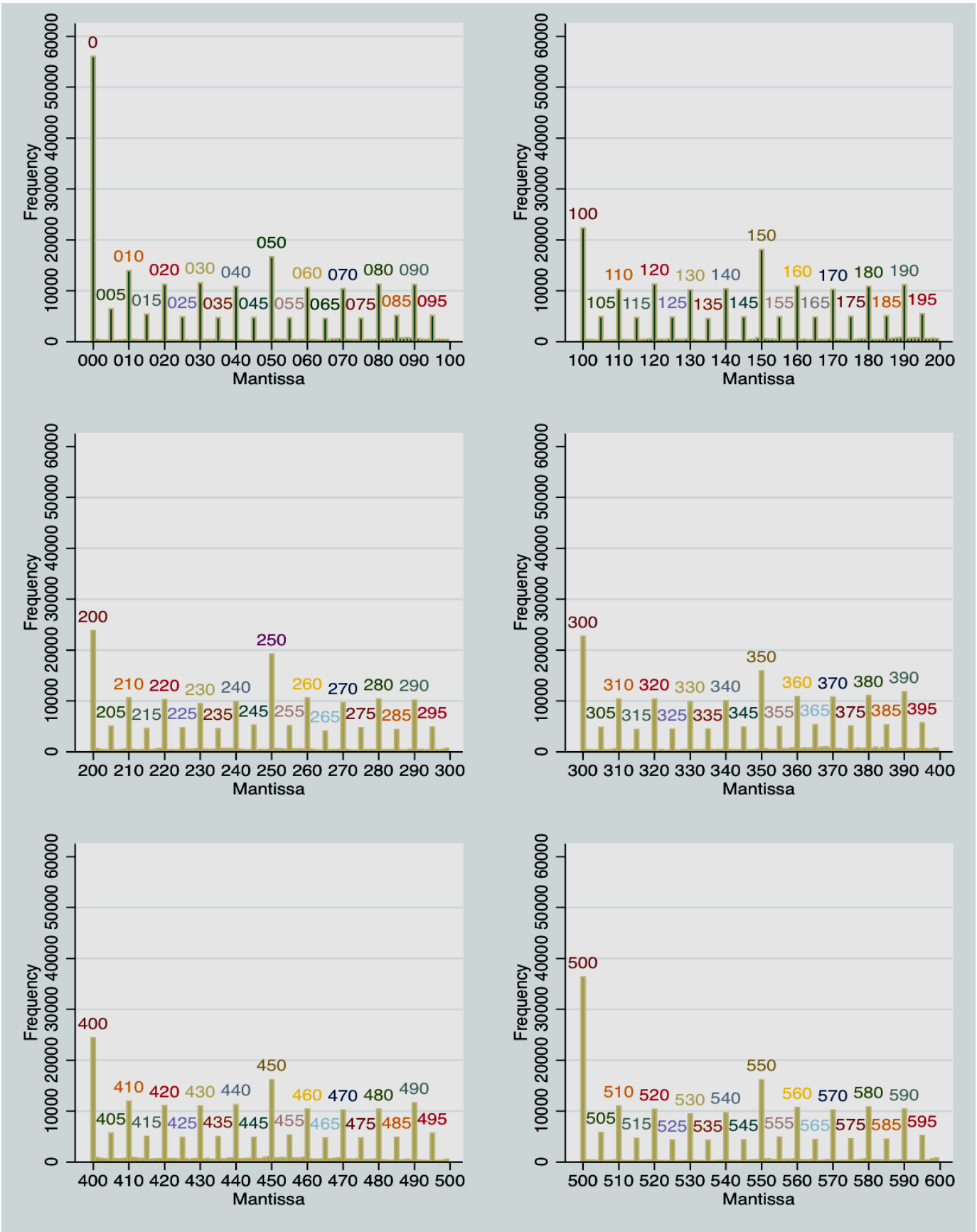
Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
450	2,881	0.41	500	3,515	0.5	550	2,682	0.38
451	629	0.09	501	789	0.11	551	777	0.11
452	488	0.07	502	717	0.1	552	682	0.1
453	514	0.07	503	688	0.1	553	559	0.08
454	490	0.07	504	585	0.08	554	480	0.07
455	787	0.11	505	946	0.13	555	999	0.14
456	574	0.08	506	610	0.09	556	698	0.1
457	516	0.07	507	736	0.1	557	674	0.09
458	478	0.07	508	687	0.1	558	722	0.1
459	667	0.09	509	657	0.09	559	786	0.11
460	2,192	0.31	510	2,492	0.35	560	2,559	0.36
461	738	0.1	511	660	0.09	561	663	0.09
462	704	0.1	512	556	0.08	562	598	0.08
463	549	0.08	513	509	0.07	563	507	0.07
464	513	0.07	514	491	0.07	564	666	0.09
465	884	0.12	515	749	0.11	565	886	0.12
466	528	0.07	516	524	0.07	566	615	0.09
467	494	0.07	517	441	0.06	567	628	0.09
468	637	0.09	518	385	0.05	568	729	0.1
469	673	0.09	519	468	0.07	569	944	0.13
470	2,137	0.3	520	1,983	0.28	570	2,682	0.38
471	594	0.08	521	412	0.06	571	820	0.12
472	675	0.1	522	343	0.05	572	899	0.13
473	459	0.06	523	340	0.05	573	749	0.11
474	464	0.07	524	358	0.05	574	773	0.11
475	1,008	0.14	525	640	0.09	575	867	0.12
476	555	0.08	526	367	0.05	576	455	0.06
477	609	0.09	527	368	0.05	577	538	0.08
478	674	0.09	528	433	0.06	578	507	0.07
479	845	0.12	529	477	0.07	579	659	0.09
480	2,935	0.41	530	1,802	0.25	580	2,396	0.34
481	1,173	0.17	531	633	0.09	581	738	0.1
482	1,039	0.15	532	474	0.07	582	831	0.12
483	1,056	0.15	533	432	0.06	583	707	0.1
484	979	0.14	534	342	0.05	584	574	0.08
485	1,270	0.18	535	699	0.1	585	956	0.13
486	920	0.13	536	430	0.06	586	460	0.06
487	891	0.13	537	492	0.07	587	451	0.06
488	943	0.13	538	469	0.07	588	574	0.08
489	1,069	0.15	539	521	0.07	589	613	0.09
490	2,936	0.41	540	1,757	0.25	590	2,011	0.28
491	819	0.12	541	446	0.06	591	479	0.07
492	895	0.13	542	381	0.05	592	449	0.06
493	826	0.12	543	447	0.06	593	409	0.06
494	867	0.12	544	348	0.05	594	424	0.06
495	945	0.13	545	708	0.1	595	778	0.11
496	638	0.09	546	384	0.05	596	419	0.06
497	704	0.1	547	475	0.07	597	396	0.06
498	738	0.1	548	596	0.08	598	454	0.06
499	936	0.13	549	684	0.1	599	630	0.09

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
600	3,540	0.5	650	3,187	0.45	700	4,776	0.67
601	994	0.14	651	728	0.1	701	926	0.13
602	772	0.11	652	521	0.07	702	604	0.09
603	719	0.1	653	440	0.06	703	463	0.07
604	554	0.08	654	342	0.05	704	504	0.07
605	1,091	0.15	655	833	0.12	705	862	0.12
606	594	0.08	656	456	0.06	706	490	0.07
607	629	0.09	657	354	0.05	707	526	0.07
608	778	0.11	658	397	0.06	708	467	0.07
609	917	0.13	659	525	0.07	709	811	0.11
610	2,969	0.42	660	2,599	0.37	710	3,356	0.47
611	1,215	0.17	661	694	0.1	711	779	0.11
612	1,188	0.17	662	393	0.06	712	761	0.11
613	1,016	0.14	663	419	0.06	713	767	0.11
614	1,107	0.16	664	449	0.06	714	828	0.12
615	1,656	0.23	665	877	0.12	715	1,610	0.23
616	1,059	0.15	666	565	0.08	716	871	0.12
617	1,367	0.19	667	487	0.07	717	890	0.13
618	1,359	0.19	668	439	0.06	718	1,088	0.15
619	1,293	0.18	669	521	0.07	719	1,337	0.19
620	3,286	0.46	670	2,385	0.34	720	4,651	0.65
621	1,043	0.15	671	601	0.08	721	1,144	0.16
622	1,124	0.16	672	422	0.06	722	929	0.13
623	1,153	0.16	673	381	0.05	723	939	0.13
624	1,152	0.16	674	362	0.05	724	878	0.12
625	1,703	0.24	675	794	0.11	725	1,483	0.21
626	1,033	0.15	676	462	0.07	726	801	0.11
627	957	0.13	677	429	0.06	727	828	0.12
628	791	0.11	678	386	0.05	728	857	0.12
629	1,122	0.16	679	561	0.08	729	990	0.14
630	3,145	0.44	680	3,081	0.43	730	4,185	0.59
631	898	0.13	681	708	0.1	731	1,146	0.16
632	828	0.12	682	490	0.07	732	928	0.13
633	698	0.1	683	578	0.08	733	918	0.13
634	632	0.09	684	475	0.07	734	947	0.13
635	1,036	0.15	685	1,039	0.15	735	1,576	0.22
636	519	0.07	686	612	0.09	736	874	0.12
637	607	0.09	687	587	0.08	737	742	0.1
638	623	0.09	688	641	0.09	738	890	0.13
639	742	0.1	689	833	0.12	739	1,129	0.16
640	2,623	0.37	690	3,007	0.42	740	4,170	0.59
641	555	0.08	691	681	0.1	741	1,178	0.17
642	507	0.07	692	692	0.1	742	1,032	0.15
643	488	0.07	693	561	0.08	743	1,035	0.15
644	570	0.08	694	555	0.08	744	1,107	0.16
645	917	0.13	695	966	0.14	745	1,747	0.25
646	510	0.07	696	483	0.07	746	1,061	0.15
647	467	0.07	697	527	0.07	747	1,074	0.15
648	495	0.07	698	670	0.09	748	1,318	0.19
649	723	0.1	699	879	0.12	749	1,593	0.22

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
750	5,784	0.81	800	4,298	0.61	850	3,000	0.42
751	1,404	0.2	801	982	0.14	851	578	0.08
752	1,335	0.19	802	702	0.1	852	551	0.08
753	1,036	0.15	803	605	0.09	853	563	0.08
754	1,091	0.15	804	629	0.09	854	538	0.08
755	1,676	0.24	805	1,098	0.15	855	734	0.1
756	977	0.14	806	726	0.1	856	486	0.07
757	1,104	0.16	807	548	0.08	857	507	0.07
758	1,042	0.15	808	633	0.09	858	534	0.08
759	1,191	0.17	809	650	0.09	859	694	0.1
760	3,611	0.51	810	2,703	0.38	860	2,350	0.33
761	1,135	0.16	811	599	0.08	861	577	0.08
762	945	0.13	812	480	0.07	862	459	0.06
763	825	0.12	813	693	0.1	863	285	0.04
764	746	0.11	814	614	0.09	864	272	0.04
765	1,103	0.16	815	813	0.11	865	703	0.1
766	617	0.09	816	453	0.06	866	286	0.04
767	660	0.09	817	425	0.06	867	329	0.05
768	741	0.1	818	581	0.08	868	378	0.05
769	870	0.12	819	580	0.08	869	450	0.06
770	3,473	0.49	820	2,202	0.31	870	1,753	0.25
771	847	0.12	821	452	0.06	871	440	0.06
772	771	0.11	822	419	0.06	872	310	0.04
773	802	0.11	823	460	0.06	873	312	0.04
774	1,008	0.14	824	435	0.06	874	292	0.04
775	1,275	0.18	825	834	0.12	875	475	0.07
776	740	0.1	826	409	0.06	876	234	0.03
777	920	0.13	827	425	0.06	877	343	0.05
778	807	0.11	828	388	0.05	878	381	0.05
779	830	0.12	829	546	0.08	879	485	0.07
780	3,597	0.51	830	1,848	0.26	880	1,759	0.25
781	988	0.14	831	483	0.07	881	408	0.06
782	844	0.12	832	371	0.05	882	286	0.04
783	752	0.11	833	433	0.06	883	205	0.03
784	664	0.09	834	373	0.05	884	200	0.03
785	1,096	0.15	835	826	0.12	885	433	0.06
786	700	0.1	836	448	0.06	886	279	0.04
787	742	0.1	837	486	0.07	887	238	0.03
788	767	0.11	838	492	0.07	888	332	0.05
789	867	0.12	839	662	0.09	889	352	0.05
790	2,850	0.4	840	2,291	0.32	890	1,578	0.22
791	805	0.11	841	413	0.06	891	218	0.03
792	699	0.1	842	411	0.06	892	161	0.02
793	684	0.1	843	421	0.06	893	140	0.02
794	706	0.1	844	388	0.05	894	193	0.03
795	997	0.14	845	688	0.1	895	395	0.06
796	712	0.1	846	414	0.06	896	248	0.03
797	661	0.09	847	410	0.06	897	226	0.03
798	829	0.12	848	460	0.06	898	249	0.04
799	986	0.14	849	684	0.1	899	426	0.06

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
900	2,131	0.3	950	2,166	0.31
901	320	0.05	951	324	0.05
902	227	0.03	952	288	0.04
903	252	0.04	953	238	0.03
904	234	0.03	954	201	0.03
905	397	0.06	955	409	0.06
906	205	0.03	956	251	0.04
907	205	0.03	957	270	0.04
908	194	0.03	958	265	0.04
909	261	0.04	959	284	0.04
910	1,258	0.18	960	1,507	0.21
911	265	0.04	961	514	0.07
912	224	0.03	962	313	0.04
913	255	0.04	963	244	0.03
914	229	0.03	964	223	0.03
915	388	0.05	965	500	0.07
916	211	0.03	966	255	0.04
917	178	0.03	967	368	0.05
918	232	0.03	968	300	0.04
919	291	0.04	969	288	0.04
920	1,256	0.18	970	1,355	0.19
921	284	0.04	971	491	0.07
922	174	0.02	972	300	0.04
923	208	0.03	973	312	0.04
924	213	0.03	974	291	0.04
925	563	0.08	975	558	0.08
926	195	0.03	976	274	0.04
927	181	0.03	977	275	0.04
928	262	0.04	978	258	0.04
929	253	0.04	979	316	0.04
930	1,152	0.16	980	1,489	0.21
931	255	0.04	981	394	0.06
932	186	0.03	982	300	0.04
933	163	0.02	983	276	0.04
934	220	0.03	984	240	0.03
935	359	0.05	985	321	0.05
936	237	0.03	986	234	0.03
937	125	0.02	987	303	0.04
938	229	0.03	988	264	0.04
939	271	0.04	989	362	0.05
940	1,279	0.18	990	1,841	0.26
941	321	0.05	991	558	0.08
942	229	0.03	992	352	0.05
943	243	0.03	993	270	0.04
944	247	0.03	994	260	0.04
945	431	0.06	995	705	0.1
946	299	0.04	996	332	0.05
947	247	0.03	997	279	0.04
948	302	0.04	998	374	0.05
949	423	0.06	999	529	0.07
			Total	**710,081**	**100**

Figure 2: Transaction Prices Mantissa for Brussels Market



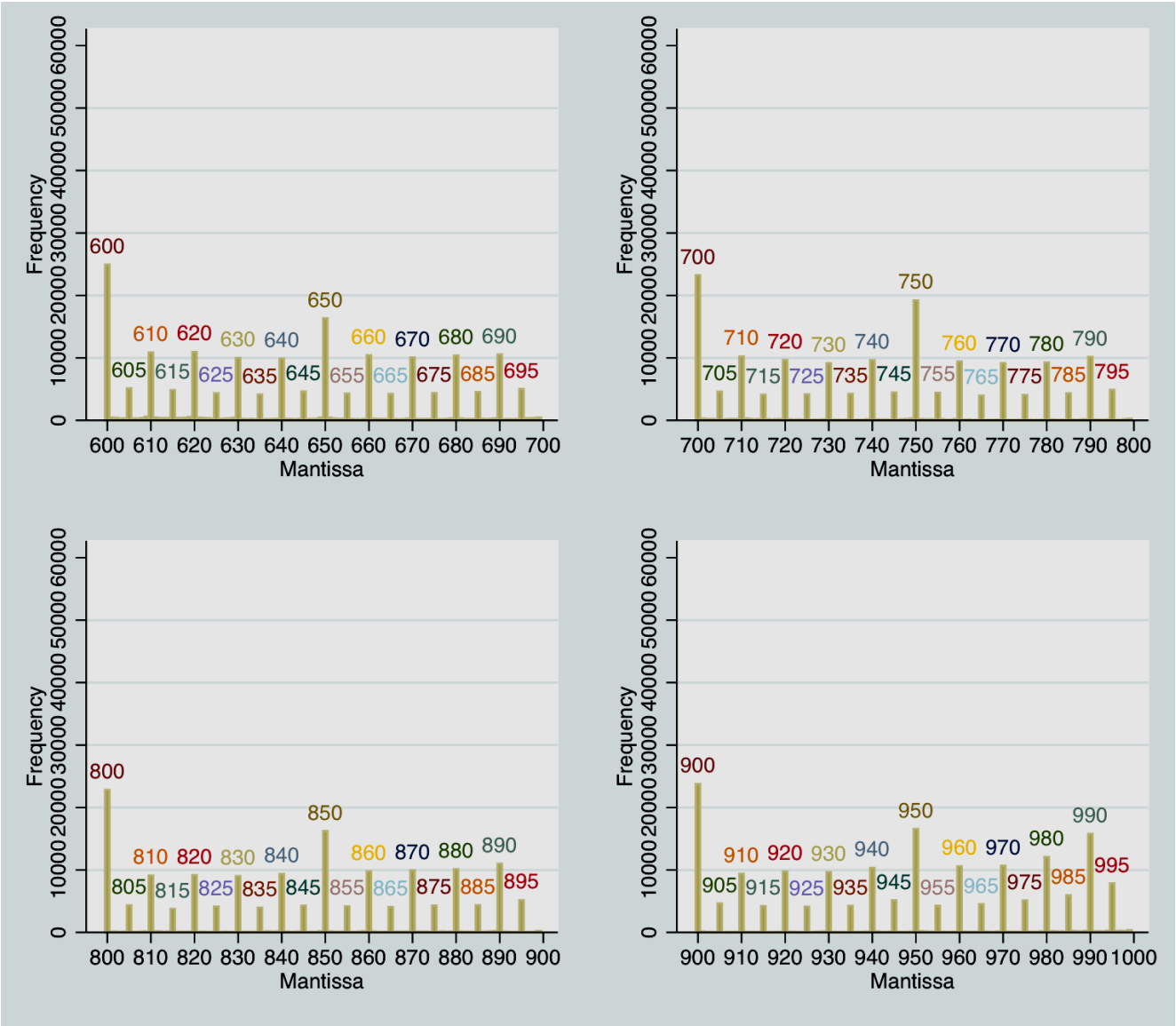


Figure 2: Transaction Prices Mantissa for Brussels Market

Table 3: Transaction Prices Mantissa frequency and percentage frequency for Brussels Market

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
0	56,051	2.77	43	219	0.01	86	710	0.04
1	410	0.02	44	181	0.01	87	684	0.03
2	303	0.01	45	4,749	0.23	88	773	0.04
3	255	0.01	46	244	0.01	89	654	0.03
4	237	0.01	47	264	0.01	90	11,227	0.55
5	6,446	0.32	48	292	0.01	91	583	0.03
6	245	0.01	49	282	0.01	92	477	0.02
7	271	0.01	50	16,663	0.82	93	416	0.02
8	252	0.01	51	504	0.02	94	451	0.02
9	398	0.02	52	420	0.02	95	5,150	0.25
10	13,947	0.69	53	430	0.02	96	402	0.02
11	392	0.02	54	383	0.02	97	444	0.02
12	359	0.02	55	4,667	0.23	98	436	0.02
13	284	0.01	56	396	0.02	99	421	0.02
14	345	0.02	57	337	0.02	100	22,357	1.1
15	5,395	0.27	58	380	0.02	101	413	0.02
16	230	0.01	59	371	0.02	102	369	0.02
17	276	0.01	60	10,642	0.53	103	319	0.02
18	201	0.01	61	382	0.02	104	249	0.01
19	325	0.02	62	357	0.02	105	4,903	0.24
20	11,254	0.56	63	315	0.02	106	264	0.01
21	252	0.01	64	272	0.01	107	270	0.01
22	265	0.01	65	4,552	0.22	108	312	0.02
23	306	0.02	66	383	0.02	109	320	0.02
24	258	0.01	67	501	0.02	110	10,386	0.51
25	4,894	0.24	68	527	0.03	111	407	0.02
26	335	0.02	69	585	0.03	112	348	0.02
27	156	0.01	70	10,408	0.51	113	338	0.02
28	219	0.01	71	458	0.02	114	317	0.02
29	240	0.01	72	405	0.02	115	4,739	0.23
30	11,545	0.57	73	361	0.02	116	378	0.02
31	335	0.02	74	365	0.02	117	429	0.02
32	391	0.02	75	4,607	0.23	118	484	0.02
33	350	0.02	76	356	0.02	119	558	0.03
34	402	0.02	77	430	0.02	120	11,289	0.56
35	4,698	0.23	78	410	0.02	121	449	0.02
36	387	0.02	79	462	0.02	122	449	0.02
37	289	0.01	80	11,285	0.56	123	366	0.02
38	276	0.01	81	553	0.03	124	509	0.03
39	326	0.02	82	519	0.03	125	4,823	0.24
40	10,852	0.54	83	542	0.03	126	441	0.02
41	330	0.02	84	628	0.03	127	395	0.02

42	263	0.01	85	5,148	0.25	128	385	0.02
Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
129	511	0.03	173	435	0.02	217	385	0.02
130	10,195	0.5	174	419	0.02	218	537	0.03
131	389	0.02	175	4,972	0.25	219	639	0.03
132	259	0.01	176	372	0.02	220	10,215	0.5
133	253	0.01	177	466	0.02	221	382	0.02
134	256	0.01	178	552	0.03	222	397	0.02
135	4,520	0.22	179	527	0.03	223	320	0.02
136	224	0.01	180	10,853	0.54	224	394	0.02
137	227	0.01	181	481	0.02	225	4,692	0.23
138	259	0.01	182	418	0.02	226	484	0.02
139	396	0.02	183	466	0.02	227	449	0.02
140	10,379	0.51	184	461	0.02	228	478	0.02
141	292	0.01	185	5,055	0.25	229	580	0.03
142	305	0.02	186	576	0.03	230	9,431	0.47
143	298	0.01	187	671	0.03	231	473	0.02
144	235	0.01	188	729	0.04	232	472	0.02
145	4,881	0.24	189	810	0.04	233	437	0.02
146	263	0.01	190	11,200	0.55	234	487	0.02
147	425	0.02	191	668	0.03	235	4,514	0.22
148	475	0.02	192	709	0.04	236	622	0.03
149	738	0.04	193	731	0.04	237	623	0.03
150	18,082	0.89	194	720	0.04	238	644	0.03
151	560	0.03	195	5,474	0.27	239	618	0.03
152	477	0.02	196	595	0.03	240	9,822	0.49
153	484	0.02	197	608	0.03	241	501	0.02
154	417	0.02	198	651	0.03	242	388	0.02
155	4,904	0.24	199	592	0.03	243	320	0.02
156	400	0.02	200	23,772	1.17	244	394	0.02
157	403	0.02	201	595	0.03	245	5,222	0.26
158	375	0.02	202	398	0.02	246	330	0.02
159	460	0.02	203	392	0.02	247	442	0.02
160	10,938	0.54	204	316	0.02	248	350	0.02
161	372	0.02	205	5,009	0.25	249	450	0.02
162	457	0.02	206	341	0.02	250	19,168	0.95
163	338	0.02	207	321	0.02	251	626	0.03
164	397	0.02	208	406	0.02	252	546	0.03
165	4,848	0.24	209	510	0.03	253	520	0.03
166	398	0.02	210	10,578	0.52	254	442	0.02
167	388	0.02	211	448	0.02	255	5,091	0.25
168	374	0.02	212	373	0.02	256	548	0.03
169	521	0.03	213	347	0.02	257	482	0.02
170	10,260	0.51	214	420	0.02	258	542	0.03
171	472	0.02	215	4,563	0.23	259	489	0.02

