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Rouge Waves over a Shoal - Modelled by Mathematical Finance

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Abstract

Rogue waves are surface gravity waves whose wave heights are significantly larger than expected for the average sea state. This thesis is motivated by experimental data that shows that rogue wave statistics for surface displacement and rogue wave statistics for water velocity seem to behave independently. We want to describe this behaviour with the simplest possible model, using higher order comoments. Explanatory models with higher order comoments are fairly uncommon in hydrodynamics and wave theory, but are a common occurrence in mathematical finance. Due to unsynchronised measurement equipment there is a variant unknown lag between the surface displacement and the water velocity. Moreover, there is also a significant lack of benchmarks for higher order comoments. This makes it difficult to make a categorical conclusion on the behaviour of the higher order comoments. Yet we see that the cokurtosis between water velocity and surface displacement may indicate leptokurtic behaviour.

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1 Introduction

1.1 Motivation

Rogue waves garner significant attention from academia, the shipping and offshore industries, with good reason. These waves could be characterised by being much larger than the surrounding waves and are potentially extremely hazardous to ships and surrounding sea structures. An example of such a wave is the "New Year Wave" that hit the Draupner oil platform on January 1st 1995. It had a significant wave height of 11.8 meters and a crest height of 18.5 meters. (Haver 2004).

Oceanic rogue waves can be described as surface gravity waves whose wave heights are much larger than expected for the average sea state. (Dysthe, Krogstad and Müller 2008). This makes rogue waves a fascinating subject to study through the lens of financial mathematics. In essence, tools from financial asset pricing try to model deviations from expected outcomes.

This thesis is motivated by a surprising observation in experimental data from the master thesis by Stian Jorde (Jorde 2018) and published in (Trulsen et al. 2020). The rogue wave statistics for surface displacement have a completely different behavior than the rogue wave statistics for water velocity. This contradicts our 'ordinary' intuition. This research studies how surface displacement and water velocity seem to live separate lives with independent behaviour. Therefore, we propose a higher order comoment analysis as the simplest possible explanatory model. Although numerical simulations (ongoing doctoral work by Christopher Lawrence) appear to describe the behavior of the experiments, conducted by Stian Jorde, we must admit that the full hydrodynamic equations are not intuitive in how higher order comoments behave.

We therefore want to describe the behavior as simply as possible. We limit ourselves to coskewness and cokurtosis on an entirely empirical basis without attempting to find similar results from the Euler equation analytically.

Figure 2 on the following page shows that the surprising difference between surface displacement and water velocity appears in the fourth order moment, kurtosis, not the third order moment, skewness. Therefore, we have reason to believe that the simplest model that captures this strangeness must have fourth order comoments.

Explanatory models with higher order comoments are fairly uncommon in hydrodynamics and wave theory, but are a common occurrence in mathematical finance. Furthermore, using higher order comoments in financial asset pricing models is becoming an increasingly more popular field within financial research.

1.2 Previous research

Numerous studies have shown that as ocean waves propagate over a shoal the changes of depth, wavelength and amplitude can alter the statistical distribution of the waves. (Bitner 1980) Furthermore, a significant deviation from Gaussian statistics is found. (Cherneva et al. 2005).

This project uses experimental data produced in the master thesis of Stian Jorde, published in (Trulsen et al. 2020).

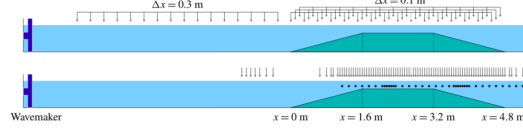


Figure 1: Wavemaker (Trulsen et al. 2020)

The experiments were carried out in a tank at the Hydrodynamical Laboratory of the Department of Mathematics at the University of Oslo. The paddle on the left generates irregular waves. The waves propagate from left to right. Surface displacement measurements were made with ultrasound probes from General Acoustics. Water velocity measurements were made with a 'vectrino' Acoustic Velocimeter (ADV) from Nortek. Non-linear wave processes are intensified as the waves propagate towards the shoal. This amplifies the occurrence of rogue waves, and we can therefore expect a deviation from Gaussian statistics. Hence, it is useful to study how higher order moments develop over the shoal.

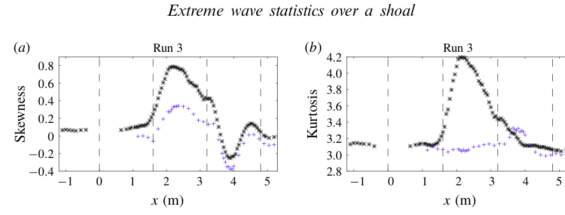


Figure 2: Skewness (a) and kurtosis (b) of surface displacement and water velocity, (Trulsen et al. 2020)

It is surprising that the kurtosis of the surface displacement and the kurtosis of the water velocity are vastly different from each other. It is relevant to study the simultaneous distributions of the two different observations, especially with regards to thick-tailed distributions and higher order cross moments such as coskewness and cokurtosis.