172	479	0.02	216	373	0.02	260	10,567	0.52
Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
261	490	0.02	306	389	0.02	351	588	0.03
262	347	0.02	307	326	0.02	352	458	0.02
263	335	0.02	308	408	0.02	353	383	0.02
264	295	0.01	309	542	0.03	354	442	0.02
265	4,050	0.2	310	10,341	0.51	355	4,932	0.24
266	346	0.02	311	389	0.02	356	617	0.03
267	393	0.02	312	345	0.02	357	484	0.02
268	369	0.02	313	291	0.01	358	675	0.03
269	481	0.02	314	412	0.02	359	775	0.04
270	9,630	0.48	315	4,353	0.22	360	10,821	0.53
271	423	0.02	316	351	0.02	361	592	0.03
272	332	0.02	317	343	0.02	362	733	0.04
273	287	0.01	318	316	0.02	363	637	0.03
274	318	0.02	319	337	0.02	364	719	0.04
275	4,693	0.23	320	10,343	0.51	365	5,282	0.26
276	418	0.02	321	337	0.02	366	779	0.04
277	379	0.02	322	419	0.02	367	881	0.04
278	420	0.02	323	255	0.01	368	968	0.05
279	399	0.02	324	304	0.02	369	769	0.04
280	10,361	0.51	325	4,411	0.22	370	10,733	0.53
281	368	0.02	326	341	0.02	371	622	0.03
282	379	0.02	327	288	0.01	372	623	0.03
283	352	0.02	328	428	0.02	373	455	0.02
284	418	0.02	329	416	0.02	374	498	0.02
285	4,337	0.21	330	9,832	0.49	375	5,035	0.25
286	372	0.02	331	392	0.02	376	529	0.03
287	275	0.01	332	409	0.02	377	742	0.04
288	365	0.02	333	342	0.02	378	576	0.03
289	488	0.02	334	390	0.02	379	687	0.03
290	10,125	0.5	335	4,433	0.22	380	11,049	0.55
291	373	0.02	336	437	0.02	381	659	0.03
292	418	0.02	337	314	0.02	382	857	0.04
293	311	0.02	338	445	0.02	383	533	0.03
294	361	0.02	339	443	0.02	384	814	0.04
295	4,837	0.24	340	9,981	0.49	385	5,268	0.26
296	406	0.02	341	417	0.02	386	654	0.03
297	325	0.02	342	391	0.02	387	479	0.02
298	431	0.02	343	361	0.02	388	632	0.03
299	659	0.03	344	392	0.02	389	725	0.04
300	22,675	1.12	345	4,823	0.24	390	11,762	0.58
301	385	0.02	346	386	0.02	391	589	0.03
302	367	0.02	347	352	0.02	392	472	0.02

303	311	0.02	348	396	0.02	393	446	0.02
304	344	0.02	349	485	0.02	394	624	0.03
305	4,786	0.24	350	15,871	0.78	395	5,666	0.28
Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
396	626	0.03	441	616	0.03	486	350	0.02
397	465	0.02	442	585	0.03	487	400	0.02
398	575	0.03	443	659	0.03	488	512	0.03
399	750	0.04	444	667	0.03	489	405	0.02
400	24,376	1.2	445	4,824	0.24	490	11,633	0.57
401	833	0.04	446	629	0.03	491	334	0.02
402	681	0.03	447	573	0.03	492	307	0.02
403	616	0.03	448	834	0.04	493	271	0.01
404	550	0.03	449	999	0.05	494	236	0.01
405	5,655	0.28	450	16,118	0.8	495	5,653	0.28
406	614	0.03	451	731	0.04	496	285	0.01
407	541	0.03	452	777	0.04	497	282	0.01
408	609	0.03	453	853	0.04	498	334	0.02
409	697	0.03	454	721	0.04	499	519	0.03
410	11,898	0.59	455	5,255	0.26	500	36,338	1.79
411	885	0.04	456	743	0.04	501	367	0.02
412	794	0.04	457	729	0.04	502	328	0.02
413	621	0.03	458	718	0.04	503	330	0.02
414	674	0.03	459	898	0.04	504	258	0.01
415	4,998	0.25	460	10,372	0.51	505	5,782	0.29
416	482	0.02	461	562	0.03	506	239	0.01
417	540	0.03	462	521	0.03	507	251	0.01
418	618	0.03	463	499	0.02	508	306	0.02
419	619	0.03	464	574	0.03	509	378	0.02
420	11,033	0.54	465	4,693	0.23	510	10,956	0.54
421	625	0.03	466	561	0.03	511	303	0.01
422	648	0.03	467	616	0.03	512	228	0.01
423	608	0.03	468	699	0.03	513	189	0.01
424	527	0.03	469	809	0.04	514	261	0.01
425	4,809	0.24	470	10,179	0.5	515	4,614	0.23
426	621	0.03	471	544	0.03	516	229	0.01
427	418	0.02	472	491	0.02	517	290	0.01
428	619	0.03	473	527	0.03	518	345	0.02
429	648	0.03	474	620	0.03	519	373	0.02
430	10,977	0.54	475	4,689	0.23	520	10,322	0.51
431	574	0.03	476	457	0.02	521	299	0.01
432	653	0.03	477	456	0.02	522	242	0.01
433	496	0.02	478	469	0.02	523	199	0.01
434	501	0.02	479	540	0.03	524	224	0.01
435	4,963	0.25	480	10,370	0.51	525	4,291	0.21
436	582	0.03	481	384	0.02	526	183	0.01

437	512	0.03	482	339	0.02	527	193	0.01
438	710	0.04	483	274	0.01	528	204	0.01
439	771	0.04	484	319	0.02	529	284	0.01
440	11,228	0.55	485	4,830	0.24	530	9,416	0.47
Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
531	262	0.01	576	309	0.02	621	423	0.02
532	254	0.01	577	386	0.02	622	375	0.02
533	207	0.01	578	465	0.02	623	337	0.02
534	241	0.01	579	590	0.03	624	286	0.01
535	4,260	0.21	580	10,776	0.53	625	4,343	0.21
536	148	0.01	581	390	0.02	626	218	0.01
537	232	0.01	582	353	0.02	627	276	0.01
538	270	0.01	583	362	0.02	628	286	0.01
539	333	0.02	584	335	0.02	629	400	0.02
540	9,662	0.48	585	4,471	0.22	630	9,979	0.49
541	286	0.01	586	239	0.01	631	233	0.01
542	263	0.01	587	322	0.02	632	177	0.01
543	231	0.01	588	302	0.01	633	231	0.01
544	228	0.01	589	403	0.02	634	179	0.01
545	4,316	0.21	590	10,388	0.51	635	4,135	0.2
546	304	0.02	591	291	0.01	636	178	0.01
547	370	0.02	592	271	0.01	637	172	0.01
548	382	0.02	593	198	0.01	638	197	0.01
549	445	0.02	594	308	0.02	639	252	0.01
550	16,097	0.8	595	5,150	0.25	640	9,884	0.49
551	557	0.03	596	316	0.02	641	246	0.01
552	586	0.03	597	329	0.02	642	224	0.01
553	399	0.02	598	608	0.03	643	173	0.01
554	451	0.02	599	767	0.04	644	225	0.01
555	4,864	0.24	600	24,932	1.23	645	4,611	0.23
556	434	0.02	601	418	0.02	646	199	0.01
557	499	0.02	602	377	0.02	647	198	0.01
558	467	0.02	603	278	0.01	648	257	0.01
559	574	0.03	604	307	0.02	649	425	0.02
560	10,693	0.53	605	5,127	0.25	650	16,334	0.81
561	414	0.02	606	302	0.01	651	410	0.02
562	431	0.02	607	270	0.01	652	276	0.01
563	349	0.02	608	358	0.02	653	234	0.01
564	463	0.02	609	565	0.03	654	247	0.01
565	4,390	0.22	610	10,859	0.54	655	4,267	0.21
566	275	0.01	611	426	0.02	656	222	0.01
567	289	0.01	612	363	0.02	657	172	0.01
568	363	0.02	613	361	0.02	658	170	0.01
569	415	0.02	614	356	0.02	659	218	0.01
570	10,177	0.5	615	4,835	0.24	660	10,415	0.51

571	280	0.01	616	379	0.02	661	264	0.01
572	250	0.01	617	353	0.02	662	226	0.01
573	306	0.02	618	406	0.02	663	230	0.01
574	256	0.01	619	528	0.03	664	211	0.01
575	4,530	0.22	620	10,950	0.54	665	4,224	0.21
Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
666	175	0.01	711	299	0.01	756	174	0.01
667	166	0.01	712	214	0.01	757	121	0.01
668	189	0.01	713	151	0.01	758	95	0
669	280	0.01	714	218	0.01	759	210	0.01
670	10,053	0.5	715	4,097	0.2	760	9,417	0.47
671	225	0.01	716	183	0.01	761	102	0.01
672	224	0.01	717	122	0.01	762	135	0.01
673	207	0.01	718	176	0.01	763	62	0
674	238	0.01	719	203	0.01	764	72	0
675	4,366	0.22	720	9,654	0.48	765	3,954	0.2
676	180	0.01	721	176	0.01	766	58	0
677	168	0.01	722	101	0	767	53	0
678	225	0.01	723	152	0.01	768	82	0
679	316	0.02	724	109	0.01	769	109	0.01
680	10,375	0.51	725	4,152	0.21	770	9,146	0.45
681	299	0.01	726	99	0	771	75	0
682	193	0.01	727	119	0.01	772	62	0
683	222	0.01	728	100	0	773	62	0
684	221	0.01	729	156	0.01	774	50	0
685	4,523	0.22	730	9,144	0.45	775	4,051	0.2
686	239	0.01	731	89	0	776	76	0
687	189	0.01	732	107	0.01	777	54	0
688	248	0.01	733	80	0	778	67	0
689	311	0.02	734	107	0.01	779	96	0
690	10,537	0.52	735	4,240	0.21	780	9,247	0.46
691	176	0.01	736	86	0	781	145	0.01
692	187	0.01	737	76	0	782	103	0.01
693	185	0.01	738	101	0	783	93	0
694	219	0.01	739	173	0.01	784	99	0
695	5,025	0.25	740	9,630	0.48	785	4,329	0.21
696	313	0.02	741	145	0.01	786	99	0
697	311	0.02	742	122	0.01	787	86	0
698	363	0.02	743	135	0.01	788	135	0.01
699	427	0.02	744	119	0.01	789	176	0.01
700	23,231	1.15	745	4,453	0.22	790	10,150	0.5
701	276	0.01	746	133	0.01	791	129	0.01
702	231	0.01	747	179	0.01	792	108	0.01
703	209	0.01	748	216	0.01	793	81	0
704	205	0.01	749	291	0.01	794	143	0.01

705	4,594	0.23	750	19,191	0.95	795	4,878	0.24
706	156	0.01	751	198	0.01	796	85	0
707	187	0.01	752	176	0.01	797	72	0
708	213	0.01	753	150	0.01	798	178	0.01
709	219	0.01	754	164	0.01	799	250	0.01
710	10,225	0.51	755	4,414	0.22	800	22,813	1.13
Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
801	134	0.01	846	62	0	891	119	0.01
802	118	0.01	847	99	0	892	95	0
803	59	0	848	71	0	893	85	0
804	127	0.01	849	177	0.01	894	60	0
805	4,323	0.21	850	16,224	0.8	895	5,157	0.25
806	86	0	851	150	0.01	896	72	0
807	84	0	852	123	0.01	897	87	0
808	118	0.01	853	96	0	898	100	0
809	154	0.01	854	107	0.01	899	226	0.01
810	9,108	0.45	855	4,172	0.21	900	23,755	1.17
811	178	0.01	856	98	0	901	144	0.01
812	166	0.01	857	98	0	902	87	0
813	95	0	858	144	0.01	903	61	0
814	136	0.01	859	184	0.01	904	43	0
815	3,763	0.19	860	9,777	0.48	905	4,632	0.23
816	61	0	861	140	0.01	906	27	0
817	110	0.01	862	74	0	907	59	0
818	95	0	863	64	0	908	60	0
819	116	0.01	864	93	0	909	65	0
820	9,170	0.45	865	4,068	0.2	910	9,385	0.46
821	79	0	866	101	0	911	92	0
822	119	0.01	867	114	0.01	912	78	0
823	52	0	868	108	0.01	913	86	0
824	63	0	869	132	0.01	914	62	0
825	4,121	0.2	870	9,941	0.49	915	4,206	0.21
826	41	0	871	133	0.01	916	27	0
827	111	0.01	872	112	0.01	917	40	0
828	78	0	873	122	0.01	918	72	0
829	83	0	874	96	0	919	74	0
830	9,009	0.44	875	4,293	0.21	920	9,750	0.48
831	90	0	876	86	0	921	108	0.01
832	92	0	877	143	0.01	922	78	0
833	69	0	878	97	0	923	48	0
834	104	0.01	879	130	0.01	924	61	0
835	3,942	0.19	880	10,131	0.5	925	4,103	0.2
836	130	0.01	881	134	0.01	926	51	0
837	156	0.01	882	97	0	927	103	0.01
838	112	0.01	883	116	0.01	928	120	0.01

839	144	0.01	884	92	0	929	149	0.01
840	9,359	0.46	885	4,346	0.21	930	9,646	0.48
841	121	0.01	886	91	0	931	73	0
842	102	0.01	887	121	0.01	932	51	0
843	84	0	888	156	0.01	933	31	0
844	124	0.01	889	219	0.01	934	43	0
845	4,276	0.21	890	10,983	0.54	935	4,242	0.21

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
936	63	0	981	189	0.01
937	65	0	982	161	0.01
938	89	0	983	130	0.01
939	119	0.01	984	150	0.01
940	10,326	0.51	985	5,945	0.29
941	149	0.01	986	242	0.01
942	83	0	987	167	0.01
943	74	0	988	157	0.01
944	106	0.01	989	233	0.01
945	5,143	0.25	990	15,767	0.78
946	77	0	991	178	0.01
947	66	0	992	160	0.01
948	65	0	993	164	0.01
949	127	0.01	994	257	0.01
950	16,550	0.82	995	7,850	0.39
951	198	0.01	996	214	0.01
952	158	0.01	997	257	0.01
953	108	0.01	998	218	0.01
954	100	0	999	356	0.02
955	4,257	0.21			
956	94	0	**Total**	**2,024,648**	**100**
957	99	0			
958	82	0			
959	102	0.01			
960	10,584	0.52			
961	120	0.01			
962	85	0			
963	96	0			
964	101	0			
965	4,526	0.22			
966	124	0.01			
967	76	0			
968	77	0			
969	148	0.01			
970	10,674	0.53			
971	122	0.01			
972	102	0.01			

973	101	0
974	88	0
975	5,115	0.25
976	107	0.01
977	98	0
978	116	0.01
979	177	0.01
980	12,077	0.6

Figure 3: Transaction Prices Mantissa for Amsterdam Market

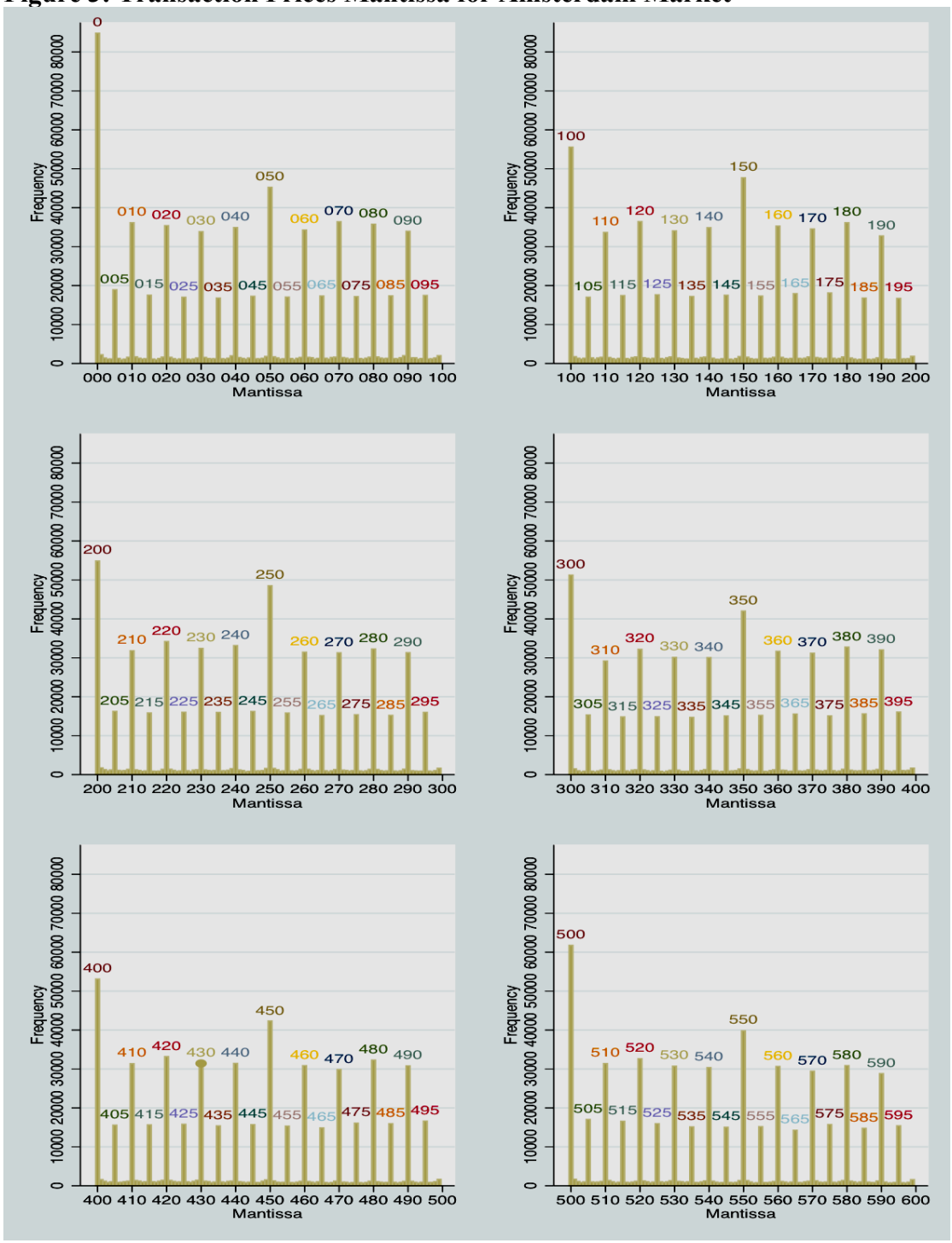


Figure 3: Transaction Prices Mantissa for Amsterdam Market

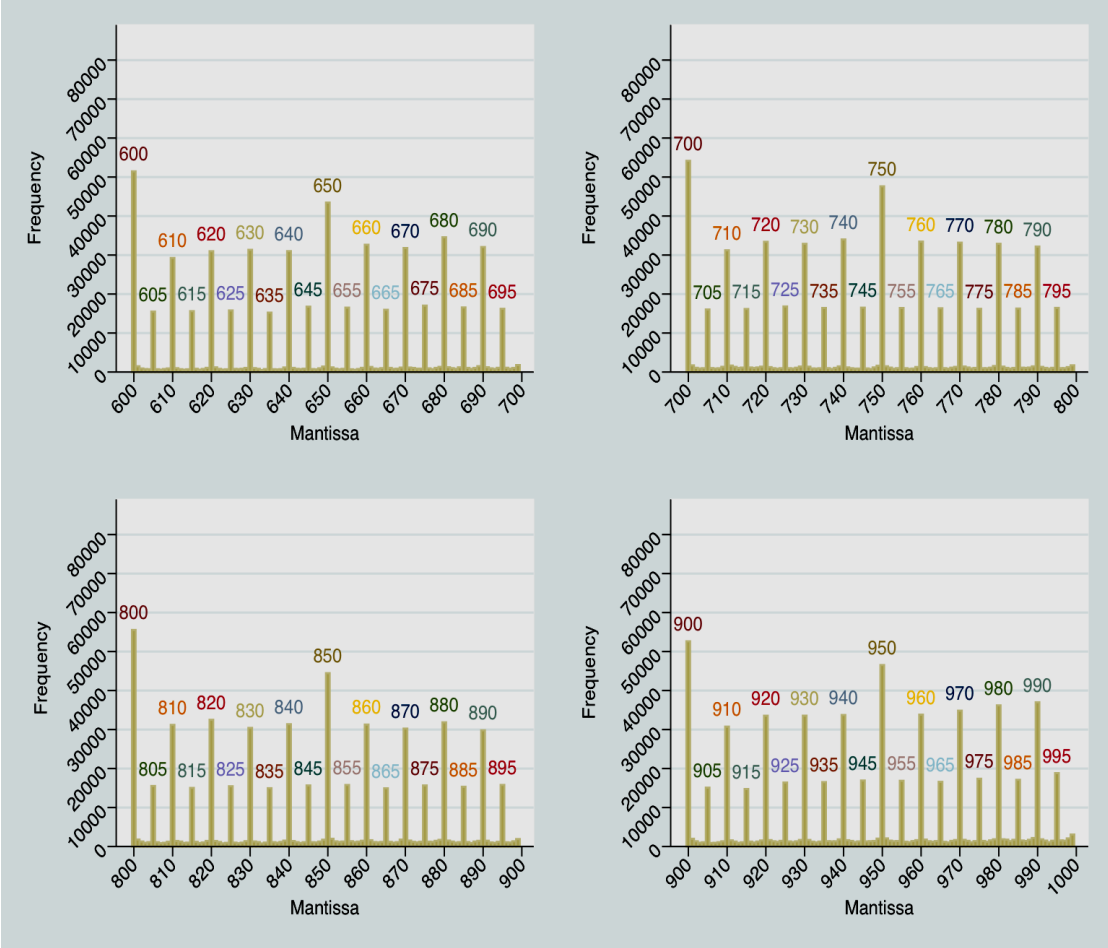


Table 4: Transaction Prices Mantissa frequency and % for Amsterdam Market

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
0	84,820	1.38	43	1,056	0.02	86	1,242	0.02
1	2,235	0.04	44	1,400	0.02	87	1,200	0.02
2	1,405	0.02	45	17,247	0.28	88	1,488	0.02
3	1,126	0.02	46	1,202	0.02	89	1,990	0.03
4	1,154	0.02	47	1,171	0.02	90	33,946	0.55
5	18,922	0.31	48	1,341	0.02	91	1,448	0.02
6	1,306	0.02	49	1,808	0.03	92	1,458	0.02
7	949	0.02	50	45,232	0.74	93	1,077	0.02
8	1,140	0.02	51	1,718	0.03	94	1,272	0.02
9	1,597	0.03	52	1,429	0.02	95	17,463	0.28
10	36,146	0.59	53	1,107	0.02	96	1,170	0.02
11	1,714	0.03	54	1,211	0.02	97	1,186	0.02
12	1,356	0.02	55	17,034	0.28	98	1,426	0.02
13	1,145	0.02	56	1,279	0.02	99	1,995	0.03
14	1,229	0.02	57	980	0.02	100	55,550	0.9
15	17,534	0.29	58	1,333	0.02	101	1,751	0.03
16	1,149	0.02	59	1,564	0.03	102	1,352	0.02
17	948	0.02	60	34,260	0.56	103	1,123	0.02
18	1,276	0.02	61	1,584	0.03	104	1,357	0.02
19	1,644	0.03	62	1,486	0.02	105	17,004	0.28
20	35,381	0.58	63	1,071	0.02	106	1,440	0.02
21	1,593	0.03	64	1,315	0.02	107	1,042	0.02
22	1,245	0.02	65	17,320	0.28	108	1,422	0.02
23	982	0.02	66	1,356	0.02	109	1,595	0.03
24	1,181	0.02	67	1,110	0.02	110	33,633	0.55
25	16,993	0.28	68	1,541	0.03	111	1,540	0.03
26	1,159	0.02	69	1,632	0.03	112	1,267	0.02
27	1,001	0.02	70	36,396	0.59	113	1,024	0.02
28	1,167	0.02	71	1,535	0.02	114	1,313	0.02
29	1,423	0.02	72	1,371	0.02	115	17,429	0.28
30	33,832	0.55	73	1,120	0.02	116	1,271	0.02
31	1,564	0.03	74	1,257	0.02	117	1,118	0.02
32	1,274	0.02	75	17,165	0.28	118	1,528	0.02
33	1,196	0.02	76	1,278	0.02	119	1,681	0.03
34	1,218	0.02	77	1,079	0.02	120	36,425	0.59
35	16,792	0.27	78	1,366	0.02	121	1,487	0.02
36	1,226	0.02	79	1,624	0.03	122	1,322	0.02
37	1,120	0.02	80	35,756	0.58	123	1,129	0.02
38	1,364	0.02	81	1,679	0.03	124	1,345	0.02
39	1,961	0.03	82	1,395	0.02	125	17,626	0.29
40	34,892	0.57	83	1,212	0.02	126	1,280	0.02
41	1,522	0.02	84	1,348	0.02	127	1,104	0.02
42	1,299	0.02	85	17,356	0.28	128	1,453	0.02

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
129	1,686	0.03	173	1,122	0.02	217	849	0.01
130	34,045	0.55	174	1,332	0.02	218	910	0.01
131	1,410	0.02	175	18,102	0.29	219	1,358	0.02
132	1,263	0.02	176	1,351	0.02	220	34,163	0.56
133	1,096	0.02	177	1,109	0.02	221	1,380	0.02
134	1,128	0.02	178	1,306	0.02	222	1,090	0.02
135	17,191	0.28	179	1,677	0.03	223	832	0.01
136	1,314	0.02	180	36,145	0.59	224	950	0.02
137	1,105	0.02	181	1,414	0.02	225	16,004	0.26
138	1,530	0.02	182	1,165	0.02	226	986	0.02
139	1,638	0.03	183	941	0.02	227	777	0.01
140	34,860	0.57	184	1,085	0.02	228	1,160	0.02
141	1,374	0.02	185	16,778	0.27	229	1,241	0.02
142	1,094	0.02	186	1,093	0.02	230	32,406	0.53
143	1,022	0.02	187	958	0.02	231	1,190	0.02
144	1,238	0.02	188	1,144	0.02	232	1,065	0.02
145	17,512	0.28	189	1,455	0.02	233	946	0.02
146	1,129	0.02	190	32,742	0.53	234	1,080	0.02
147	951	0.02	191	1,154	0.02	235	15,966	0.26
148	1,276	0.02	192	1,009	0.02	236	985	0.02
149	1,774	0.03	193	1,004	0.02	237	977	0.02
150	47,676	0.78	194	1,047	0.02	238	1,120	0.02
151	1,624	0.03	195	16,695	0.27	239	1,511	0.02
152	1,257	0.02	196	1,162	0.02	240	33,126	0.54
153	1,049	0.02	197	1,165	0.02	241	1,193	0.02
154	1,149	0.02	198	1,236	0.02	242	1,054	0.02
155	17,305	0.28	199	1,840	0.03	243	734	0.01
156	1,325	0.02	200	54,863	0.89	244	837	0.01
157	1,176	0.02	201	1,723	0.03	245	16,213	0.26
158	1,329	0.02	202	1,277	0.02	246	936	0.02
159	1,595	0.03	203	949	0.02	247	961	0.02
160	35,272	0.57	204	1,191	0.02	248	1,044	0.02
161	1,583	0.03	205	16,232	0.26	249	1,572	0.03
162	1,263	0.02	206	1,087	0.02	250	48,507	0.79
163	1,146	0.02	207	965	0.02	251	1,591	0.03
164	1,316	0.02	208	1,046	0.02	252	1,243	0.02
165	17,926	0.29	209	1,346	0.02	253	830	0.01
166	1,319	0.02	210	31,797	0.52	254	968	0.02
167	1,179	0.02	211	1,228	0.02	255	15,806	0.26
168	1,374	0.02	212	1,064	0.02	256	960	0.02
169	1,688	0.03	213	856	0.01	257	855	0.01
170	34,540	0.56	214	950	0.02	258	966	0.02
171	1,538	0.03	215	15,833	0.26	259	1,329	0.02
172	1,384	0.02	216	899	0.01	260	31,434	0.51

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
261	1,360	0.02	305	15,315	0.25	349	1,449	0.02
262	1,031	0.02	306	891	0.01	350	42,007	0.68
263	798	0.01	307	699	0.01	351	1,302	0.02
264	1,044	0.02	308	930	0.02	352	983	0.02
265	15,160	0.25	309	1,149	0.02	353	799	0.01
266	989	0.02	310	29,167	0.47	354	933	0.02
267	740	0.01	311	1,222	0.02	355	15,202	0.25
268	995	0.02	312	990	0.02	356	828	0.01
269	1,285	0.02	313	797	0.01	357	786	0.01
270	31,279	0.51	314	997	0.02	358	1,053	0.02
271	1,145	0.02	315	14,810	0.24	359	1,227	0.02
272	1,071	0.02	316	954	0.02	360	31,665	0.52
273	858	0.01	317	776	0.01	361	1,132	0.02
274	1,021	0.02	318	1,154	0.02	362	1,088	0.02
275	15,378	0.25	319	1,227	0.02	363	811	0.01
276	953	0.02	320	32,164	0.52	364	887	0.01
277	791	0.01	321	1,200	0.02	365	15,543	0.25
278	982	0.02	322	998	0.02	366	952	0.02
279	1,347	0.02	323	750	0.01	367	845	0.01
280	32,255	0.52	324	971	0.02	368	957	0.02
281	1,322	0.02	325	14,842	0.24	369	1,239	0.02
282	1,023	0.02	326	848	0.01	370	31,174	0.51
283	844	0.01	327	658	0.01	371	1,158	0.02
284	956	0.02	328	902	0.01	372	971	0.02
285	15,206	0.25	329	1,121	0.02	373	870	0.01
286	925	0.02	330	30,097	0.49	374	1,082	0.02
287	779	0.01	331	1,149	0.02	375	15,065	0.25
288	968	0.02	332	865	0.01	376	1,023	0.02
289	1,391	0.02	333	828	0.01	377	748	0.01
290	31,305	0.51	334	871	0.01	378	942	0.02
291	993	0.02	335	14,689	0.24	379	1,365	0.02
292	924	0.02	336	931	0.02	380	32,742	0.53
293	865	0.01	337	691	0.01	381	1,132	0.02
294	892	0.01	338	1,048	0.02	382	969	0.02
295	15,974	0.26	339	1,291	0.02	383	899	0.01
296	917	0.01	340	30,046	0.49	384	977	0.02
297	769	0.01	341	971	0.02	385	15,595	0.25
298	1,027	0.02	342	957	0.02	386	1,014	0.02
299	1,631	0.03	343	708	0.01	387	925	0.02
300	51,241	0.83	344	848	0.01	388	1,095	0.02
301	1,487	0.02	345	15,056	0.24	389	1,341	0.02
302	976	0.02	346	916	0.01	390	32,012	0.52
303	708	0.01	347	952	0.02	391	1,063	0.02
304	878	0.01	348	1,037	0.02	392	909	0.01

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
393	733	0.01	437	860	0.01	481	1,066	0.02
394	988	0.02	438	1,141	0.02	482	938	0.02
395	16,059	0.26	439	1,211	0.02	483	811	0.01
396	1,046	0.02	440	31,430	0.51	484	889	0.01
397	977	0.02	441	1,072	0.02	485	15,946	0.26
398	1,117	0.02	442	960	0.02	486	913	0.01
399	1,664	0.03	443	766	0.01	487	689	0.01
400	53,094	0.86	444	938	0.02	488	898	0.01
401	1,585	0.03	445	15,692	0.26	489	1,146	0.02
402	1,182	0.02	446	851	0.01	490	30,789	0.5
403	827	0.01	447	816	0.01	491	1,151	0.02
404	1,020	0.02	448	1,192	0.02	492	910	0.01
405	15,567	0.25	449	1,516	0.02	493	712	0.01
406	869	0.01	450	42,326	0.69	494	925	0.02
407	924	0.02	451	1,263	0.02	495	16,607	0.27
408	1,072	0.02	452	949	0.02	496	862	0.01
409	1,190	0.02	453	844	0.01	497	868	0.01
410	31,354	0.51	454	916	0.01	498	1,061	0.02
411	1,374	0.02	455	15,315	0.25	499	1,647	0.03
412	1,199	0.02	456	833	0.01	500	61,743	1
413	957	0.02	457	774	0.01	501	1,679	0.03
414	1,035	0.02	458	949	0.02	502	1,111	0.02
415	15,635	0.25	459	1,149	0.02	503	816	0.01
416	1,044	0.02	460	30,840	0.5	504	1,005	0.02
417	947	0.02	461	1,122	0.02	505	17,029	0.28
418	1,177	0.02	462	951	0.02	506	988	0.02
419	1,414	0.02	463	758	0.01	507	918	0.01
420	33,178	0.54	464	1,031	0.02	508	959	0.02
421	1,389	0.02	465	14,868	0.24	509	1,119	0.02
422	1,129	0.02	466	856	0.01	510	31,388	0.51
423	956	0.02	467	700	0.01	511	1,360	0.02
424	1,000	0.02	468	835	0.01	512	1,030	0.02
425	15,798	0.26	469	1,192	0.02	513	744	0.01
426	1,033	0.02	470	29,848	0.49	514	939	0.02
427	844	0.01	471	948	0.02	515	16,568	0.27
428	1,153	0.02	472	918	0.01	516	919	0.01
429	1,431	0.02	473	689	0.01	517	800	0.01
430	31,417	0.51	474	828	0.01	518	963	0.02
431	1,194	0.02	475	16,082	0.26	519	1,156	0.02
432	1,093	0.02	476	813	0.01	520	32,622	0.53
433	785	0.01	477	691	0.01	521	1,255	0.02
434	973	0.02	478	864	0.01	522	1,052	0.02
435	15,374	0.25	479	1,162	0.02	523	772	0.01
436	992	0.02	480	32,282	0.53	524	968	0.02

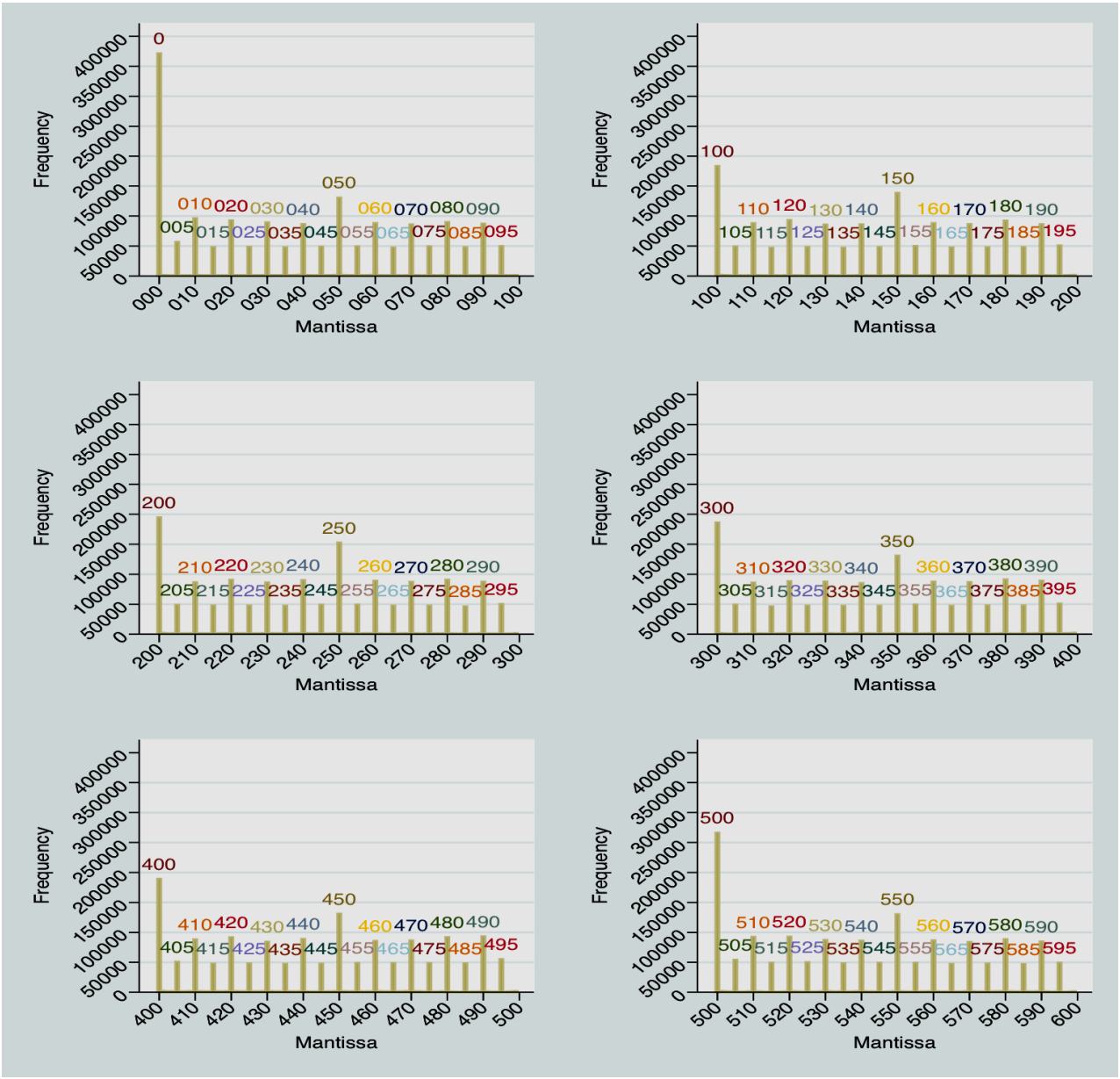
Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
525	15,946	0.26	569	1,180	0.02	613	605	0.01
526	1,019	0.02	570	29,423	0.48	614	705	0.01
527	874	0.01	571	1,285	0.02	615	15,611	0.25
528	1,019	0.02	572	954	0.02	616	844	0.01
529	1,311	0.02	573	849	0.01	617	613	0.01
530	30,710	0.5	574	970	0.02	618	791	0.01
531	1,139	0.02	575	15,724	0.26	619	1,074	0.02
532	1,061	0.02	576	938	0.02	620	30,983	0.5
533	826	0.01	577	803	0.01	621	1,205	0.02
534	1,029	0.02	578	1,093	0.02	622	813	0.01
535	15,131	0.25	579	1,354	0.02	623	625	0.01
536	870	0.01	580	30,853	0.5	624	706	0.01
537	815	0.01	581	1,205	0.02	625	15,785	0.26
538	1,016	0.02	582	1,027	0.02	626	803	0.01
539	1,257	0.02	583	765	0.01	627	749	0.01
540	30,359	0.49	584	993	0.02	628	828	0.01
541	1,189	0.02	585	14,764	0.24	629	1,055	0.02
542	943	0.02	586	962	0.02	630	31,339	0.51
543	777	0.01	587	853	0.01	631	1,007	0.02
544	843	0.01	588	816	0.01	632	819	0.01
545	15,032	0.24	589	1,234	0.02	633	522	0.01
546	873	0.01	590	28,799	0.47	634	759	0.01
547	766	0.01	591	965	0.02	635	15,243	0.25
548	906	0.01	592	720	0.01	636	725	0.01
549	1,354	0.02	593	728	0.01	637	672	0.01
550	39,788	0.65	594	879	0.01	638	740	0.01
551	1,341	0.02	595	15,401	0.25	639	1,174	0.02
552	982	0.02	596	798	0.01	640	31,000	0.5
553	680	0.01	597	703	0.01	641	1,065	0.02
554	787	0.01	598	925	0.02	642	815	0.01
555	15,180	0.25	599	1,578	0.03	643	746	0.01
556	849	0.01	600	51,457	0.84	644	857	0.01
557	816	0.01	601	1,485	0.02	645	16,765	0.27
558	947	0.02	602	914	0.01	646	754	0.01
559	1,124	0.02	603	749	0.01	647	694	0.01
560	30,648	0.5	604	714	0.01	648	953	0.02
561	1,123	0.02	605	15,506	0.25	649	1,412	0.02
562	978	0.02	606	717	0.01	650	43,460	0.71
563	747	0.01	607	613	0.01	651	1,202	0.02
564	967	0.02	608	770	0.01	652	865	0.01
565	14,258	0.23	609	924	0.02	653	689	0.01
566	864	0.01	610	29,246	0.48	654	821	0.01
567	787	0.01	611	981	0.02	655	16,522	0.27
568	1,024	0.02	612	721	0.01	656	703	0.01

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
657	575	0.01	701	1,705	0.03	745	16,514	0.27
658	771	0.01	702	1,087	0.02	746	923	0.02
659	1,078	0.02	703	907	0.01	747	774	0.01
660	32,639	0.53	704	976	0.02	748	1,190	0.02
661	1,300	0.02	705	16,045	0.26	749	1,621	0.03
662	898	0.01	706	1,012	0.02	750	47,623	0.77
663	810	0.01	707	891	0.01	751	1,476	0.02
664	995	0.02	708	961	0.02	752	1,132	0.02
665	15,966	0.26	709	1,342	0.02	753	837	0.01
666	1,063	0.02	710	31,218	0.51	754	998	0.02
667	796	0.01	711	1,652	0.03	755	16,417	0.27
668	859	0.01	712	1,317	0.02	756	985	0.02
669	1,148	0.02	713	1,034	0.02	757	806	0.01
670	31,803	0.52	714	1,149	0.02	758	893	0.01
671	1,161	0.02	715	16,163	0.26	759	1,291	0.02
672	1,043	0.02	716	1,172	0.02	760	33,457	0.54
673	859	0.01	717	1,022	0.02	761	1,273	0.02
674	874	0.01	718	1,181	0.02	762	991	0.02
675	17,030	0.28	719	1,385	0.02	763	841	0.01
676	947	0.02	720	33,397	0.54	764	976	0.02
677	719	0.01	721	1,263	0.02	765	16,343	0.27
678	1,064	0.02	722	981	0.02	766	1,000	0.02
679	1,323	0.02	723	830	0.01	767	846	0.01
680	34,555	0.56	724	983	0.02	768	1,121	0.02
681	1,225	0.02	725	16,809	0.27	769	1,315	0.02
682	993	0.02	726	985	0.02	770	33,179	0.54
683	822	0.01	727	889	0.01	771	1,424	0.02
684	1,211	0.02	728	1,108	0.02	772	1,164	0.02
685	16,575	0.27	729	1,415	0.02	773	927	0.02
686	1,062	0.02	730	32,872	0.53	774	1,058	0.02
687	801	0.01	731	1,367	0.02	775	16,206	0.26
688	1,060	0.02	732	920	0.01	776	982	0.02
689	1,501	0.02	733	886	0.01	777	963	0.02
690	32,054	0.52	734	960	0.02	778	1,115	0.02
691	1,230	0.02	735	16,432	0.27	779	1,545	0.03
692	946	0.02	736	990	0.02	780	32,887	0.54
693	791	0.01	737	767	0.01	781	1,391	0.02
694	1,088	0.02	738	1,073	0.02	782	1,068	0.02
695	16,211	0.26	739	1,445	0.02	783	872	0.01
696	1,092	0.02	740	33,997	0.55	784	1,055	0.02
697	838	0.01	741	1,186	0.02	785	16,273	0.26
698	1,059	0.02	742	976	0.02	786	1,113	0.02
699	1,789	0.03	743	872	0.01	787	1,070	0.02
700	54,157	0.88	744	882	0.01	788	1,152	0.02

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
789	1,448	0.02	833	770	0.01	877	1,171	0.02
790	32,178	0.52	834	1,002	0.02	878	1,458	0.02
791	1,315	0.02	835	14,949	0.24	879	1,709	0.03
792	1,062	0.02	836	1,105	0.02	880	31,843	0.52
793	891	0.01	837	961	0.02	881	1,525	0.02
794	1,083	0.02	838	1,167	0.02	882	1,255	0.02
795	16,452	0.27	839	1,508	0.02	883	987	0.02
796	999	0.02	840	31,357	0.51	884	1,121	0.02
797	992	0.02	841	1,398	0.02	885	15,314	0.25
798	1,255	0.02	842	1,122	0.02	886	1,147	0.02
799	1,714	0.03	843	905	0.01	887	874	0.01
800	55,530	0.9	844	1,092	0.02	888	1,269	0.02
801	1,790	0.03	845	15,661	0.25	889	1,458	0.02
802	1,274	0.02	846	1,101	0.02	890	29,790	0.48
803	949	0.02	847	1,050	0.02	891	1,484	0.02
804	1,117	0.02	848	1,270	0.02	892	1,048	0.02
805	15,511	0.25	849	1,744	0.03	893	923	0.02
806	1,103	0.02	850	44,443	0.72	894	1,199	0.02
807	842	0.01	851	1,981	0.03	895	15,778	0.26
808	957	0.02	852	1,320	0.02	896	1,082	0.02
809	1,229	0.02	853	1,168	0.02	897	1,011	0.02
810	31,178	0.51	854	1,265	0.02	898	1,331	0.02
811	1,425	0.02	855	15,766	0.26	899	1,910	0.03
812	1,257	0.02	856	1,348	0.02	900	52,614	0.86
813	918	0.01	857	1,123	0.02	901	1,976	0.03
814	988	0.02	858	1,254	0.02	902	1,335	0.02
815	15,016	0.24	859	1,486	0.02	903	960	0.02
816	1,201	0.02	860	31,260	0.51	904	1,086	0.02
817	882	0.01	861	1,608	0.03	905	15,088	0.25
818	1,033	0.02	862	1,142	0.02	906	897	0.01
819	1,430	0.02	863	1,070	0.02	907	935	0.02
820	32,490	0.53	864	1,165	0.02	908	1,098	0.02
821	1,417	0.02	865	14,922	0.24	909	1,326	0.02
822	1,153	0.02	866	1,183	0.02	910	30,737	0.5
823	800	0.01	867	961	0.02	911	1,573	0.03
824	936	0.02	868	1,115	0.02	912	1,258	0.02
825	15,447	0.25	869	1,770	0.03	913	924	0.02
826	995	0.02	870	30,239	0.49	914	1,084	0.02
827	829	0.01	871	1,526	0.02	915	14,736	0.24
828	982	0.02	872	1,200	0.02	916	1,246	0.02
829	1,361	0.02	873	1,044	0.02	917	990	0.02
830	30,416	0.49	874	1,233	0.02	918	1,265	0.02
831	1,291	0.02	875	15,655	0.25	919	1,553	0.03
832	1,134	0.02	876	1,241	0.02	920	33,547	0.55

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
921	1,634	0.03	965	16,579	0.27
922	1,336	0.02	966	1,197	0.02
923	1,176	0.02	967	1,022	0.02
924	1,447	0.02	968	1,442	0.02
925	16,398	0.27	969	1,657	0.03
926	1,303	0.02	970	34,836	0.57
927	1,120	0.02	971	1,706	0.03
928	1,320	0.02	972	1,452	0.02
929	1,676	0.03	973	1,072	0.02
930	33,555	0.55	974	1,369	0.02
931	1,677	0.03	975	17,372	0.28
932	1,234	0.02	976	1,433	0.02
933	1,036	0.02	977	1,206	0.02
934	1,261	0.02	978	1,575	0.03
935	16,507	0.27	979	1,845	0.03
936	1,360	0.02	980	36,188	0.59
937	1,300	0.02	981	1,848	0.03
938	1,325	0.02	982	1,758	0.03
939	1,823	0.03	983	1,363	0.02
940	33,716	0.55	984	1,714	0.03
941	1,604	0.03	985	17,094	0.28
942	1,427	0.02	986	1,547	0.03
943	1,139	0.02	987	1,410	0.02
944	1,305	0.02	988	1,719	0.03
945	16,930	0.28	989	2,172	0.04
946	1,295	0.02	990	36,981	0.6
947	1,351	0.02	991	1,837	0.03
948	1,417	0.02	992	1,514	0.02
949	2,017	0.03	993	1,121	0.02
950	46,528	0.76	994	1,486	0.02
951	2,074	0.03	995	18,810	0.31
952	1,500	0.02	996	1,562	0.03
953	1,338	0.02	997	1,495	0.02
954	1,390	0.02	998	2,069	0.03
955	16,859	0.27	999	3,062	0.05
956	1,225	0.02			
957	1,084	0.02	**Total**	**6,146,785**	**100**
958	1,384	0.02			
959	1,619	0.03			
960	33,804	0.55			
961	1,776	0.03			
962	1,352	0.02			
963	1,202	0.02			
964	1,377	0.02			

Figure 4: Transaction Prices Mantissa for Paris Market



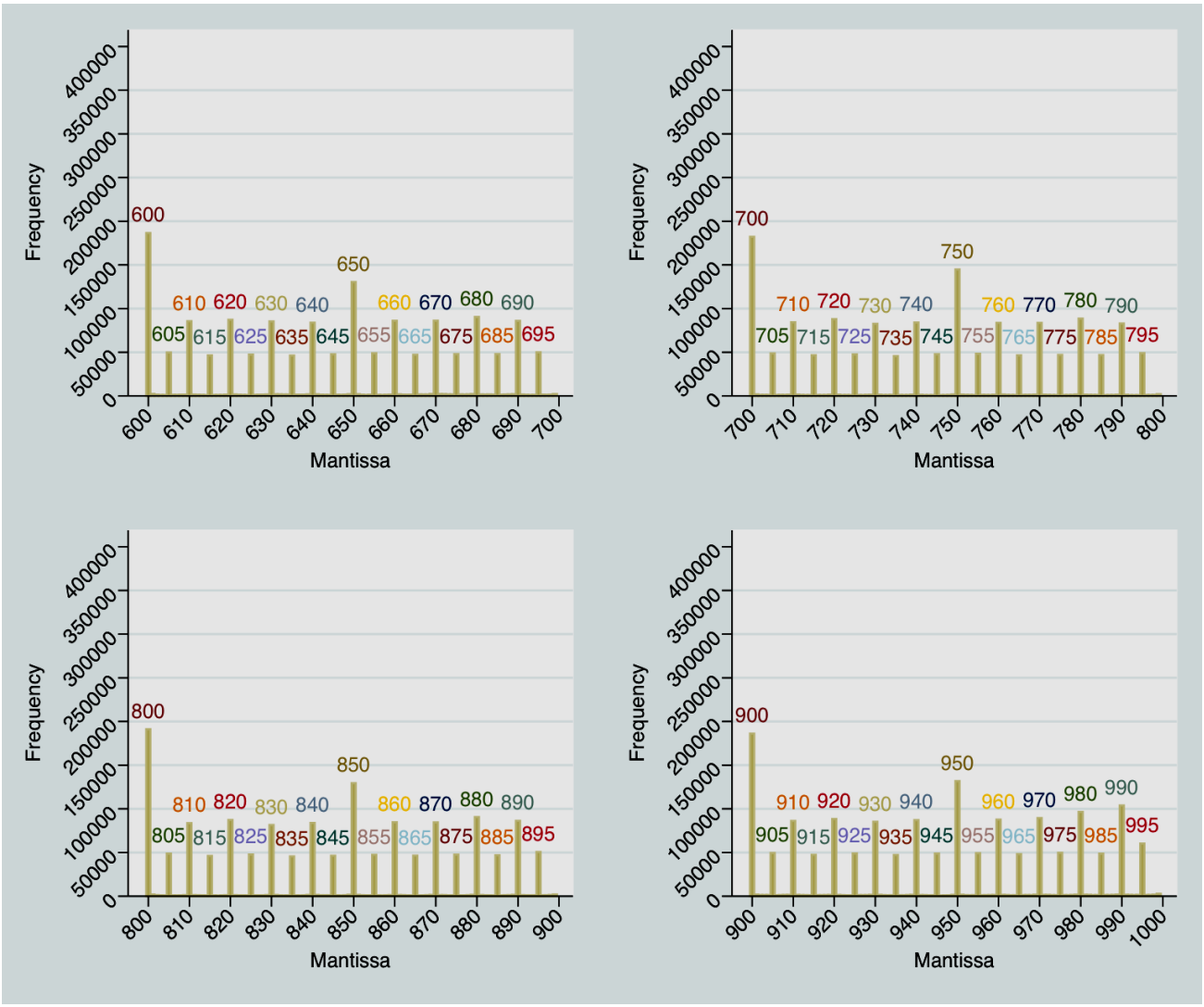


Figure 4: Transaction Prices Mantissa for Paris Market

Table 5: Transaction Prices Mantissa Frequency and % for Paris Market

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
0	371,845	2.25	42	1,642	0.01	84	1,268	0.01
1	1,754	0.01	43	1,421	0.01	85	48,355	0.29
2	1,438	0.01	44	1,495	0.01	86	1,406	0.01
3	1,227	0.01	45	49,220	0.3	87	1,343	0.01
4	1,143	0.01	46	1,436	0.01	88	1,373	0.01
5	57,080	0.34	47	1,565	0.01	89	1,703	0.01
6	1,112	0.01	48	1,621	0.01	90	87,410	0.53
7	1,167	0.01	49	2,016	0.01	91	1,836	0.01
8	1,268	0.01	50	130,964	0.79	92	1,644	0.01
9	1,207	0.01	51	2,028	0.01	93	1,475	0.01
10	96,652	0.58	52	1,723	0.01	94	1,478	0.01
11	1,647	0.01	53	1,675	0.01	95	50,085	0.3
12	1,309	0.01	54	1,542	0.01	96	1,528	0.01
13	1,199	0.01	55	49,578	0.3	97	1,280	0.01
14	1,359	0.01	56	1,491	0.01	98	1,552	0.01
15	48,415	0.29	57	1,533	0.01	99	1,802	0.01
16	1,219	0.01	58	1,627	0.01	100	183,769	1.11
17	1,105	0.01	59	1,975	0.01	101	2,125	0.01
18	1,385	0.01	60	88,510	0.53	102	1,600	0.01
19	1,266	0.01	61	1,787	0.01	103	1,462	0.01
20	93,058	0.56	62	1,560	0.01	104	1,183	0.01
21	1,657	0.01	63	1,466	0.01	105	49,414	0.3
22	1,494	0.01	64	1,572	0.01	106	1,290	0.01
23	1,542	0.01	65	47,769	0.29	107	1,235	0.01
24	1,500	0.01	66	1,473	0.01	108	1,234	0.01
25	49,001	0.3	67	1,299	0.01	109	1,356	0.01
26	1,472	0.01	68	1,415	0.01	110	88,275	0.53
27	1,347	0.01	69	1,699	0.01	111	1,661	0.01
28	1,553	0.01	70	86,271	0.52	112	1,282	0.01
29	1,790	0.01	71	1,780	0.01	113	1,242	0.01
30	89,658	0.54	72	1,473	0.01	114	1,187	0.01
31	1,771	0.01	73	1,225	0.01	115	47,478	0.29
32	1,588	0.01	74	1,313	0.01	116	1,234	0.01
33	1,569	0.01	75	49,687	0.3	117	1,141	0.01
34	1,676	0.01	76	1,528	0.01	118	1,084	0.01
35	48,167	0.29	77	1,290	0.01	119	1,443	0.01
36	1,487	0.01	78	1,474	0.01	120	93,629	0.57
37	1,675	0.01	79	1,946	0.01	121	1,418	0.01
38	1,813	0.01	80	90,197	0.54	122	1,297	0.01
39	2,090	0.01	81	1,650	0.01	123	1,288	0.01
40	86,757	0.52	82	1,351	0.01	124	1,172	0.01
41	1,716	0.01	83	1,272	0.01	125	48,701	0.29

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
126	1,164	0.01	169	1,407	0.01	212	1,682	0.01
127	1,185	0.01	170	86,815	0.52	213	1,520	0.01
128	1,281	0.01	171	1,531	0.01	214	1,558	0.01
129	1,371	0.01	172	1,362	0.01	215	47,901	0.29
130	86,010	0.52	173	1,187	0.01	216	1,619	0.01
131	1,503	0.01	174	1,246	0.01	217	1,727	0.01
132	1,275	0.01	175	48,291	0.29	218	1,768	0.01
133	1,122	0.01	176	1,235	0.01	219	2,042	0.01
134	1,242	0.01	177	1,226	0.01	220	90,885	0.55
135	47,461	0.29	178	1,446	0.01	221	1,972	0.01
136	1,054	0.01	179	1,701	0.01	222	1,671	0.01
137	1,212	0.01	180	92,722	0.56	223	1,697	0.01
138	1,215	0.01	181	1,620	0.01	224	1,671	0.01
139	1,682	0.01	182	1,417	0.01	225	48,008	0.29
140	86,367	0.52	183	1,192	0.01	226	1,631	0.01
141	1,330	0.01	184	1,179	0.01	227	1,403	0.01
142	1,141	0.01	185	48,633	0.29	228	1,528	0.01
143	1,118	0.01	186	1,272	0.01	229	1,893	0.01
144	1,095	0.01	187	1,280	0.01	230	86,502	0.52
145	48,561	0.29	188	1,501	0.01	231	1,858	0.01
146	1,095	0.01	189	1,629	0.01	232	1,914	0.01
147	1,178	0.01	190	86,640	0.52	233	1,630	0.01
148	1,339	0.01	191	1,586	0.01	234	1,811	0.01
149	1,676	0.01	192	1,299	0.01	235	47,585	0.29
150	138,866	0.84	193	1,201	0.01	236	1,809	0.01
151	1,750	0.01	194	1,352	0.01	237	1,878	0.01
152	1,519	0.01	195	51,208	0.31	238	1,816	0.01
153	1,385	0.01	196	1,248	0.01	239	2,089	0.01
154	1,300	0.01	197	1,483	0.01	240	90,367	0.55
155	50,285	0.3	198	1,579	0.01	241	2,054	0.01
156	1,239	0.01	199	2,003	0.01	242	1,712	0.01
157	1,312	0.01	200	195,292	1.18	243	1,608	0.01
158	1,309	0.01	201	2,399	0.01	244	1,770	0.01
159	1,484	0.01	202	1,754	0.01	245	49,313	0.3
160	88,365	0.53	203	1,390	0.01	246	1,301	0.01
161	1,587	0.01	204	1,613	0.01	247	1,291	0.01
162	1,262	0.01	205	49,068	0.3	248	1,503	0.01
163	1,301	0.01	206	1,506	0.01	249	1,869	0.01
164	1,295	0.01	207	1,530	0.01	250	153,121	0.92
165	47,843	0.29	208	1,497	0.01	251	2,262	0.01
166	1,382	0.01	209	1,746	0.01	252	1,788	0.01
167	1,302	0.01	210	86,759	0.52	253	1,509	0.01
168	1,248	0.01	211	1,781	0.01	254	1,439	0.01

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
255	49,552	0.3	298	1,338	0.01	341	1,687	0.01
256	1,496	0.01	299	1,905	0.01	342	1,659	0.01
257	1,727	0.01	300	186,636	1.13	343	1,458	0.01
258	1,636	0.01	301	2,061	0.01	344	1,464	0.01
259	1,610	0.01	302	1,542	0.01	345	47,709	0.29
260	89,326	0.54	303	1,194	0.01	346	1,620	0.01
261	1,698	0.01	304	1,295	0.01	347	1,312	0.01
262	1,351	0.01	305	49,446	0.3	348	1,593	0.01
263	1,252	0.01	306	1,124	0.01	349	1,858	0.01
264	1,327	0.01	307	992	0.01	350	131,274	0.79
265	47,719	0.29	308	1,198	0.01	351	1,823	0.01
266	1,364	0.01	309	1,414	0.01	352	1,662	0.01
267	1,469	0.01	310	86,221	0.52	353	1,213	0.01
268	1,692	0.01	311	1,604	0.01	354	1,345	0.01
269	1,678	0.01	312	1,487	0.01	355	49,585	0.3
270	87,477	0.53	313	1,324	0.01	356	1,376	0.01
271	1,873	0.01	314	1,350	0.01	357	1,486	0.01
272	1,314	0.01	315	46,485	0.28	358	1,485	0.01
273	1,303	0.01	316	1,374	0.01	359	1,789	0.01
274	1,382	0.01	317	1,457	0.01	360	87,736	0.53
275	47,848	0.29	318	1,511	0.01	361	1,651	0.01
276	1,323	0.01	319	1,795	0.01	362	1,389	0.01
277	1,442	0.01	320	88,606	0.54	363	1,371	0.01
278	1,425	0.01	321	1,762	0.01	364	1,451	0.01
279	1,683	0.01	322	1,553	0.01	365	47,562	0.29
280	91,077	0.55	323	1,368	0.01	366	1,267	0.01
281	1,694	0.01	324	1,382	0.01	367	1,299	0.01
282	1,358	0.01	325	47,706	0.29	368	1,414	0.01
283	1,172	0.01	326	1,338	0.01	369	1,472	0.01
284	1,263	0.01	327	1,311	0.01	370	87,076	0.53
285	46,445	0.28	328	1,556	0.01	371	1,535	0.01
286	1,299	0.01	329	1,695	0.01	372	1,293	0.01
287	1,175	0.01	330	87,820	0.53	373	1,195	0.01
288	1,371	0.01	331	1,976	0.01	374	1,270	0.01
289	1,751	0.01	332	1,511	0.01	375	48,157	0.29
290	87,724	0.53	333	1,466	0.01	376	1,114	0.01
291	1,333	0.01	334	1,438	0.01	377	1,323	0.01
292	1,294	0.01	335	47,562	0.29	378	1,369	0.01
293	1,108	0.01	336	1,730	0.01	379	1,866	0.01
294	1,171	0.01	337	1,462	0.01	380	91,556	0.55
295	50,558	0.31	338	1,813	0.01	381	1,472	0.01
296	1,107	0.01	339	2,224	0.01	382	1,341	0.01
297	1,231	0.01	340	85,314	0.52	383	1,238	0.01

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
384	1,394	0.01	427	1,719	0.01	470	86,858	0.52
385	48,144	0.29	428	2,098	0.01	471	2,031	0.01
386	1,435	0.01	429	2,150	0.01	472	1,867	0.01
387	1,507	0.01	430	84,568	0.51	473	1,642	0.01
388	1,490	0.01	431	2,125	0.01	474	1,509	0.01
389	1,908	0.01	432	1,840	0.01	475	49,020	0.3
390	89,382	0.54	433	1,641	0.01	476	1,453	0.01
391	1,920	0.01	434	1,707	0.01	477	1,430	0.01
392	1,848	0.01	435	47,662	0.29	478	1,655	0.01
393	1,593	0.01	436	1,881	0.01	479	1,892	0.01
394	1,641	0.01	437	1,626	0.01	480	92,206	0.56
395	51,262	0.31	438	1,743	0.01	481	1,508	0.01
396	1,857	0.01	439	1,872	0.01	482	1,368	0.01
397	1,806	0.01	440	89,273	0.54	483	1,233	0.01
398	1,836	0.01	441	1,776	0.01	484	1,260	0.01
399	2,552	0.02	442	1,512	0.01	485	48,597	0.29
400	189,713	1.15	443	1,290	0.01	486	1,330	0.01
401	2,610	0.02	444	1,534	0.01	487	1,340	0.01
402	1,887	0.01	445	48,137	0.29	488	1,478	0.01
403	1,826	0.01	446	1,604	0.01	489	1,559	0.01
404	1,823	0.01	447	1,699	0.01	490	93,601	0.57
405	51,243	0.31	448	1,820	0.01	491	1,597	0.01
406	1,726	0.01	449	2,174	0.01	492	1,551	0.01
407	1,770	0.01	450	131,447	0.79	493	1,292	0.01
408	1,973	0.01	451	2,114	0.01	494	1,378	0.01
409	2,220	0.01	452	1,899	0.01	495	55,605	0.34
410	88,556	0.53	453	1,725	0.01	496	1,439	0.01
411	2,187	0.01	454	1,878	0.01	497	1,546	0.01
412	1,918	0.01	455	49,193	0.3	498	1,828	0.01
413	1,727	0.01	456	1,684	0.01	499	2,275	0.01
414	1,759	0.01	457	1,698	0.01	500	266,589	1.61
415	48,043	0.29	458	1,669	0.01	501	2,425	0.01
416	1,963	0.01	459	2,002	0.01	502	1,858	0.01
417	1,672	0.01	460	85,961	0.52	503	1,645	0.01
418	1,997	0.01	461	2,121	0.01	504	1,393	0.01
419	2,261	0.01	462	1,860	0.01	505	54,547	0.33
420	92,124	0.56	463	1,675	0.01	506	1,202	0.01
421	2,226	0.01	464	1,736	0.01	507	1,372	0.01
422	2,068	0.01	465	49,036	0.3	508	1,427	0.01
423	1,788	0.01	466	1,762	0.01	509	1,785	0.01
424	1,815	0.01	467	1,670	0.01	510	92,753	0.56
425	48,463	0.29	468	1,978	0.01	511	1,629	0.01
426	1,845	0.01	469	2,214	0.01	512	1,593	0.01

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
513	1,289	0.01	556	1,468	0.01	599	1,978	0.01
514	1,226	0.01	557	1,617	0.01	600	186,409	1.13
515	49,730	0.3	558	1,813	0.01	601	2,213	0.01
516	1,233	0.01	559	1,883	0.01	602	1,485	0.01
517	1,193	0.01	560	87,045	0.53	603	1,182	0.01
518	1,345	0.01	561	1,938	0.01	604	1,141	0.01
519	1,611	0.01	562	1,592	0.01	605	49,700	0.3
520	93,080	0.56	563	1,448	0.01	606	1,297	0.01
521	1,853	0.01	564	1,454	0.01	607	1,280	0.01
522	1,743	0.01	565	47,682	0.29	608	1,429	0.01
523	1,466	0.01	566	1,440	0.01	609	1,499	0.01
524	1,309	0.01	567	1,543	0.01	610	85,546	0.52
525	50,444	0.3	568	1,668	0.01	611	1,584	0.01
526	1,443	0.01	569	2,013	0.01	612	1,362	0.01
527	1,412	0.01	570	84,197	0.51	613	1,287	0.01
528	1,527	0.01	571	1,945	0.01	614	1,032	0.01
529	1,851	0.01	572	1,532	0.01	615	46,441	0.28
530	87,616	0.53	573	1,450	0.01	616	1,124	0.01
531	2,073	0.01	574	1,689	0.01	617	1,200	0.01
532	1,664	0.01	575	48,223	0.29	618	1,198	0.01
533	1,605	0.01	576	1,602	0.01	619	1,501	0.01
534	1,647	0.01	577	1,799	0.01	620	87,143	0.53
535	48,674	0.29	578	1,817	0.01	621	1,727	0.01
536	1,476	0.01	579	2,112	0.01	622	1,372	0.01
537	1,466	0.01	580	88,848	0.54	623	1,221	0.01
538	1,727	0.01	581	1,762	0.01	624	1,142	0.01
539	2,031	0.01	582	1,772	0.01	625	47,304	0.29
540	86,373	0.52	583	1,459	0.01	626	1,216	0.01
541	1,909	0.01	584	1,564	0.01	627	1,393	0.01
542	1,591	0.01	585	47,356	0.29	628	1,484	0.01
543	1,569	0.01	586	1,609	0.01	629	1,678	0.01
544	1,502	0.01	587	1,548	0.01	630	85,333	0.52
545	49,636	0.3	588	1,559	0.01	631	1,850	0.01
546	1,330	0.01	589	1,986	0.01	632	1,749	0.01
547	1,488	0.01	590	84,988	0.51	633	1,637	0.01
548	1,489	0.01	591	1,643	0.01	634	1,621	0.01
549	2,106	0.01	592	1,522	0.01	635	46,215	0.28
550	130,530	0.79	593	1,275	0.01	636	1,426	0.01
551	1,981	0.01	594	1,494	0.01	637	1,434	0.01
552	1,633	0.01	595	49,823	0.3	638	1,437	0.01
553	1,377	0.01	596	1,289	0.01	639	1,807	0.01
554	1,447	0.01	597	1,264	0.01	640	83,832	0.51
555	49,476	0.3	598	1,414	0.01	641	1,829	0.01

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
642	1,383	0.01	685	47,881	0.29	728	1,252	0.01
643	1,292	0.01	686	1,408	0.01	729	1,352	0.01
644	1,266	0.01	687	1,626	0.01	730	82,556	0.5
645	47,689	0.29	688	1,756	0.01	731	1,411	0.01
646	1,396	0.01	689	1,903	0.01	732	1,109	0.01
647	1,311	0.01	690	85,890	0.52	733	1,130	0.01
648	1,493	0.01	691	1,621	0.01	734	1,217	0.01
649	1,960	0.01	692	1,351	0.01	735	45,608	0.28
650	130,427	0.79	693	1,185	0.01	736	1,121	0.01
651	1,955	0.01	694	1,290	0.01	737	1,033	0.01
652	1,418	0.01	695	49,930	0.3	738	1,118	0.01
653	1,119	0.01	696	1,501	0.01	739	1,428	0.01
654	1,396	0.01	697	1,362	0.01	740	84,018	0.51
655	48,843	0.3	698	1,544	0.01	741	1,258	0.01
656	1,253	0.01	699	2,099	0.01	742	1,014	0.01
657	1,152	0.01	700	182,118	1.1	743	935	0.01
658	1,304	0.01	701	1,763	0.01	744	1,022	0.01
659	1,548	0.01	702	1,215	0.01	745	47,816	0.29
660	86,031	0.52	703	1,265	0.01	746	1,011	0.01
661	1,812	0.01	704	1,229	0.01	747	1,046	0.01
662	1,510	0.01	705	48,675	0.29	748	1,180	0.01
663	1,417	0.01	706	1,145	0.01	749	1,676	0.01
664	1,476	0.01	707	1,252	0.01	750	144,799	0.87
665	47,085	0.28	708	1,197	0.01	751	1,551	0.01
666	1,715	0.01	709	1,431	0.01	752	1,255	0.01
667	1,605	0.01	710	84,321	0.51	753	1,175	0.01
668	1,683	0.01	711	1,534	0.01	754	1,039	0.01
669	2,150	0.01	712	1,182	0.01	755	48,262	0.29
670	86,134	0.52	713	999	0.01	756	1,263	0.01
671	2,107	0.01	714	1,068	0.01	757	1,166	0.01
672	2,014	0.01	715	46,653	0.28	758	1,069	0.01
673	1,771	0.01	716	1,142	0.01	759	1,356	0.01
674	1,737	0.01	717	1,028	0.01	760	83,676	0.51
675	47,843	0.29	718	1,138	0.01	761	1,626	0.01
676	1,763	0.01	719	1,494	0.01	762	1,258	0.01
677	1,638	0.01	720	87,905	0.53	763	1,133	0.01
678	1,809	0.01	721	1,433	0.01	764	1,126	0.01
679	2,076	0.01	722	1,012	0.01	765	46,544	0.28
680	90,373	0.55	723	1,117	0.01	766	1,218	0.01
681	1,697	0.01	724	986	0.01	767	1,282	0.01
682	1,565	0.01	725	47,567	0.29	768	1,283	0.01
683	1,700	0.01	726	1,073	0.01	769	1,539	0.01
684	1,472	0.01	727	1,008	0.01	770	83,692	0.51

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
771	1,454	0.01	814	913	0.01	857	846	0.01
772	1,286	0.01	815	46,100	0.28	858	1,048	0.01
773	1,084	0.01	816	898	0.01	859	1,246	0.01
774	1,091	0.01	817	722	0	860	84,555	0.51
775	46,928	0.28	818	956	0.01	861	1,251	0.01
776	1,074	0.01	819	1,149	0.01	862	1,175	0.01
777	1,151	0.01	820	87,172	0.53	863	890	0.01
778	1,205	0.01	821	1,161	0.01	864	874	0.01
779	1,608	0.01	822	1,020	0.01	865	46,406	0.28
780	88,501	0.53	823	983	0.01	866	871	0.01
781	1,467	0.01	824	916	0.01	867	978	0.01
782	1,275	0.01	825	47,684	0.29	868	1,198	0.01
783	1,213	0.01	826	985	0.01	869	1,405	0.01
784	1,185	0.01	827	1,019	0.01	870	84,433	0.51
785	46,800	0.28	828	996	0.01	871	1,193	0.01
786	950	0.01	829	1,270	0.01	872	1,226	0.01
787	1,098	0.01	830	81,425	0.49	873	961	0.01
788	1,127	0.01	831	1,383	0.01	874	1,008	0.01
789	1,399	0.01	832	1,015	0.01	875	47,518	0.29
790	82,895	0.5	833	883	0.01	876	945	0.01
791	1,331	0.01	834	904	0.01	877	962	0.01
792	1,022	0.01	835	45,527	0.28	878	1,184	0.01
793	925	0.01	836	916	0.01	879	1,480	0.01
794	1,023	0.01	837	878	0.01	880	90,501	0.55
795	48,976	0.3	838	994	0.01	881	1,324	0.01
796	1,138	0.01	839	1,395	0.01	882	1,064	0.01
797	1,117	0.01	840	83,772	0.51	883	1,013	0.01
798	1,213	0.01	841	1,425	0.01	884	883	0.01
799	1,993	0.01	842	1,064	0.01	885	46,858	0.28
800	191,064	1.15	843	1,032	0.01	886	921	0.01
801	1,910	0.01	844	1,029	0.01	887	1,069	0.01
802	1,239	0.01	845	46,271	0.28	888	1,184	0.01
803	1,021	0.01	846	991	0.01	889	1,477	0.01
804	853	0.01	847	866	0.01	890	86,174	0.52
805	48,684	0.29	848	1,108	0.01	891	1,201	0.01
806	933	0.01	849	1,605	0.01	892	1,045	0.01
807	869	0.01	850	129,302	0.78	893	1,000	0.01
808	960	0.01	851	1,438	0.01	894	1,035	0.01
809	1,204	0.01	852	1,069	0.01	895	50,548	0.31
810	83,555	0.5	853	964	0.01	896	1,030	0.01
811	1,221	0.01	854	939	0.01	897	1,077	0.01
812	1,090	0.01	855	47,289	0.29	898	1,360	0.01
813	1,005	0.01	856	1,036	0.01	899	1,931	0.01

Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency	Mantissa	Frequency	Percentage Frequency
900	186,030	1.12	943	987	0.01	986	1,361	0.01
901	1,815	0.01	944	1,050	0.01	987	1,300	0.01
902	1,339	0.01	945	48,792	0.29	988	1,480	0.01
903	1,299	0.01	946	824	0	989	1,821	0.01
904	1,356	0.01	947	933	0.01	990	103,803	0.63
905	49,375	0.3	948	1,017	0.01	991	1,646	0.01
906	1,066	0.01	949	1,490	0.01	992	1,504	0.01
907	1,275	0.01	950	131,711	0.8	993	1,263	0.01
908	1,423	0.01	951	1,613	0.01	994	1,484	0.01
909	1,501	0.01	952	1,195	0.01	995	60,199	0.36
910	86,098	0.52	953	1,063	0.01	996	1,370	0.01
911	1,511	0.01	954	1,163	0.01	997	1,454	0.01
912	1,275	0.01	955	49,197	0.3	998	1,720	0.01
913	1,198	0.01	956	1,110	0.01	999	2,731	0.02
914	1,050	0.01	957	1,196	0.01			
915	47,317	0.29	958	1,287	0.01	**Total**	**16,553,882**	**100**
916	1,166	0.01	959	1,349	0.01			
917	1,166	0.01	960	87,607	0.53			
918	1,248	0.01	961	1,477	0.01			
919	1,406	0.01	962	1,314	0.01			
920	88,316	0.53	963	1,065	0.01			
921	1,402	0.01	964	1,115	0.01			
922	1,129	0.01	965	48,132	0.29			
923	1,004	0.01	966	1,239	0.01			
924	926	0.01	967	1,303	0.01			
925	48,859	0.3	968	1,238	0.01			
926	1,212	0.01	969	1,672	0.01			
927	1,173	0.01	970	89,382	0.54			
928	1,264	0.01	971	1,474	0.01			
929	1,507	0.01	972	1,515	0.01			
930	85,139	0.51	973	1,230	0.01			
931	1,475	0.01	974	1,171	0.01			
932	1,174	0.01	975	49,628	0.3			
933	1,010	0.01	976	1,259	0.01			
934	1,068	0.01	977	1,194	0.01			
935	47,145	0.28	978	1,404	0.01			
936	1,100	0.01	979	1,696	0.01			
937	1,056	0.01	980	96,360	0.58			
938	1,328	0.01	981	1,677	0.01			
939	1,489	0.01	982	1,529	0.01			
940	87,028	0.53	983	1,244	0.01			
941	1,266	0.01	984	1,333	0.01			
942	1,223	0.01	985	48,630	0.29			

Table 4: Lisbon market

	Lisbon Market							
	Nearest Euro (Integer)		Nearest 0.5 of a Euro		Nearest 0.1 of a Euro		Nearest 0.05 of a Euro	
Time Interval	Freq.	%	Freq.	%	Freq.	%	Freq.	%
09:00-09:14	131	3.27	208	5.92	1094	4.04	1514	4.97
09:15-09:59	98	2.44	144	4.10	833	3.08	978	3.21
09:30-09:45	51	1.27	120	3.41	805	2.97	937	3.07
09:45-09:59	93	2.32	95	2.70	631	2.33	930	3.05
10:00-10:14	86	2.15	108	3.07	856	3.16	960	3.15
10:15-10:29	69	1.72	110	3.13	682	2.52	884	2.90
10:30-10:44	83	2.07	123	3.50	675	2.49	675	2.21
10:45-10:59	88	2.20	120	3.41	731	2.70	726	2.38
11:00-11:14	114	2.84	104	2.96	799	2.95	604	1.98
11:15-11:29	128	3.19	123	3.50	685	2.53	598	1.96
11:30-11:44	120	2.99	95	2.70	795	2.93	650	2.13
11:45-11:59	45	1.12	184	5.23	721	2.66	765	2.51
12:00-12:14	88	2.20	45	1.28	569	2.10	708	2.32
12:15-12:29	129	3.22	82	2.33	688	2.54	670	2.20
12:30-12:44	81	2.02	100	2.84	611	2.26	830	2.72
12:45-12:59	77	1.92	58	1.65	508	1.88	629	2.06
13:00-13:14	73	1.82	73	2.08	674	2.49	626	2.05
13:15-13:29	83	2.07	55	1.56	499	1.84	464	1.52
13:30-13:44	52	1.30	52	1.48	500	1.85	538	1.76
13:45-13:59	67	1.67	42	1.19	530	1.96	597	1.96
14:00-14:14	112	2.79	74	2.11	493	1.82	569	1.87
14:15-14:29	98	2.44	76	2.16	492	1.82	778	2.55
14:30-14:44	104	2.59	64	1.82	676	2.50	829	2.72
14:45-14:59	116	2.89	77	2.19	964	3.56	835	2.74
15:00-15:14	122	3.04	107	3.04	790	2.92	889	2.92
15:15-15:29	125	3.12	87	2.48	870	3.21	1038	3.40
15:30-15:44	161	4.02	75	2.13	935	3.45	1167	3.83
15:45-15:59	147	3.67	61	1.74	932	3.44	1147	3.76
16:00-16:14	156	3.89	105	2.99	865	3.19	1134	3.72
16:15-16:29	154	3.84	108	3.07	1091	4.03	1093	3.59
16:30-16:44	245	6.11	148	4.21	1294	4.78	1212	3.98
16:45-16:59	250	6.24	150	4.27	1313	4.85	1106	3.63
17:00-17:14	225	5.61	159	4.52	1107	4.09	1242	4.07
17:15-17:29	197	4.91	142	4.04	1379	5.09	1837	6.03
Total	4,009	100	3,515	100	27,087	100	30486	100

Table 4: Lisbon Market - Transaction price Mantissa frequency and percentage at different clustering levels (i.e Rounded nearest to whole number, nearest 0.5 of a Euro, nearest 0.1 of a Euro and nearest 0.05 of a Euro) with respect to intraday 15-min time intervals .

Table 5: Brussels market

	Brussels Market							
	Nearest Euro (Integer)		Nearest 0.5 of a Euro		Nearest 0.1 of a Euro		Nearest 0.05 of a Euro	
Time Interval	Freq.	%	Freq.	%	Freq.	%	Freq.	%
09:00-09:14	3,046	5.48	2,472	6.86	10039	5.37	7652	4.51
09:15-09:59	2,195	3.95	1,345	3.73	6937	3.71	6418	3.78
09:30-09:45	1,801	3.24	1,413	3.92	6252	3.35	5977	3.52
09:45-09:59	1,596	2.87	1,070	2.97	6181	3.31	5424	3.20
10:00-10:14	1,551	2.79	969	2.69	6239	3.34	5182	3.06
10:15-10:29	1,188	2.14	1,041	2.89	5726	3.06	4812	2.84
10:30-10:44	1,631	2.93	995	2.76	4981	2.67	4769	2.81
10:45-10:59	1,787	3.21	997	2.77	5119	2.74	4539	2.68
11:00-11:14	1,360	2.45	942	2.61	4881	2.61	4620	2.72
11:15-11:29	1,265	2.28	872	2.42	4476	2.40	4617	2.72
11:30-11:44	1,837	3.30	1,081	3.00	4562	2.44	4254	2.51
11:45-11:59	1,475	2.65	1,050	2.91	4976	2.66	4740	2.79
12:00-12:14	1,178	2.12	1,141	3.16	4527	2.42	3653	2.15
12:15-12:29	1,112	2.00	787	2.18	4557	2.44	3616	2.13
12:30-12:44	919	1.65	775	2.15	3813	2.04	3279	1.93
12:45-12:59	992	1.78	528	1.46	3882	2.08	3171	1.87
13:00-13:14	868	1.56	504	1.40	3102	1.66	2778	1.64
13:15-13:29	827	1.49	602	1.67	3044	1.63	3063	1.81
13:30-13:44	795	1.43	633	1.76	3294	1.76	3329	1.96
13:45-13:59	1,055	1.90	604	1.68	3405	1.82	3425	2.02
14:00-14:14	1,080	1.94	631	1.75	3801	2.03	3304	1.95
14:15-14:29	1,080	1.94	757	2.10	4184	2.24	3660	2.16
14:30-14:44	1,528	2.75	829	2.30	4715	2.52	4525	2.67
14:45-14:59	1,537	2.76	1,050	2.91	5225	2.80	4468	2.63
15:00-15:14	2,079	3.74	1,102	3.06	5245	2.81	4612	2.72
15:15-15:29	1,563	2.81	1,084	3.01	5425	2.90	4518	2.66
15:30-15:44	1,578	2.84	1,262	3.50	6471	3.46	6038	3.56
15:45-15:59	2,237	4.02	1,413	3.92	6764	3.62	6690	3.94
16:00-16:14	2,180	3.92	1,215	3.37	6791	3.63	6103	3.60
16:15-16:29	2,139	3.85	1,287	3.57	6575	3.52	6140	3.62
16:30-16:44	2,777	4.99	1,257	3.49	7540	4.03	6674	3.94
16:45-16:59	2,319	4.17	1,097	3.04	7252	3.88	6956	4.10
17:00-17:14	2,368	4.26	1,549	4.30	7486	4.01	7409	4.37
17:15-17:29	2,657	4.78	1,698	4.71	9399	5.03	9181	5.41
Total	55,600	100	36,052	100	186,866	100.00	169,596	100.00

Table 5: Brussels market - Transaction price Mantissa frequency and percentage at different clustering levels (i.e Rounded nearest to whole number, nearest 0.5 of a Euro, nearest 0.1 of a Euro and nearest 0.05 of a Euro) with respect to intraday 15-min time intervals .

Table 6: Amsterdam market

	Amsterdam Market							
	Nearest Euro (Integer)		Nearest 0.5 of a Euro		Nearest 0.1 of a Euro		Nearest 0.05 of a Euro	
Time Interval	Freq.	%	Freq.	%	Freq.	%	Freq.	%
09:00-09:14	4,354	5.17	3,970	6.47	23254	5.44	23036	5.16
09:15-09:59	3,070	3.64	2,618	4.26	16221	3.80	16673	3.74
09:30-09:45	2,891	3.43	1,833	2.99	14614	3.42	14678	3.29
09:45-09:59	2,447	2.90	1,826	2.97	13676	3.20	13220	2.96
10:00-10:14	2,197	2.61	1,704	2.78	12599	2.95	13667	3.06
10:15-10:29	2,462	2.92	1,794	2.92	11117	2.60	11911	2.67
10:30-10:44	2,112	2.51	1,385	2.26	11220	2.63	11490	2.57
10:45-10:59	2,054	2.44	1,633	2.66	10375	2.43	10907	2.44
11:00-11:14	2,038	2.42	1,831	2.98	11274	2.64	12448	2.79
11:15-11:29	1,905	2.26	1,372	2.23	10005	2.34	10469	2.35
11:30-11:44	1,905	2.26	1,622	2.64	9325	2.18	9629	2.16
11:45-11:59	1,974	2.34	1,417	2.31	9325	2.18	9789	2.19
12:00-12:14	1,579	1.87	1,087	1.77	8308	1.94	8930	2.00
12:15-12:29	1,422	1.69	1,476	2.40	8100	1.90	8947	2.00
12:30-12:44	1,826	2.17	1,253	2.04	8962	2.10	9059	2.03
12:45-12:59	1,576	1.87	936	1.52	8461	1.98	8375	1.88
13:00-13:14	1,695	2.01	1,284	2.09	8105	1.90	8445	1.89
13:15-13:29	1,383	1.64	1,040	1.69	7316	1.71	8229	1.84
13:30-13:44	1,689	2.00	1,031	1.68	8607	2.01	8669	1.94
13:45-13:59	1,397	1.66	998	1.63	8296	1.94	7724	1.73
14:00-14:14	1,583	1.88	1,235	2.01	7773	1.82	8621	1.93
14:15-14:29	2,193	2.60	1,411	2.30	8845	2.07	9509	2.13
14:30-14:44	2,698	3.20	1,778	2.90	12136	2.84	12745	2.86
14:45-14:59	2,559	3.04	1,853	3.02	10975	2.57	11693	2.62
15:00-15:14	2,521	2.99	2,018	3.29	11384	2.66	12320	2.76
15:15-15:29	2,251	2.67	1,525	2.48	10861	2.54	11203	2.51
15:30-15:44	3,628	4.30	2,248	3.66	17594	4.12	18025	4.04
15:45-15:59	3,769	4.47	2,287	3.72	18305	4.28	18790	4.21
16:00-16:14	3,060	3.63	2,784	4.53	18281	4.28	18628	4.17
16:15-16:29	3,796	4.50	2,627	4.28	16443	3.85	18992	4.26
16:30-16:44	3,415	4.05	2,152	3.50	17469	4.09	18070	4.05
16:45-16:59	3,633	4.31	2,241	3.65	18124	4.24	18690	4.19
17:00-17:14	3,246	3.85	2,425	3.95	18774	4.39	20392	4.57
17:15-17:29	3,954	4.69	2,710	4.41	21238	4.97	22351	5.01
Total	84,282	100	61,404	100	427,362	100	446,324	100

Table 6: Amsterdam market - Transaction price Mantissa frequency and percentage at different clustering levels (i.e Rounded nearest to whole number, nearest 0.5 of a Euro, nearest 0.1 of a Euro and nearest 0.05 of a Euro) with respect to intraday 15-min time intervals .

Table 7: Paris market

	Paris Market							
	Nearest Euro (Integer)		Nearest 0.5 of a Euro		Nearest 0.1 of a Euro		Nearest 0.05 of a Euro	
Time Interval	Freq.	%	Freq.	%	Freq.	%	Freq.	%
09:00-09:14	20,973	5.67	14,165	5.33	71820	4.80	59376	4.40
09:15-09:59	13,928	3.76	9,652	3.63	55811	3.73	46450	3.44
09:30-09:45	12,011	3.25	8,310	3.13	51691	3.45	43747	3.24
09:45-09:59	11,258	3.04	8,970	3.38	47791	3.19	42149	3.12
10:00-10:14	10,241	2.77	7,799	2.94	45000	3.01	40211	2.98
10:15-10:29	9,611	2.60	7,083	2.67	42358	2.83	37531	2.78
10:30-10:44	9,695	2.62	6,865	2.59	39059	2.61	35207	2.61
10:45-10:59	9,249	2.50	7,061	2.66	38971	2.60	35059	2.60
11:00-11:14	10,011	2.71	7,700	2.90	38768	2.59	35196	2.61
11:15-11:29	8,999	2.43	6,810	2.56	36345	2.43	32166	2.38
11:30-11:44	9,614	2.60	6,391	2.41	35724	2.39	31920	2.37
11:45-11:59	8,434	2.28	6,120	2.30	38981	2.60	33378	2.47
12:00-12:14	8,211	2.22	5,449	2.05	32902	2.20	28506	2.11
12:15-12:29	7,698	2.08	5,088	1.92	30444	2.03	26996	2.00
12:30-12:44	7,023	1.90	5,072	1.91	29449	1.97	26890	1.99
12:45-12:59	6,343	1.71	4,658	1.75	26824	1.79	24232	1.80
13:00-13:14	5,772	1.56	4,565	1.72	27788	1.86	24797	1.84
13:15-13:29	5,552	1.50	4,023	1.52	24566	1.64	21751	1.61
13:30-13:44	6,741	1.82	4,472	1.68	26335	1.76	24194	1.79
13:45-13:59	5,907	1.60	4,712	1.77	28226	1.89	24379	1.81
14:00-14:14	7,352	1.99	4,794	1.81	29201	1.95	27144	2.01
14:15-14:29	7,546	2.04	5,560	2.09	31252	2.09	28215	2.09
14:30-14:44	10,340	2.79	8,074	3.04	42901	2.87	39573	2.93
14:45-14:59	10,006	2.70	6,908	2.60	39881	2.66	37113	2.75
15:00-15:14	10,137	2.74	8,382	3.16	42086	2.81	39020	2.89
15:15-15:29	10,287	2.78	6,560	2.47	38792	2.59	35585	2.64
15:30-15:44	12,737	3.44	9,786	3.69	52579	3.51	48494	3.60
15:45-15:59	14,240	3.85	10,593	3.99	58884	3.93	55218	4.09
16:00-16:14	15,645	4.23	10,366	3.90	61344	4.10	56673	4.20
16:15-16:29	15,533	4.20	10,619	4.00	60671	4.05	54610	4.05
16:30-16:44	17,056	4.61	10,897	4.10	60844	4.07	56813	4.21
16:45-16:59	16,525	4.47	11,205	4.22	62486	4.17	58380	4.33
17:00-17:14	17,458	4.72	12,933	4.87	67561	4.51	63822	4.73
17:15-17:29	17,824	4.82	13,900	5.23	79440	5.31	74107	5.49
Total	369,957	100	265,542	100	1,496,775	100	1,348,902	100

Table 7: Paris market - Transaction price Mantissa frequency and percentage at different clustering levels (i.e Rounded nearest to whole number, nearest 0.5 of a Euro, nearest 0.1 of a Euro and nearest 0.05 of a Euro) with respect to intraday 15-min time intervals .

Figure 5: Lisbon Market Intraday Price Clustering Frequency (Rounded to whole number, to nearest 0.5 of a Euro, 0.1 of a Euro and 0.05 of a Euro)

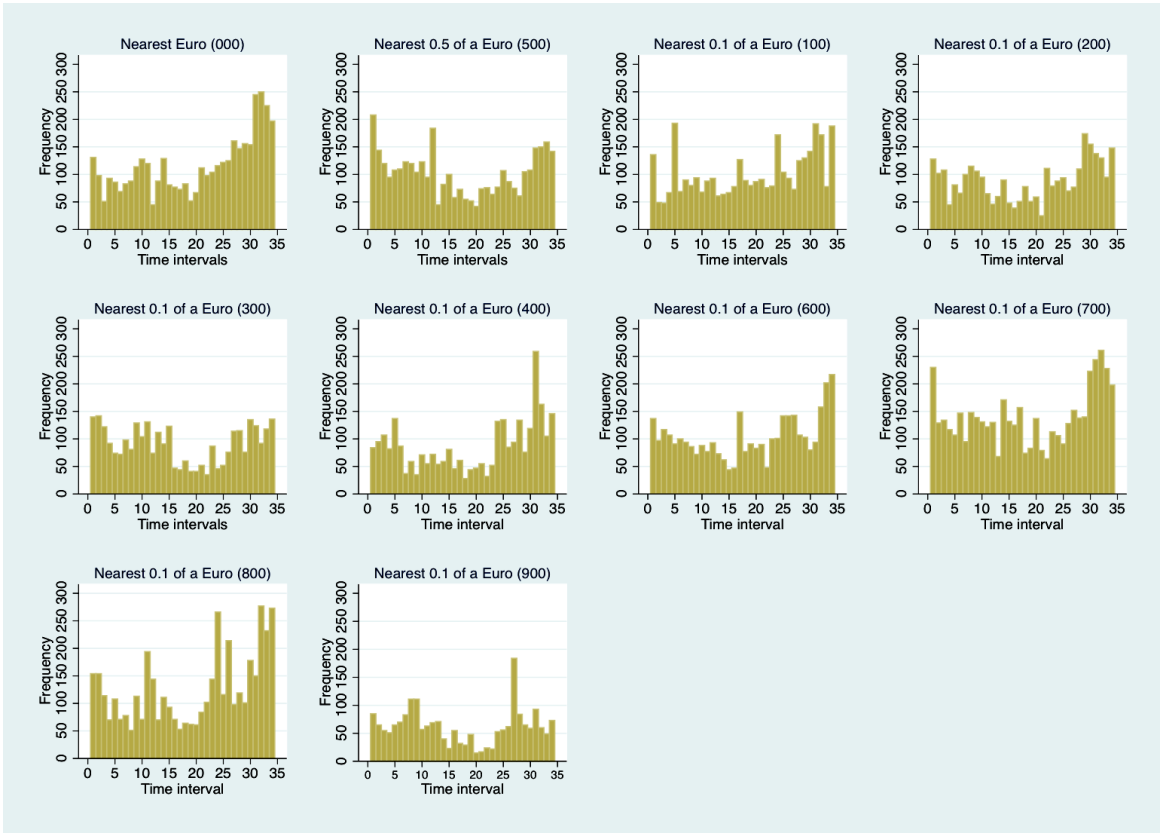


Figure 6: Brussels Market Intraday Price Clustering Frequency (Rounded to whole number, to nearest 0.5 of a Euro, 0.1 of a Euro and 0.05 of a Euro)

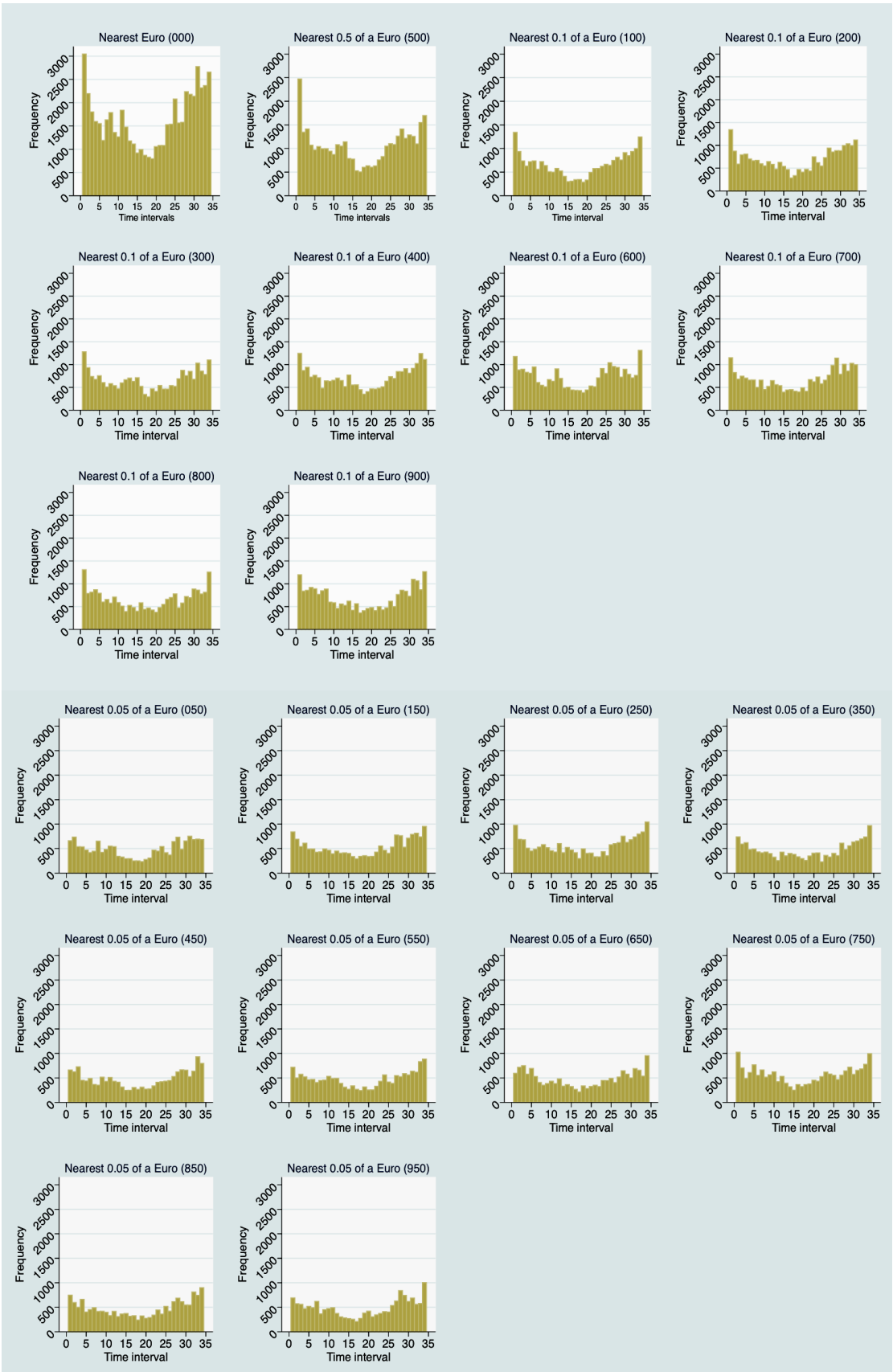
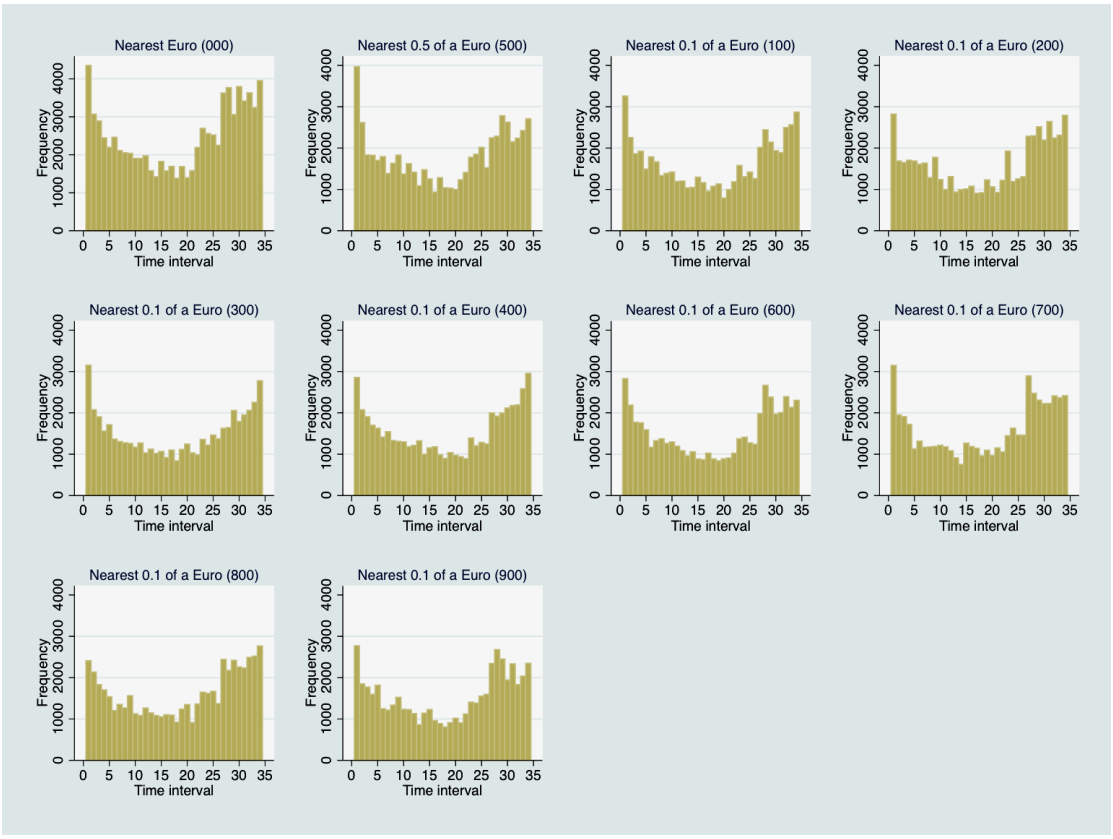


Figure 7: Amsterdam Market Intraday Price Clustering Frequency (Rounded to whole number, to nearest 0.5 of a Euro, 0.1 of a Euro and 0.05 of a Euro)



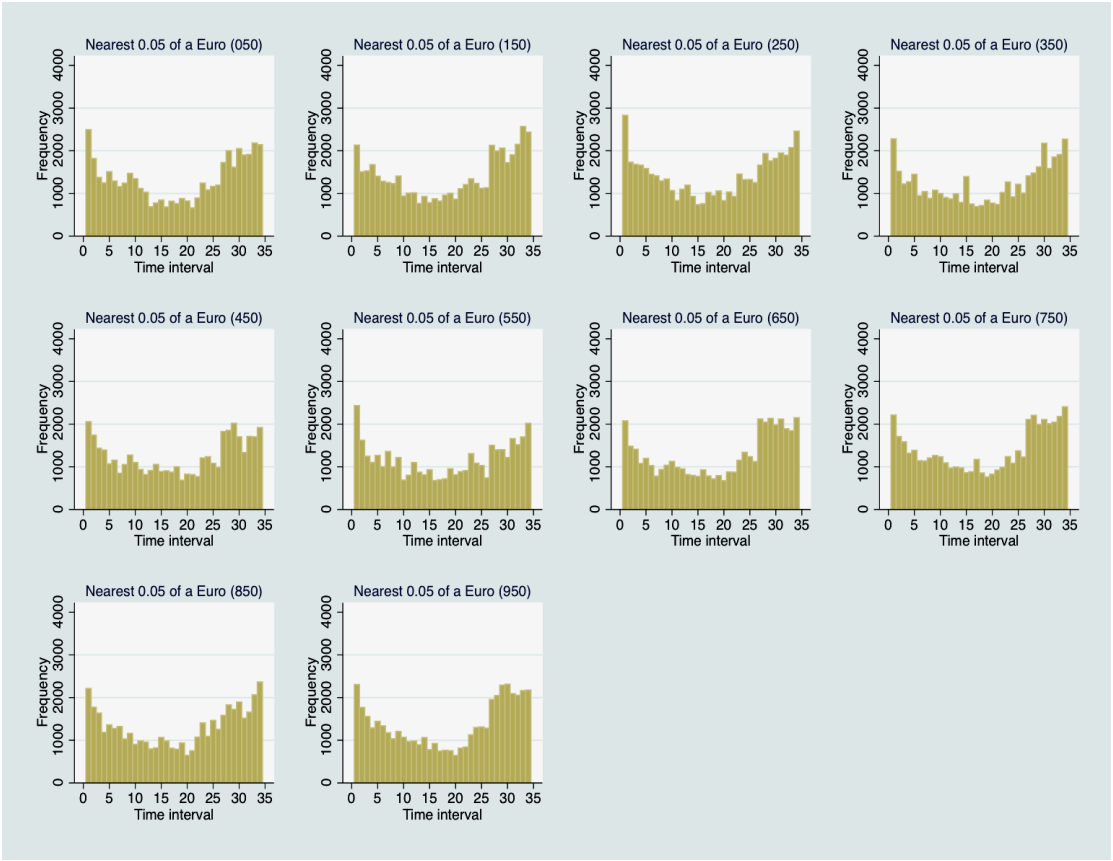


Figure 8: Paris Market Intraday Price Clustering Frequency (Rounded to whole number, to nearest 0.5 of a Euro, 0.1 of a Euro and 0.05 of a Euro)

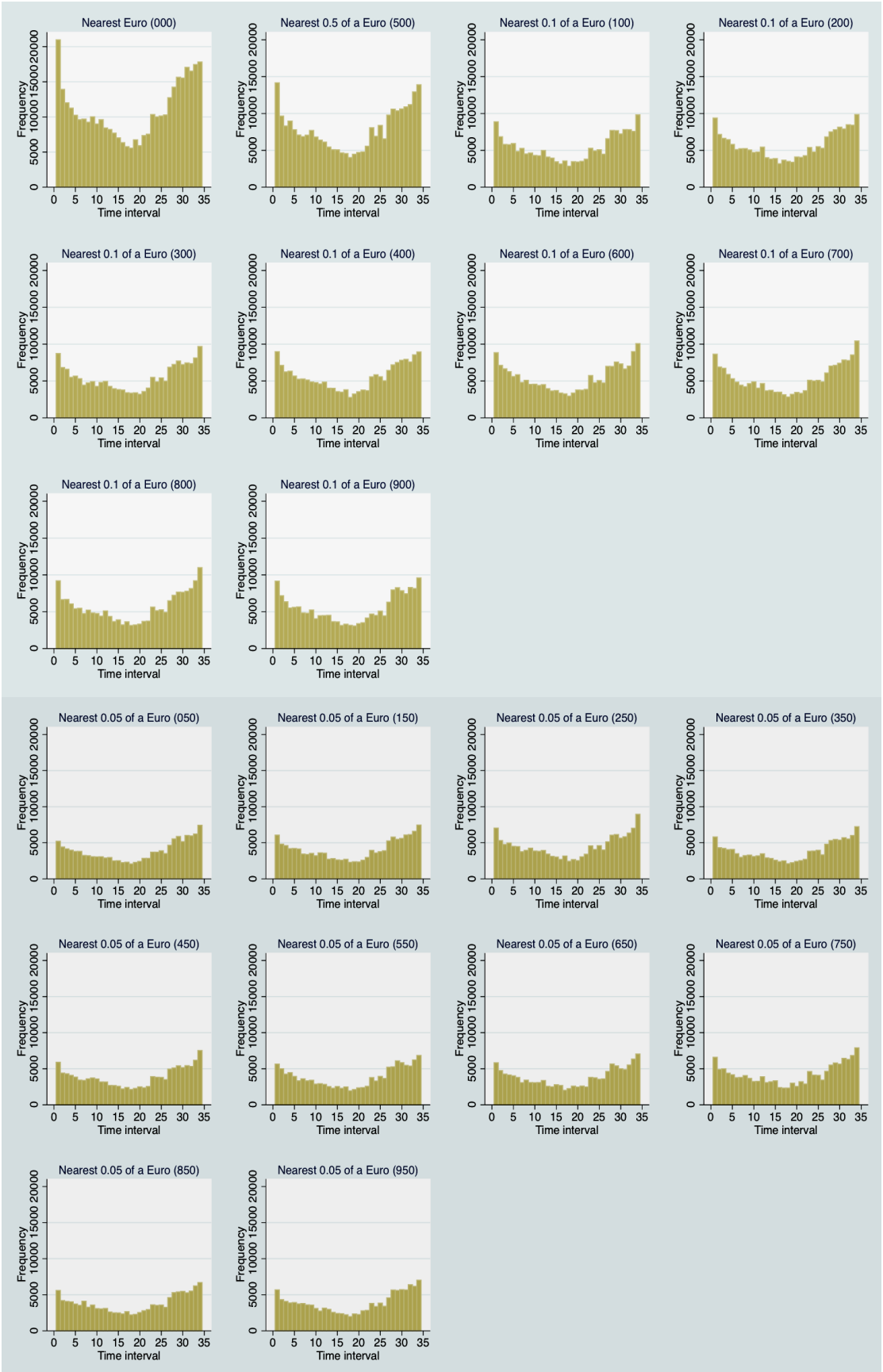


Table 8: Intraday level summary statistics (Lisbon market)

	Lisbon Market							
	Time interval	**No. of companies traded**	**No. of Transactions**	**No. of Transactions (%)**	**Total Turnove (Million Euro**	**Total Volatility per 15-mins**	**Mean Volatility per 15-mins**	**Mean Volatility (%)**
d1	09:00-09:14	47	21,728	3.08	88.30	32.95	0.0111	1.11
d2	09:15-09:29	46	20,583	2.91	79.00	20.10	0.0069	0.69
d3	09:30-09:44	45	20,456	2.90	79.70	19.57	0.0069	0.69
d4	09:45-09:59	46	20,199	2.86	81.80	18.57	0.0064	0.64
d5	10:00-10:14	47	20,165	2.85	81.10	16.84	0.0057	0.57
d6	10:15-10:29	46	19,025	2.69	75.90	16.84	0.0058	0.58
d7	10:30-10:44	47	18,533	2.62	74.70	15.64	0.0053	0.53
d8	10:45-10:59	45	18,001	2.55	74.40	14.40	0.0051	0.51
d9	11:00-11:14	47	18,021	2.55	71.50	13.90	0.0047	0.47
d10	11:15-11:29	46	18,239	2.58	77.30	13.38	0.0046	0.46
d11	11:30-11:44	65	18,521	2.62	73.40	14.56	0.0036	0.36
d12	11:45-11:59	49	19,421	2.75	81.90	13.23	0.0043	0.43
d13	12:00-12:14	47	16,695	2.36	69.70	11.31	0.0038	0.38
d14	12:15-12:29	47	16,461	2.33	65.30	10.89	0.0037	0.37
d15	12:30-12:44	47	15,787	2.23	66.80	10.84	0.0037	0.37
d16	12:45-12:59	47	15,492	2.19	59.50	10.25	0.0035	0.35
d17	13:00-13:14	47	14,984	2.12	61.80	9.70	0.0033	0.33
d18	13:15-13:29	46	13,555	1.92	56.20	8.60	0.0030	0.30
d19	13:30-13:44	46	13,180	1.87	50.10	7.82	0.0027	0.27
d20	13:45-13:59	46	13,500	1.91	53.70	8.01	0.0028	0.28
d21	14:00-14:14	46	13,579	1.92	54.20	8.06	0.0028	0.28
d22	14:15-14:29	45	14,988	2.12	64.10	8.84	0.0031	0.31
d23	14:30-14:44	47	17,464	2.47	75.90	10.29	0.0035	0.35
d24	14:45-14:59	46	18,292	2.59	76.30	10.29	0.0036	0.36
d25	15:00-15:14	46	19,700	2.79	80.70	11.29	0.0039	0.39
d26	15:15-15:29	45	22,039	3.12	90.60	13.17	0.0046	0.46
d27	15:30-15:44	46	24,606	3.48	110.00	15.15	0.0052	0.52
d28	15:45-15:59	46	27,880	3.95	128.00	16.13	0.0056	0.56
d29	16:00-16:14	46	28,499	4.03	122.00	17.26	0.0060	0.60
d30	16:15-16:29	47	27,141	3.84	139.00	17.87	0.0060	0.60
d31	16:30-16:44	69	30,769	4.36	148.00	18.86	0.0043	0.43
d32	16:45-16:59	49	32,558	4.61	153.00	22.63	0.0073	0.73
d33	17:00-17:14	46	35,852	5.07	184.00	25.76	0.0089	0.89
d34	17:15-17:29	47	40,585	5.74	209.00	32.65	0.0110	1.10
	Total	-	706,498	100	3056.90	-	-	-

Mean Volatility per 15-mins is calculated as Total Volatility of 15-mins divided by the number of companies multiplied by the number of trading days (63 days) in the sample period.

Table 9: Intraday level summary statistics (Brussels market)

	Brussels Market							
	Time interval	**No. of Companies traded**	**No. of Transactions**	**No. of Transactions (%)**	**Total Turnover (Million Euro)**	**Total Volatility per 15-mins**	**Mean Volatility per 15-mins**	**Mean Volatility (%)**
d1	09:00-09:14	128	81,762	4.05	466	135.65	0.0168	1.68
d2	09:15-09:29	121	71,214	3.53	393	88.96	0.0117	1.17
d3	09:30-09:44	123	65,440	3.24	354	74.68	0.0096	0.96
d4	09:45-09:59	122	62,765	3.11	328	64.75	0.0084	0.84
d5	10:00-10:14	122	61,089	3.03	313	60.63	0.0079	0.79
d6	10:15-10:29	120	56,085	2.78	292	54.08	0.0072	0.72
d7	10:30-10:44	121	53,109	2.63	271	49.29	0.0065	0.65
d8	10:45-10:59	124	52,455	2.6	282	45.52	0.0058	0.58
d9	11:00-11:14	120	51,817	2.57	270	46.53	0.0062	0.62
d10	11:15-11:29	124	50,165	2.49	255	44.42	0.0057	0.57
d11	11:30-11:44	164	50,396	2.5	270	43.86	0.0042	0.42
d12	11:45-11:59	136	55,184	2.73	274	46.23	0.0054	0.54
d13	12:00-12:14	121	44,695	2.21	225	37.99	0.0050	0.50
d14	12:15-12:29	119	42,730	2.12	205	35.98	0.0048	0.48
d15	12:30-12:44	117	39,418	1.95	192	31.74	0.0043	0.43
d16	12:45-12:59	117	39,125	1.94	196	29.69	0.0040	0.40
d17	13:00-13:14	117	36,600	1.81	172	27.74	0.0038	0.38
d18	13:15-13:29	121	35,771	1.77	177	26.72	0.0035	0.35
d19	13:30-13:44	116	37,599	1.86	184	28.35	0.0039	0.39
d20	13:45-13:59	120	39,409	1.95	200	29.87	0.0040	0.40
d21	14:00-14:14	120	42,795	2.12	208	33.25	0.0044	0.44
d22	14:15-14:29	122	45,452	2.25	222	34.48	0.0045	0.45
d23	14:30-14:44	125	53,079	2.63	290	40.67	0.0052	0.52
d24	14:45-14:59	123	54,568	2.7	294	40.50	0.0052	0.52
d25	15:00-15:14	174	58,557	2.9	304	41.26	0.0038	0.38
d26	15:15-15:29	132	59,249	2.94	299	39.39	0.0047	0.47
d27	15:30-15:44	130	72,165	3.57	388	48.20	0.0059	0.59
d28	15:45-15:59	120	85,669	4.24	466	55.31	0.0073	0.73
d29	16:00-16:14	120	76,176	3.77	426	52.85	0.0070	0.70
d30	16:15-16:29	121	75,954	3.76	427	52.85	0.0069	0.69
d31	16:30-16:44	165	83,029	4.11	469	56.42	0.0054	0.54
d32	16:45-16:59	134	84,764	4.2	467	57.39	0.0068	0.68
d33	17:00-17:14	123	92,421	4.58	524	61.56	0.0079	0.79
d34	17:15-17:29	120	107,922	5.35	654	84.92	0.0112	1.12
	Total	-	2,018,628	100	10757	-	-	-

Mean Volatility per 15-mins is calculated as Total Volatility of 15-mins divided by the number of companies multiplied by the number of trading days (63 days) in the sample period.

Table 10: Intraday level summary statistics (Amsterdam market)

	Amsterdam Market							
	Time interval	No. of Companies Traded	No. of Transactions	No. of Transactions (%)	Total Turnover (Million Euro)	Total Volatility per 15-mins	Mean Volatility per 15-mins	Mean Volatility (%)
d1	09:00-09:14	145	252,268	4.11	2260	296.99	0.0325	3.25
d2	09:15-09:29	140	201,128	3.28	1630	172.10	0.0195	1.95
d3	09:30-09:44	143	186,183	3.04	1490	138.86	0.0154	1.54
d4	09:45-09:59	145	175,757	2.87	1380	123.48	0.0135	1.35
d5	10:00-10:14	142	175,216	2.86	1340	117.58	0.0131	1.31
d6	10:15-10:29	136	157,496	2.57	1200	106.03	0.0124	1.24
d7	10:30-10:44	140	153,081	2.5	1170	99.47	0.0113	1.13
d8	10:45-10:59	135	146,846	2.39	1100	95.71	0.0113	1.13
d9	11:00-11:14	138	159,079	2.59	1200	96.70	0.0111	1.11
d10	11:15-11:29	144	141,411	2.31	1060	89.49	0.0099	0.99
d11	11:30-11:44	173	135,070	2.2	980	84.47	0.0078	0.78
d12	11:45-11:59	153	146,025	2.38	1040	85.88	0.0089	0.89
d13	12:00-12:14	137	127,250	2.07	940	73.48	0.0085	0.85
d14	12:15-12:29	134	122,304	1.99	878	72.27	0.0086	0.86
d15	12:30-12:44	140	124,116	2.02	910	71.36	0.0081	0.81
d16	12:45-12:59	138	115,772	1.89	827	67.07	0.0077	0.77
d17	13:00-13:14	134	117,202	1.91	837	67.54	0.0080	0.80
d18	13:15-13:29	136	107,383	1.75	751	63.59	0.0074	0.74
d19	13:30-13:44	139	116,008	1.89	829	68.02	0.0078	0.78
d20	13:45-13:59	135	112,127	1.83	807	65.54	0.0077	0.77
d21	14:00-14:14	138	119,345	1.95	873	68.20	0.0078	0.78
d22	14:15-14:29	140	131,473	2.14	982	70.83	0.0080	0.80
d23	14:30-14:44	141	181,159	2.95	1400	98.49	0.0111	1.11
d24	14:45-14:59	144	163,761	2.67	1220	88.66	0.0098	0.98
d25	15:00-15:14	144	169,723	2.77	1280	90.91	0.0100	1.00
d26	15:15-15:29	140	159,968	2.61	1210	84.78	0.0096	0.96
d27	15:30-15:44	140	261,596	4.27	1960	124.34	0.0141	1.41
d28	15:45-15:59	143	269,963	4.4	2000	133.14	0.0148	1.48
d29	16:00-16:14	139	265,612	4.33	2060	127.74	0.0146	1.46
d30	16:15-16:29	143	254,405	4.15	1970	123.73	0.0137	1.37
d31	16:30-16:44	169	269,248	4.39	2040	1281.43	0.1204	12.04
d32	16:45-16:59	153	280,597	4.57	2160	136.36	0.0141	1.41
d33	17:00-17:14	144	298,139	4.86	2390	138.86	0.0153	1.53
d34	17:15-17:29	142	336,716	5.49	2820	175.89	0.0197	1.97
	Total	-	6,133,427	100	46994	-	-	-

Mean Volatility per 15-mins is calculated as Total Volatility of 15-mins divided by the number of companies multiplied by the number of trading days (63 days) in the sample period.

Table 11: Intraday level summary statistics (Paris market)

	Paris Market							
	Time interval	**No. of Companies Traded**	**No. of Transactions**	**No. of Transactions (%)**	**Total Turnover (Million Euro)**	**Total Volatility per 15-mins**	**Mean Volatility per 15-mins**	**Mean Volatility (%)**
d1	09:00-09:14	573	596,824	3.61	4670	662.70	0.0184	1.84
d2	09:15-09:29	554	518,383	3.14	3870	382.95	0.0110	1.10
d3	09:30-09:44	558	495,643	3.00	3630	326.75	0.0093	0.93
d4	09:45-09:59	551	481,425	2.91	3420	290.21	0.0084	0.84
d5	10:00-10:14	552	483,136	2.92	3370	278.01	0.0080	0.80
d6	10:15-10:29	551	442,486	2.68	3090	251.50	0.0072	0.72
d7	10:30-10:44	553	423,924	2.57	2940	233.55	0.0067	0.67
d8	10:45-10:59	553	416,769	2.52	2860	228.28	0.0066	0.66
d9	11:00-11:14	547	435,574	2.64	3000	229.00	0.0066	0.66
d10	11:15-11:29	551	400,760	2.43	2730	212.36	0.0061	0.61
d11	11:30-11:44	699	385,164	2.33	2580	194.37	0.0044	0.44
d12	11:45-11:59	577	427,195	2.59	2840	208.63	0.0057	0.57
d13	12:00-12:14	556	355,472	2.15	2450	176.20	0.0050	0.50
d14	12:15-12:29	531	327,999	1.99	2230	160.00	0.0048	0.48
d15	12:30-12:44	525	322,428	1.95	2230	153.39	0.0046	0.46
d16	12:45-12:59	527	296,457	1.79	2010	140.19	0.0042	0.42
d17	13:00-13:14	529	300,113	1.82	2010	143.41	0.0043	0.43
d18	13:15-13:29	524	274,631	1.66	1820	133.27	0.0040	0.40
d19	13:30-13:44	523	303,730	1.84	2060	145.81	0.0044	0.44
d20	13:45-13:59	536	303,399	1.84	2010	145.00	0.0043	0.43
d21	14:00-14:14	533	328,179	1.99	2210	156.05	0.0046	0.46
d22	14:15-14:29	538	350,918	2.12	2390	169.08	0.0050	0.50
d23	14:30-14:44	544	479,265	2.90	3520	239.92	0.0070	0.70
d24	14:45-14:59	546	444,027	2.69	3180	211.02	0.0061	0.61
d25	15:00-15:14	775	467,100	2.83	3330	220.87	0.0045	0.45
d26	15:15-15:29	589	443,323	2.68	3070	207.79	0.0056	0.56
d27	15:30-15:44	589	607,232	3.68	4530	274.73	0.0074	0.74
d28	15:45-15:59	562	678,031	4.10	5010	300.17	0.0085	0.85
d29	16:00-16:14	547	717,956	4.35	5300	322.62	0.0094	0.94
d30	16:15-16:29	558	703,399	4.26	5130	311.83	0.0089	0.89
d31	16:30-16:44	699	734,909	4.45	5380	317.68	0.0072	0.72
d32	16:45-16:59	589	767,883	4.65	5760	332.43	0.0090	0.90
d33	17:00-17:14	562	851,153	5.15	6710	360.96	0.0102	1.02
d34	17:15-17:29	560	953,652	5.77	8060	460.22	0.0130	1.30
	Total	-	16,518,539	100	119400	-	-	-

Mean Volatility per 15-mins is calculated as Total Volatility of 15-mins divided by the number of companies multiplied by the number of trading days (63 days) in the sample period.

Table 12: Probit estimates of the determinants of price clustering (Panel A)

	Lisbon	Brussels	Amsterdam
	Probit coeff	Probit coeff	Probit coeff
Panel A: Nearest 0.5 of a Euro rounding			
Transaction Price Mantissa of 500			
Turnover	0.0494***	0.0584***	0.0184***
	(0.0044)	(0.0018)	(0.0012)
Price	-0.0283***	0.0002***	0.0095***
	(0.0030)	(0.0000)	(0.0001)
Volatility	4.0804***	-3.6165***	-3.5520***
	(1.4378)	(1.1674)	(1.1213)
Liquidity	-0.0979***	-0.0990***	-0.0546***
	(0.0070)	(0.0021)	(0.0016)
d1	0.3913***	0.3079***	0.2314***
	(0.0596)	(0.0199)	(0.0136)
d2	0.2824***	0.1242***	0.1564***
	(0.0618)	(0.0210)	(0.0142)
d3	0.2303***	0.1767***	0.0354**
	(0.0627)	(0.0209)	(0.0149)
d4	0.1304**	0.0624***	0.0533***
	(0.0648)	(0.0217)	(0.0149)
d5	0.1971***	0.0279	0.0287*
	(0.0633)	(0.0220)	(0.0151)
d6	0.1967***	0.0969***	0.0884***
	(0.0638)	(0.0218)	(0.0151)
d7	0.2722***	0.0848***	-0.0080
	(0.0624)	(0.0221)	(0.0157)
d8	0.2323***	0.0801***	0.0745***
	(0.0633)	(0.0221)	(0.0153)
d9	0.1968***	0.0710***	0.0883***
	(0.0642)	(0.0223)	(0.0150)
d10	0.2739***	0.0430*	0.0125
	(0.0628)	(0.0226)	(0.0158)
d11	0.1573**	0.1075***	0.0867***
	(0.0650)	(0.0222)	(0.0155)
d12	0.4047***	0.1236***	0.0271*
	(0.0601)	(0.0218)	(0.0157)
d13	-0.0735	0.2134***	-0.0453***
	(0.0745)	(0.0218)	(0.0166)
d14	0.1146*	0.0532**	0.0944***
	(0.0677)	(0.0232)	(0.0157)
d15	0.1873***	0.0869***	0.0245
	(0.0662)	(0.0233)	(0.0161)
d16	-0.0546	-0.0770***	-0.0666***
	(0.0746)	(0.0250)	(0.0171)

d17	0.1223*	-0.0891***	0.0533***
	(0.0684)	(0.0255)	(0.0161)
d19	0.0249	0.0129	-0.0295*
	(0.0739)	(0.0243)	(0.0168)
d20	-0.1072	-0.0194	-0.0305*
	(0.0798)	(0.0244)	(0.0170)
d21	0.1184*	-0.0366	0.0316*
	(0.0697)	(0.0242)	(0.0162)
d22	0.1378**	0.0209	0.0484***
	(0.0682)	(0.0233)	(0.0157)
d23	0.0320	-0.0046	0.0387***
	(0.0696)	(0.0227)	(0.0150)
d24	0.0798	0.0989***	0.0833***
	(0.0674)	(0.0218)	(0.0150)
d25	0.1921***	0.0900***	0.1099***
	(0.0640)	(0.0218)	(0.0148)
d26	0.0787	0.1011***	0.0172
	(0.0657)	(0.0216)	(0.0154)
d27	-0.0384	0.0794***	0.0054
	(0.0681)	(0.0211)	(0.0144)
d28	-0.1039	0.0813***	-0.0024
	(0.0685)	(0.0206)	(0.0143)
d29	0.0673	0.0480**	0.0814***
	(0.0638)	(0.0211)	(0.0140)
d30	0.0482	0.0613***	0.0691***
	(0.0641)	(0.0210)	(0.0141)
d31	0.1696***	-0.0028	-0.0350**
	(0.0609)	(0.0211)	(0.0145)
d32	0.1627***	-0.0398*	-0.0245*
	(0.0605)	(0.0213)	(0.0143)
d33	0.1376**	0.0855***	-0.0181
	(0.0605)	(0.0204)	(0.0142)
d34	0.0595	0.0658***	-0.0176
	(0.0609)	(0.0201)	(0.0140)
Constant	-2.6936***	-2.2643***	-2.4087***
	(0.0646)	(0.0232)	(0.0161)
Observations	653672	1908912	5979555
pseudo R-sq	0.0243	0.0145	0.0118
chi2	986.9427	4945.1530	9759.6814

Standard errors in parentheses		
"* p<0.1	** p<0.05	*** p<0.01"

Table 13: Probit estimates of the determinants of price clustering (Panel B and C)

	Probit Regression Coefficients of Price Clustering					
	Lisbon	Brussels	Amsterdam	Lisbon	Brussels	Amsterdam
	Panel B: Nearest 0.1 rounding			***Panel C: Nearest 0.05 rounding***		
Turnover	0.0444***	0.0419***	0.0226***	0.0312***	0.0281***	0.0114***
	(0.0019)	(0.0009)	(0.0006)	(0.0018)	(0.0010)	(0.0006)
Price	0.0484***	0.0001***	0.0094***	0.0447***	-0.0001***	0.0085***
	(0.0011)	(0.0000)	(0.0001)	(0.0012)	(0.0000)	(0.0001)
Volatility	3.6524***	-3.3875***	0.0015	6.6011***	-0.4316	-0.0025**
	(1.2280)	(0.6132)	(0.0018)	(1.0772)	(0.5987)	(0.0012)
Liquidity	-0.0605***	-0.0720***	-0.0440***	-0.0701***	-0.0786***	-0.0248***
	(0.0036)	(0.0012)	(0.0008)	(0.0035)	(0.0013)	(0.0008)
d1	0.1359***	0.2597***	0.1974***	0.3706***	0.0748***	0.1025***
	(0.0268)	(0.0117)	(0.0070)	(0.0273)	(0.0122)	(0.0070)
d2	0.0726***	0.1317***	0.1200***	0.2079***	0.0851***	0.0532***
	(0.0274)	(0.0120)	(0.0073)	(0.0283)	(0.0124)	(0.0073)
d3	0.0536*	0.1184***	0.0993***	0.1716***	0.0700***	0.0298***
	(0.0276)	(0.0122)	(0.0074)	(0.0286)	(0.0126)	(0.0074)
d4	-0.0557*	0.1321***	0.0929***	0.1720***	0.0285**	0.0023
	(0.0286)	(0.0123)	(0.0075)	(0.0287)	(0.0127)	(0.0076)
d5	0.1064***	0.1463***	0.0501***	0.2108***	0.0213*	0.0177**
	(0.0273)	(0.0123)	(0.0076)	(0.0285)	(0.0128)	(0.0075)
d6	0.0217	0.1436***	0.0357***	0.2053***	0.0197	0.0041
	(0.0283)	(0.0125)	(0.0077)	(0.0287)	(0.0130)	(0.0077)
d7	0.0286	0.0905***	0.0538***	0.0490	0.0466***	-0.0224***
	(0.0283)	(0.0127)	(0.0077)	(0.0302)	(0.0131)	(0.0078)
d8	0.0743***	0.1087***	0.0315***	0.1254***	0.0105	-0.0140*
	(0.0281)	(0.0127)	(0.0078)	(0.0297)	(0.0132)	(0.0079)
d9	0.1213***	0.0834***	0.0349***	0.0351	0.0288**	0.0125
	(0.0277)	(0.0128)	(0.0077)	(0.0304)	(0.0132)	(0.0077)
d10	0.0351	0.0505***	0.0317***	0.0106	0.0322**	-0.0013
	(0.0284)	(0.0129)	(0.0079)	(0.0307)	(0.0132)	(0.0079)
d11	0.0897***	0.0536***	0.0145*	0.0574*	-0.0195	-0.0326***
	(0.0280)	(0.0130)	(0.0080)	(0.0302)	(0.0134)	(0.0080)
d12	0.0460	0.0780***	-0.0161**	0.1353***	0.0236*	-0.0752***
	(0.0281)	(0.0127)	(0.0080)	(0.0293)	(0.0131)	(0.0080)
d13	-0.0279	0.1179***	-0.0186**	0.1083***	-0.0399***	-0.0532***
	(0.0296)	(0.0131)	(0.0082)	(0.0302)	(0.0138)	(0.0082)
d14	0.0836***	0.1554***	-0.0110	0.1072***	-0.0088	-0.0253***
	(0.0286)	(0.0131)	(0.0083)	(0.0303)	(0.0138)	(0.0082)
d15	0.0399	0.0931***	0.0384***	0.2491***	-0.0211	-0.0324***
	(0.0292)	(0.0135)	(0.0081)	(0.0294)	(0.0141)	(0.0082)
d16	-0.0334	0.1006***	0.0418***	0.1134***	-0.0480***	-0.0273***
	(0.0301)	(0.0135)	(0.0082)	(0.0307)	(0.0142)	(0.0083)

d17	0.1220***	0.0007	0.0098	0.1159***	-0.0845***	-0.0320***
	(0.0288)	(0.0140)	(0.0083)	(0.0308)	(0.0146)	(0.0083)
d19	0.0145	0.0242*	0.0539***	0.0906***	0.0091	-0.0246***
	(0.0307)	(0.0139)	(0.0082)	(0.0320)	(0.0142)	(0.0083)
d20	0.0392	0.0195	0.0488***	0.1526***	0.0147	-0.0663***
	(0.0303)	(0.0137)	(0.0083)	(0.0313)	(0.0140)	(0.0085)
d21	0.0177	0.0416***	-0.0261***	0.1378***	-0.0498***	-0.0412***
	(0.0305)	(0.0134)	(0.0083)	(0.0313)	(0.0140)	(0.0083)
d22	-0.0274	0.0631***	-0.0018	0.2670***	-0.0381***	-0.0358***
	(0.0302)	(0.0132)	(0.0081)	(0.0296)	(0.0137)	(0.0081)
d23	0.0501*	0.0489***	0.0176**	0.1868***	0.0054	-0.0407***
	(0.0284)	(0.0128)	(0.0076)	(0.0292)	(0.0131)	(0.0076)
d24	0.2060***	0.0987***	0.0091	0.1588***	-0.0353***	-0.0308***
	(0.0270)	(0.0126)	(0.0077)	(0.0292)	(0.0132)	(0.0077)
d25	0.0710**	0.0610***	0.0110	0.1838***	-0.0191	-0.0152**
	(0.0276)	(0.0126)	(0.0077)	(0.0287)	(0.0130)	(0.0076)
d26	0.0689**	0.0863***	0.0157**	0.2351***	-0.0365***	-0.0284***
	(0.0271)	(0.0125)	(0.0078)	(0.0279)	(0.0130)	(0.0077)
d27	0.0546**	0.0798***	0.0325***	0.1911***	0.0217*	-0.0335***
	(0.0267)	(0.0121)	(0.0072)	(0.0277)	(0.0125)	(0.0071)
d28	-0.0076	0.0203*	0.0346***	0.1142***	0.0078	-0.0257***
	(0.0266)	(0.0119)	(0.0071)	(0.0276)	(0.0122)	(0.0071)
d29	-0.0348	0.0764***	0.0413***	0.1334***	-0.0043	-0.0193***
	(0.0268)	(0.0120)	(0.0071)	(0.0275)	(0.0124)	(0.0071)
d30	0.0741***	0.0565***	0.0047	0.1234***	-0.0010	0.0162**
	(0.0261)	(0.0120)	(0.0072)	(0.0276)	(0.0124)	(0.0071)
d31	0.0874***	0.0877***	0.0100	0.1073***	-0.0041	-0.0550***
	(0.0256)	(0.0118)	(0.0071)	(0.0273)	(0.0122)	(0.0071)
d32	0.1014***	0.0554***	0.0106	0.0785***	0.0209*	-0.0501***
	(0.0254)	(0.0118)	(0.0071)	(0.0274)	(0.0121)	(0.0071)
d33	-0.0317	0.0346***	-0.0062	0.0769***	-0.0005	-0.0391***
	(0.0259)	(0.0117)	(0.0071)	(0.0270)	(0.0121)	(0.0070)
d34	0.0185	0.0808***	0.0001	0.2194***	0.0505***	-0.0560***
	(0.0252)	(0.0115)	(0.0070)	(0.0260)	(0.0117)	(0.0069)
Constant	-2.1809***	-1.4625***	-1.6307***	-2.1309***	-1.3545***	-1.5885***
	(0.0280)	(0.0128)	(0.0079)	(0.0290)	(0.0132)	(0.0079)
Observations	655312	1908912	5979555	655312	1908912	5979555
pseudo R-sq	0.0128	0.0063	0.0073	0.0122	0.0050	0.0047
chi2	2713.7951	7099.2579	2.44e+04	2663.4806	4999.6499	1.59e+04
Standard errors in parentheses						
"* p<0.1	** p<0.05	*** p<0.01"				

Table 14: Probit estimates of the determinants of price clustering (Paris market) based on each mantissa of 0.1 nearest rounding.

	Paris Market							
	Panel A: Probit Regression Coefficients of Price Clustering (Nearest 0.1 of a Euro rounding)							
Mantissa of:	***100***	***200***	***300***	***400***	***600***	***700***	***800***	***900***
Turnover	0.0238***	0.0261***	0.0262***	0.0262***	0.0265***	0.0287***	0.0256***	0.0246***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Price	0.0017***	0.0018***	0.0015***	0.0013***	0.0016***	0.0016***	0.0020***	0.0020***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Volatility	-0.1995	0.2011	-0.6935	-0.2447	0.0590	-1.8845***	-1.8122***	-3.7076***
	(0.4278)	(0.3930)	(0.4718)	(0.4400)	(0.4194)	(0.5495)	(0.5130)	(0.5736)
Liquidity	-0.0251***	-0.0193***	-0.0252***	-0.0166***	-0.0140***	-0.0097***	-0.0287***	-0.0142***
	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)
d1	0.1551***	0.0893***	0.0840***	0.1668***	0.1326***	0.1323***	0.1297***	0.1193***
	(0.0085)	(0.0079)	(0.0081)	(0.0085)	(0.0084)	(0.0085)	(0.0082)	(0.0082)
d2	0.1121***	0.0435***	0.0454***	0.1350***	0.1060***	0.1037***	0.0623***	0.0831***
	(0.0087)	(0.0082)	(0.0083)	(0.0087)	(0.0086)	(0.0087)	(0.0085)	(0.0084)
d3	0.0615***	0.0290***	0.0470***	0.0980***	0.0951***	0.1104***	0.0808***	0.0496***
	(0.0089)	(0.0083)	(0.0084)	(0.0089)	(0.0086)	(0.0087)	(0.0085)	(0.0085)
d4	0.0700***	0.0295***	-0.0140	0.1169***	0.0805***	0.0695***	0.0522***	0.0044
	(0.0089)	(0.0083)	(0.0086)	(0.0089)	(0.0087)	(0.0088)	(0.0086)	(0.0087)
d5	0.0780***	-0.0128	-0.0035	0.0694***	0.0372***	0.0274***	0.0010	0.0073
	(0.0088)	(0.0084)	(0.0085)	(0.0090)	(0.0088)	(0.0090)	(0.0087)	(0.0087)
d6	0.0335***	-0.0332***	0.0056	0.0730***	0.0900***	0.0277***	0.0455***	0.0451***
	(0.0091)	(0.0086)	(0.0086)	(0.0091)	(0.0088)	(0.0091)	(0.0087)	(0.0087)
d7	0.0816***	-0.0051	-0.0537***	0.0932***	0.0283***	0.0069	0.0019	0.0009
	(0.0090)	(0.0086)	(0.0089)	(0.0091)	(0.0091)	(0.0092)	(0.0090)	(0.0089)
d8	0.0265***	0.0036	-0.0194**	0.0882***	0.0547***	-0.0067	0.0433***	0.0056
	(0.0092)	(0.0086)	(0.0088)	(0.0091)	(0.0090)	(0.0093)	(0.0088)	(0.0089)
d9	0.0190**	-0.0292***	-0.0214**	0.0488***	-0.0067	0.0139	-0.0035	0.0230***
	(0.0092)	(0.0086)	(0.0087)	(0.0092)	(0.0091)	(0.0092)	(0.0089)	(0.0088)
d10	0.0201**	-0.0259***	-0.0459***	0.0738***	0.0282***	0.0682***	0.0233***	-0.0502***
	(0.0093)	(0.0088)	(0.0090)	(0.0093)	(0.0092)	(0.0091)	(0.0090)	(0.0092)
d11	0.0248***	-0.0072	0.0108	0.0693***	0.0237**	0.0059	-0.0032	0.0004
	(0.0094)	(0.0088)	(0.0089)	(0.0094)	(0.0093)	(0.0094)	(0.0092)	(0.0091)
d12	0.0619***	0.0126	-0.0048	0.0590***	0.0058	0.0269***	0.0345***	-0.0303***
	(0.0091)	(0.0086)	(0.0087)	(0.0092)	(0.0091)	(0.0092)	(0.0089)	(0.0090)
d13	0.0463***	-0.0471***	-0.0025	0.0506***	0.0168*	-0.0004	0.0328***	0.0421***
	(0.0094)	(0.0091)	(0.0090)	(0.0095)	(0.0094)	(0.0096)	(0.0091)	(0.0091)
d14	0.0630***	-0.0339***	-0.0009	0.0812***	0.0180*	0.0376***	-0.0063	-0.0128
	(0.0095)	(0.0092)	(0.0092)	(0.0096)	(0.0096)	(0.0096)	(0.0095)	(0.0094)
d15	0.0169*	-0.0196**	-0.0092	0.0395***	0.0278***	0.0149	0.0244***	-0.0076
	(0.0098)	(0.0092)	(0.0093)	(0.0098)	(0.0096)	(0.0097)	(0.0094)	(0.0095)
d16	0.0121	-0.0655***	0.0177*	0.0677***	0.0221**	0.0493***	-0.0195**	-0.0304***
	(0.0100)	(0.0096)	(0.0093)	(0.0099)	(0.0098)	(0.0098)	(0.0097)	(0.0098)

d17	0.0568***	-0.0153	-0.0279***	0.0957***	0.0053	0.0041	0.0257***	-0.0149
	(0.0097)	(0.0093)	(0.0095)	(0.0097)	(0.0098)	(0.0100)	(0.0095)	(0.0097)
d19	0.0425***	-0.0513***	-0.0329***	0.0237**	0.0091	0.0064	-0.0320***	-0.0507***
	(0.0098)	(0.0094)	(0.0095)	(0.0100)	(0.0098)	(0.0099)	(0.0097)	(0.0098)
d20	0.0369***	0.0252***	-0.0581***	0.0645***	0.0600***	0.0400***	-0.0146	-0.0128
	(0.0098)	(0.0091)	(0.0096)	(0.0098)	(0.0096)	(0.0098)	(0.0097)	(0.0096)
d21	0.0169*	-0.0101	-0.0409***	0.0590***	0.0249***	-0.0060	-0.0063	-0.0275***
	(0.0097)	(0.0091)	(0.0094)	(0.0097)	(0.0095)	(0.0098)	(0.0095)	(0.0095)
d22	0.0235**	-0.0097	-0.0184**	0.0216**	0.0146	0.0071	-0.0242**	0.0147
	(0.0096)	(0.0090)	(0.0091)	(0.0097)	(0.0095)	(0.0096)	(0.0094)	(0.0092)
d23	0.0378***	-0.0407***	-0.0131	0.0662***	0.0476***	0.0121	0.0237***	-0.0601***
	(0.0090)	(0.0085)	(0.0086)	(0.0090)	(0.0088)	(0.0090)	(0.0087)	(0.0089)
d24	0.0362***	-0.0601***	-0.0290***	0.1150***	0.0063	0.0353***	0.0173**	-0.0472***
	(0.0091)	(0.0087)	(0.0087)	(0.0090)	(0.0090)	(0.0091)	(0.0088)	(0.0090)
d25	0.0277***	-0.0285***	-0.0165*	0.0725***	0.0049	0.0180**	0.0019	-0.0243***
	(0.0091)	(0.0085)	(0.0086)	(0.0090)	(0.0090)	(0.0090)	(0.0088)	(0.0088)
d26	0.0014	-0.0208**	-0.0220**	0.0552***	0.0053	0.0291***	-0.0007	-0.0507***
	(0.0092)	(0.0086)	(0.0087)	(0.0091)	(0.0091)	(0.0091)	(0.0089)	(0.0090)
d27	0.0353***	-0.0376***	-0.0147*	0.0313***	0.0332***	-0.0105	-0.0095	-0.0347***
	(0.0087)	(0.0082)	(0.0082)	(0.0088)	(0.0085)	(0.0087)	(0.0085)	(0.0085)
d28	0.0557***	-0.0410***	-0.0324***	0.0355***	-0.0064	0.0065	-0.0059	0.0164**
	(0.0085)	(0.0081)	(0.0082)	(0.0086)	(0.0085)	(0.0086)	(0.0083)	(0.0082)
d29	0.0320***	-0.0487***	-0.0307***	0.0289***	0.0021	-0.0112	-0.0050	0.0063
	(0.0085)	(0.0080)	(0.0081)	(0.0086)	(0.0084)	(0.0085)	(0.0083)	(0.0082)
d30	0.0168**	-0.0245***	-0.0487***	0.0511***	-0.0017	0.0104	-0.0002	-0.0054
	(0.0085)	(0.0080)	(0.0082)	(0.0086)	(0.0084)	(0.0085)	(0.0083)	(0.0082)
d31	0.0284***	-0.0544***	-0.0546***	0.0410***	-0.0607***	0.0140*	-0.0122	-0.0444***
	(0.0085)	(0.0080)	(0.0081)	(0.0085)	(0.0085)	(0.0084)	(0.0082)	(0.0082)
d32	0.0133	-0.0407***	-0.0748***	0.0085	-0.0512***	-0.0037	-0.0067	-0.0165**
	(0.0084)	(0.0079)	(0.0081)	(0.0086)	(0.0085)	(0.0084)	(0.0082)	(0.0081)
d33	-0.0361***	-0.0845***	-0.0746***	0.0137	0.0046	-0.0075	0.0018	-0.0630***
	(0.0085)	(0.0079)	(0.0080)	(0.0084)	(0.0082)	(0.0083)	(0.0081)	(0.0081)
d34	0.0212**	-0.0656***	-0.0496***	-0.0114	0.0042	0.0257***	0.0279***	-0.0433***
	(0.0082)	(0.0078)	(0.0079)	(0.0084)	(0.0081)	(0.0082)	(0.0079)	(0.0080)
Constant	-2.4575***	-2.4245***	-2.4057***	-2.5144***	-2.5078***	-2.5568***	-2.4271***	-2.4756***
	(0.0093)	(0.0089)	(0.0090)	(0.0094)	(0.0093)	(0.0094)	(0.0091)	(0.0092)
Observations	16048412	16048412	16048412	16048412	16048412	16048412	16048412	16048412
pseudo R-sq	0.0031	0.0033	0.0029	0.0027	0.0031	0.0029	0.0036	0.0037
chi2	5991.1037	6737.5750	5745.2081	5356.1822	6113.1924	5650.5087	7178.2589	7337.8116

Standard errors in parentheses		
"* p<0.1	** p<0.05	*** p<0.01"

Table 15: Probit estimates of the determinants of price clustering (Paris market) based on each mantissa of 0.05 nearest rounding.

	Paris Market									
	Panel B: Probit Regression Coefficients of Price Clustering (Nearest 0.05 of a Euro rounding)									
Mantissa of:	*50*	*150*	*250*	*350*	*450*	*550*	*650*	*750*	*850*	*950*
Turnover	0.0181***	0.0199***	0.0193***	0.0187***	0.0180***	0.0205***	0.0150***	0.0239***	0.0127***	0.0164***
	(0.0008)	(0.0008)	(0.0007)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Price	0.0008***	0.0007***	0.0012***	0.0006***	0.0003***	0.0003***	0.0006***	0.0014***	0.0011***	0.0014***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Volatility	-0.1742	1.1590***	-1.7079***	1.1164***	1.0522***	1.4185***	1.0848***	-1.3742**	-1.3232**	-0.9620*
	(0.4999)	(0.3278)	(0.5697)	(0.3385)	(0.3420)	(0.3191)	(0.3501)	(0.5751)	(0.6055)	(0.5795)
Liquidity	-0.0083***	-0.0137***	-0.0131***	-0.0127***	-0.0124***	0.0009	0.0001	-0.0161***	-0.0088***	-0.0117***
	(0.0010)	(0.0010)	(0.0009)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
d1	0.0604***	0.0811***	0.1163***	0.0984***	0.0879***	0.1037***	0.0619***	0.1062***	0.0639***	0.1097***
	(0.0097)	(0.0093)	(0.0090)	(0.0096)	(0.0095)	(0.0098)	(0.0094)	(0.0092)	(0.0095)	(0.0098)
d2	0.0515***	0.0468***	0.0632***	0.0394***	0.0369***	0.1115***	0.0395***	0.0527***	0.0097	0.0656***
	(0.0099)	(0.0096)	(0.0093)	(0.0099)	(0.0098)	(0.0099)	(0.0096)	(0.0095)	(0.0098)	(0.0101)
d3	0.0454***	0.0486***	0.0397***	0.0485***	0.0464***	0.0680***	0.0185*	0.0744***	0.0124	0.0605***
	(0.0100)	(0.0096)	(0.0094)	(0.0099)	(0.0099)	(0.0101)	(0.0097)	(0.0095)	(0.0099)	(0.0102)
d4	0.0380***	0.0228**	0.0633***	0.0434***	0.0363***	0.0961***	0.0155	0.0365***	0.0175*	0.0509***
	(0.0101)	(0.0097)	(0.0094)	(0.0100)	(0.0099)	(0.0101)	(0.0098)	(0.0097)	(0.0099)	(0.0102)
d5	0.0209**	0.0227**	0.0264***	0.0425***	0.0140	0.0477***	0.0023	0.0165*	-0.0118	0.0523***
	(0.0101)	(0.0097)	(0.0095)	(0.0100)	(0.0100)	(0.0102)	(0.0098)	(0.0097)	(0.0100)	(0.0102)
d6	0.0557***	0.0507***	0.0568***	0.0159	-0.0003	0.0204*	0.0158	0.0076	0.0042	0.0665***
	(0.0101)	(0.0098)	(0.0095)	(0.0103)	(0.0102)	(0.0105)	(0.0099)	(0.0099)	(0.0101)	(0.0103)
d7	0.0113	-0.0043	0.0092	-0.0244**	0.0140	0.0678***	-0.0482***	0.0273***	0.0729***	0.0888***
	(0.0104)	(0.0101)	(0.0098)	(0.0105)	(0.0102)	(0.0104)	(0.0103)	(0.0099)	(0.0099)	(0.0103)
d8	0.0117	-0.0069	0.0299***	0.0055	0.0423***	0.0434***	0.0007	0.0585***	-0.0047	0.0754***
	(0.0104)	(0.0101)	(0.0097)	(0.0104)	(0.0102)	(0.0105)	(0.0101)	(0.0098)	(0.0102)	(0.0104)
d9	-0.0199*	-0.0047	0.0404***	-0.0005	0.0377***	0.0331***	-0.0550***	0.0035	0.0101	0.0566***
	(0.0105)	(0.0100)	(0.0096)	(0.0104)	(0.0101)	(0.0105)	(0.0103)	(0.0099)	(0.0101)	(0.0104)
d10	0.0066	-0.0146	0.0373***	0.0091	0.0531***	0.0003	-0.0239**	-0.0147	-0.0152	0.0341***
	(0.0105)	(0.0102)	(0.0098)	(0.0105)	(0.0102)	(0.0108)	(0.0103)	(0.0102)	(0.0104)	(0.0106)
d11	0.0221**	0.0492***	0.0441***	0.0364***	0.0246**	0.0257**	-0.0097	-0.0007	-0.0054	-0.0029
	(0.0106)	(0.0101)	(0.0098)	(0.0105)	(0.0104)	(0.0108)	(0.0103)	(0.0102)	(0.0104)	(0.0109)
d12	-0.0325***	0.0106	0.0233**	0.0315***	-0.0135	-0.0224**	-0.0141	0.0377***	-0.0340***	0.0198*
	(0.0106)	(0.0100)	(0.0097)	(0.0103)	(0.0104)	(0.0108)	(0.0101)	(0.0099)	(0.0103)	(0.0106)
d13	0.0391***	-0.0279***	0.0363***	0.0281***	-0.0118	0.0025	-0.0445***	0.0097	-0.0324***	0.0602***
	(0.0106)	(0.0106)	(0.0100)	(0.0106)	(0.0107)	(0.0111)	(0.0107)	(0.0103)	(0.0107)	(0.0108)
d14	0.0056	0.0126	0.0297***	0.0488***	0.0191*	-0.0050	-0.0295***	0.0569***	-0.0178	0.0343***
	(0.0110)	(0.0105)	(0.0102)	(0.0107)	(0.0108)	(0.0113)	(0.0108)	(0.0103)	(0.0108)	(0.0111)
d15	0.0147	-0.0075	0.0218**	0.0218**	0.0084	0.0374***	0.0205*	0.0792***	-0.0120	0.0165
	(0.0110)	(0.0107)	(0.0103)	(0.0109)	(0.0109)	(0.0111)	(0.0106)	(0.0102)	(0.0108)	(0.0112)
d16	0.0043	0.0194*	0.0081	0.0225**	-0.0172	0.0359***	0.0387***	-0.0181*	-0.0047	0.0425***
	(0.0113)	(0.0108)	(0.0106)	(0.0111)	(0.0112)	(0.0113)	(0.0107)	(0.0109)	(0.0110)	(0.0113)

d17	0.0070	0.0311***	0.0679***	0.0335***	0.0116	0.0554***	-0.0745***	-0.0329***	0.0373***	0.0114
	(0.0112)	(0.0107)	(0.0102)	(0.0110)	(0.0110)	(0.0112)	(0.0113)	(0.0110)	(0.0108)	(0.0114)
d19	-0.0027	-0.0240**	-0.0040	-0.0142	-0.0165	-0.0075	0.0150	0.0608***	-0.0257**	0.0282**
	(0.0112)	(0.0109)	(0.0106)	(0.0113)	(0.0112)	(0.0115)	(0.0108)	(0.0104)	(0.0111)	(0.0113)
d20	0.0222**	-0.0272**	-0.0199*	0.0184*	0.0193*	0.0319***	-0.0052	-0.0031	0.0173	0.0148
	(0.0111)	(0.0110)	(0.0106)	(0.0111)	(0.0110)	(0.0113)	(0.0109)	(0.0108)	(0.0109)	(0.0114)
d21	0.0535***	-0.0208*	0.0189*	0.0044	-0.0304***	0.0103	-0.0113	0.0577***	0.0212**	0.0642***
	(0.0108)	(0.0107)	(0.0103)	(0.0110)	(0.0110)	(0.0112)	(0.0107)	(0.0103)	(0.0106)	(0.0109)
d22	0.0279***	0.0098	0.0356***	0.0065	-0.0248**	0.0094	-0.0573***	-0.0074	0.0150	0.0451***
	(0.0107)	(0.0104)	(0.0100)	(0.0108)	(0.0108)	(0.0111)	(0.0108)	(0.0104)	(0.0105)	(0.0109)
d23	0.0128	0.0026	0.0325***	0.0220**	0.0218**	0.0369***	-0.0142	0.0566***	-0.0225**	0.0462***
	(0.0102)	(0.0098)	(0.0095)	(0.0101)	(0.0100)	(0.0103)	(0.0099)	(0.0096)	(0.0100)	(0.0103)
d24	0.0407***	-0.0056	0.0177*	0.0535***	0.0422***	0.0165	0.0081	0.0404***	-0.0021	0.0265**
	(0.0102)	(0.0100)	(0.0097)	(0.0101)	(0.0100)	(0.0105)	(0.0100)	(0.0098)	(0.0101)	(0.0105)
d25	0.0388***	-0.0101	0.0440***	0.0421***	0.0210**	0.0562***	-0.0294***	0.0189*	-0.0178*	0.0559***
	(0.0101)	(0.0099)	(0.0095)	(0.0101)	(0.0100)	(0.0103)	(0.0100)	(0.0098)	(0.0101)	(0.0103)
d26	0.0239**	0.0248**	0.0104	-0.0020	0.0099	0.0575***	-0.0031	-0.0268***	-0.0308***	0.0319***
	(0.0103)	(0.0099)	(0.0097)	(0.0103)	(0.0102)	(0.0103)	(0.0100)	(0.0100)	(0.0102)	(0.0105)
d27	0.0105	0.0235**	-0.0116	0.0204**	0.0241**	0.0678***	-0.0288***	-0.0320***	-0.0172*	0.0256**
	(0.0098)	(0.0094)	(0.0093)	(0.0097)	(0.0096)	(0.0098)	(0.0096)	(0.0095)	(0.0096)	(0.0100)
d28	0.0365***	0.0203**	0.0108	0.0197**	-0.0053	0.0307***	0.0049	-0.0045	-0.0034	0.0661***
	(0.0096)	(0.0093)	(0.0091)	(0.0096)	(0.0096)	(0.0098)	(0.0093)	(0.0093)	(0.0094)	(0.0097)
d29	0.0367***	-0.0225**	-0.0064	0.0081	-0.0038	0.0623***	-0.0348***	-0.0050	-0.0193**	0.0404***
	(0.0095)	(0.0093)	(0.0090)	(0.0095)	(0.0095)	(0.0096)	(0.0093)	(0.0092)	(0.0094)	(0.0097)
d30	-0.0038	-0.0081	-0.0311***	0.0089	-0.0143	0.0567***	-0.0545***	-0.0094	-0.0078	0.0538***
	(0.0096)	(0.0093)	(0.0091)	(0.0096)	(0.0095)	(0.0097)	(0.0094)	(0.0092)	(0.0094)	(0.0097)
d31	0.0361***	0.0061	-0.0346***	0.0157*	-0.0115	0.0144	-0.0786***	0.0220**	-0.0380***	0.0360***
	(0.0095)	(0.0092)	(0.0091)	(0.0095)	(0.0095)	(0.0097)	(0.0094)	(0.0091)	(0.0094)	(0.0097)
d32	0.0166*	-0.0047	-0.0169*	-0.0114	-0.0343***	-0.0093	-0.0513***	-0.0012	-0.0364***	0.0659***
	(0.0095)	(0.0092)	(0.0090)	(0.0095)	(0.0095)	(0.0097)	(0.0093)	(0.0091)	(0.0094)	(0.0096)
d33	-0.0048	-0.0160*	-0.0187**	-0.0171*	-0.0164*	0.0062	-0.0385***	-0.0067	-0.0278***	0.0138
	(0.0094)	(0.0091)	(0.0089)	(0.0094)	(0.0093)	(0.0096)	(0.0092)	(0.0090)	(0.0092)	(0.0096)
d34	0.0193**	-0.0127	0.0310***	0.0073	0.0132	-0.0003	-0.0410***	0.0047	-0.0430***	0.0201**
	(0.0092)	(0.0090)	(0.0087)	(0.0092)	(0.0091)	(0.0095)	(0.0090)	(0.0089)	(0.0091)	(0.0095)
Constant	-2.5700***	-2.5238***	-2.5110***	-2.5451***	-2.5241***	-2.6368***	-2.5413***	-2.5608***	-2.5081***	-2.5799***
	(0.0106)	(0.0102)	(0.0100)	(0.0105)	(0.0104)	(0.0107)	(0.0103)	(0.0102)	(0.0104)	(0.0107)
Observations	16048412	16048412	16048412	16048412	16048412	16048412	16048412	16048412	16048412	16048412
pseudo R-sq	0.0010	0.0012	0.0019	0.0010	0.0010	0.0014	0.0012	0.0024	0.0012	0.0016
chi2	1416.6720	1850.1622	3149.4695	1491.1667	1428.4391	1990.0758	1697.9301	3794.7821	1800.9580	2331.1723

Standard errors in parentheses		
"* p<0.1	** p<0.05	*** p<0.01"

Figure 9: Lisbon, Brussels and Amsterdam markets

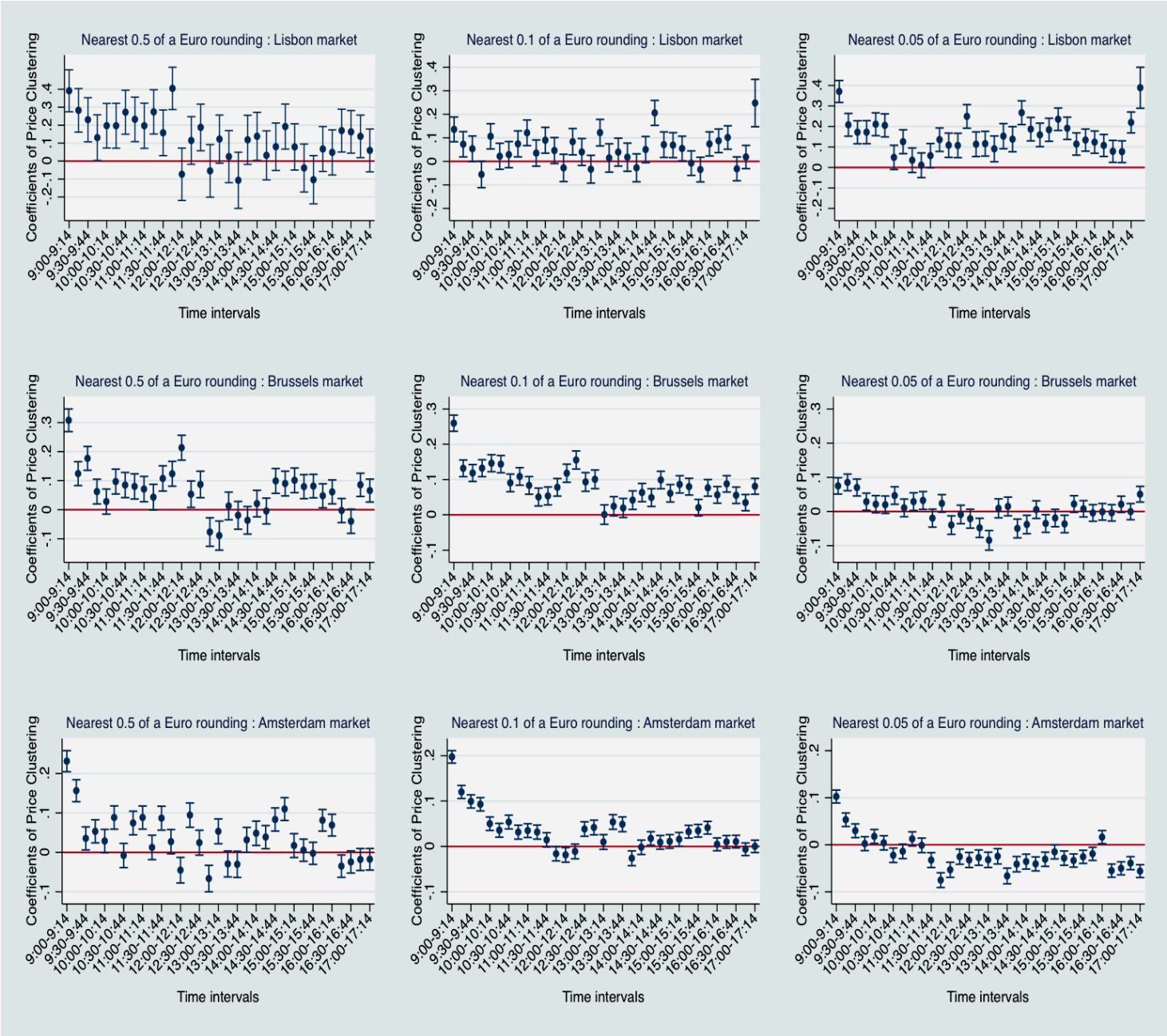


Figure 9: Probit Regression Coefficients of Intraday Price Clustering with respect to intraday 15-min time intervals at different levels of clustering (i.e nearest 0.5 rounding, 0.1 rounding and 0.05 rounding). Above graph shows Lisbon market (top row), Brussels market (middle row) and Amsterdam market (bottom row).

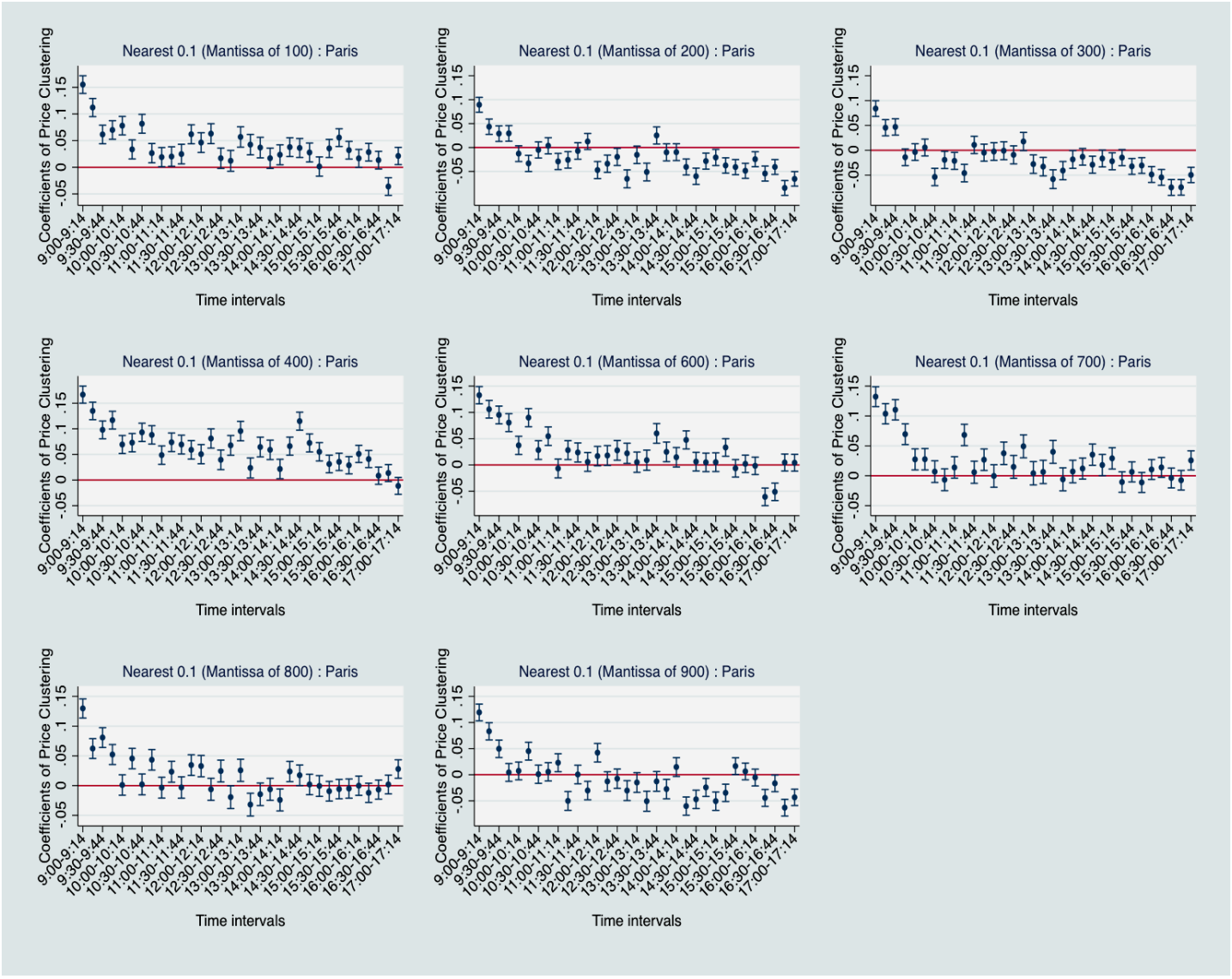


Figure 10: Paris market: Coefficients estimates of the determinants of Price clustering of Nearest 0.1 of a Euro with respect to intraday 15-min time intervals.

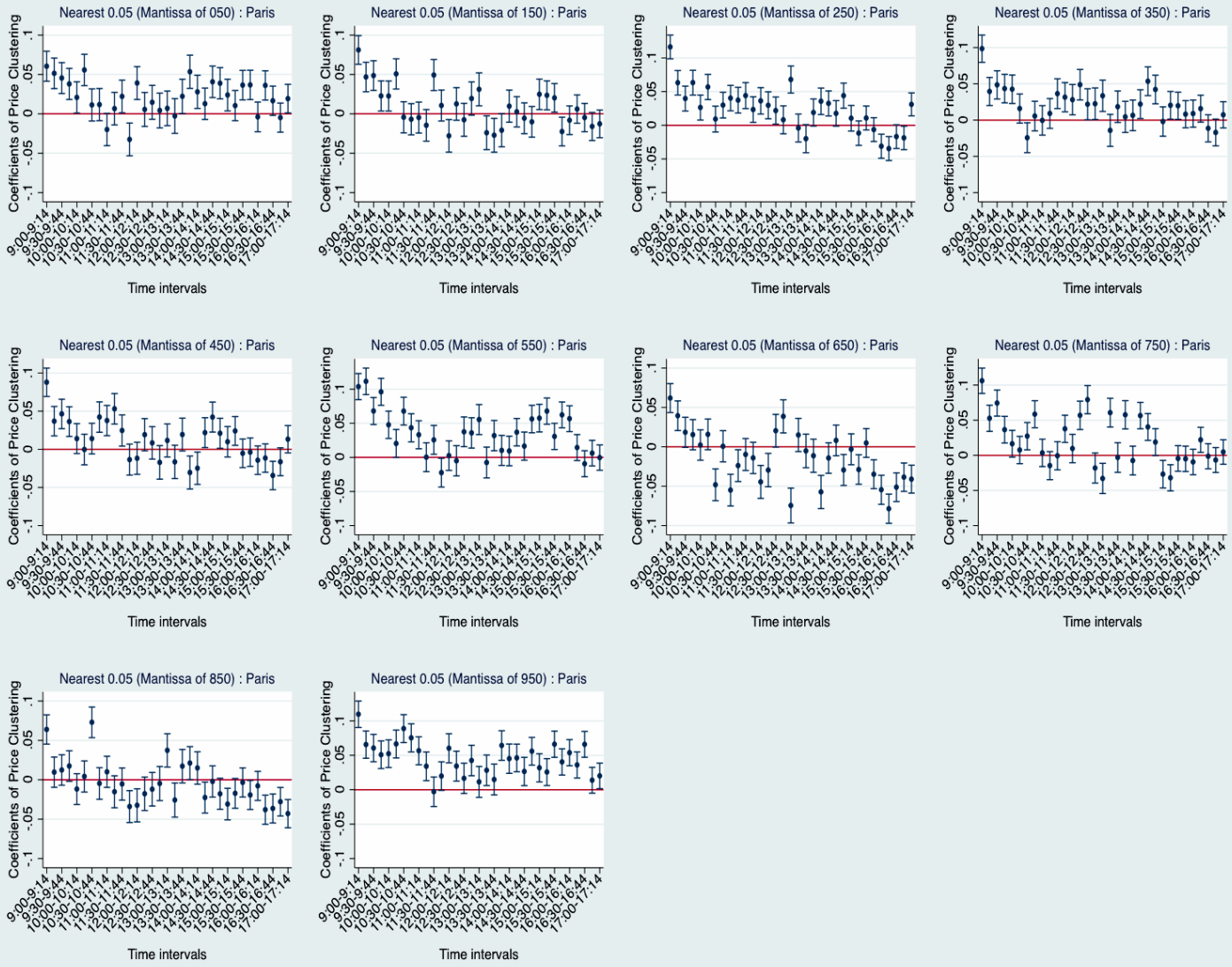


Figure 11: Paris market: Coefficients estimates of the determinants of Price clustering of Nearest 0.05 of a Euro with respect to intraday 15-min time intervals.