1.3 Research questions

Models based on coskewness and cokurtosis are widely known, and used within the realm of mathematical finance. However, using these models to study extreme waves in hydrodynamic wave theory, has probably not previously been attempted.

The experimental data provided by Stian Jorde induces an extra layer of complexity. The equipment used to measure surface displacement, $\eta(t)$, and water velocity, $v(t + \xi)$ are not synchronised. The lag, ξ , is unknown. Luckily, the data has a high resolution in time and it is therefore possible to use Fourier

analysis, particularly Discrete Fourier Transform, to interpolate to an arbitrary time, t .

Consequently, it is possible to calculate the higher order cross moments between $\eta(t)$ and $v(t + \xi + \tau)$. Still, we do not know the point at which lag is zero i.e., $\xi + \tau = 0$.

This leads to the following research question,

How can rogue waves be described by tools used in mathematical finance?

To achieve a satisfactory description of rogue waves, the lag in the data will have to be investigated. Therefore, understanding how the lag effects the higher order cross moments is critical. Luckily, there are tools that can possibly make the data less sensitive to the lag such as a Hilbert envelope. This leads to the following sub-questions:

1. How does the unknown lag effect the higher cross moments?
2. Does a Hilbert envelope make the data less sensitive to the lag?

1.4 Outline

Chapter 2 presents the relevant mathematical background, including topics in mathematics, mechanics, statistics and mathematical finance. Chapter 3 summarises the experimental setup. Chapter 4 introduces the research methodology. Chapter 5 presents the results and Chapter 6 concludes the thesis.

2 Mathematical Background

In order to describe rogue waves in hydrodynamic wave theory it is vital to have a basic familiarity with topics in mathematics, mechanics, statistics, and mathematical finance. A brief introduction to the necessary mathematical background is presented in this chapter.

2.1 Hydrodynamic Wave Theory

This thesis uses several different terms to describe the anatomy of a wave. They will be explained in turn here. The surface displacement of a wave, $\eta(t)$, describes the position of the top boundary layer between the water in which the wave propagates and air. The equilibrium surface level is the water level when the water is at rest.

A wave crest is the local maximums of the surface displacement function, i.e. a point at which the wave exhibits the maximum amount to displacement from the equilibrium surface level. Conversely, a wave trough is the local minimums of the surface displacement function.

The amplitude of a wave, a describes the maximum amount of displacement between the wave crest and the equilibrium surface level. The wave height H is the vertical distance between a neighboring wave crest and wave trough.

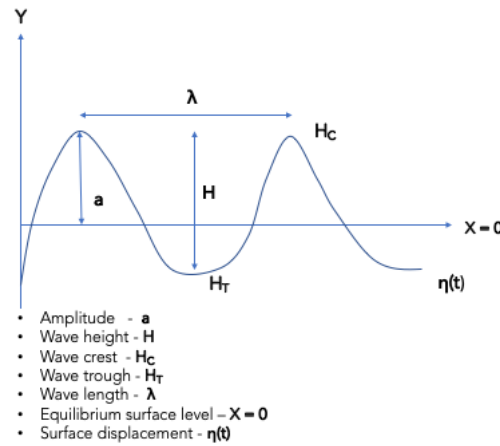


Figure 3: The anatomy of an wave

The modern definition of an ‘ordinary wave’ or the significant wave is four standard deviations of the surface displacement $\eta(x, t)$.

$$H_s = 4\sigma$$

In Hydrodynamic Wave theory there is a clear distinction between extreme waves and rogue waves. A wave categorized as extreme has large physical dimensions. A rogue wave is a wave that is unusual or suprising compared to

the significant wave height. In modern Hydrodynamic wave theory a rogue wave is defined, for a 20 minute times series measured at one point, as greater than two times the significant wave height.

$$H > 2H_s = 8\sigma$$

2.2 Fourier Analysis

The main strategy to tackle the lag is to use Fourier analysis, specifically Discrete Fourier Transform, to shift the observations of water velocity sequentially in time and observe how this effects higher order comoments.

Fourier analysis studies how arbitrary oscillations can be represented as superpositions of simple harmonic oscillations in time $e^{-i\omega t}$. The Discrete Fourier Transform converts a finite sequence with N elements, $\{f_j; j = 1, 2, \dots N\}$ into a sequence $\{\hat{f}_n; n = 1, 2, \dots N\}$ which represents a complex-valued function of frequency. The resulting sequence has the same spacing and number of elements as the original sequence. The Discrete Fourier Transform, DFT, can be represented by the expression, from (Trulsen 2019a),

$$\hat{f}_n = \frac{1}{N} \sum_{j=1}^N f_j e^{-\frac{2\pi i n j}{N}} \quad (1)$$

An in-depth theoretical knowledge of fourier analysis is not necessary for this paper. However, to be able to perform adjustments to the data so that the comoment calculations can be performed, two different techniques are introduced. The first is DFT resampling also known as ‘zero-padding’. The second technique is DFT interpolation. They will be presented as numerical methods. The Matlab code used in this thesis can be found in the appendicies. Section 7.1

DFT resampling

DFT resampling or ‘zero-padding’ is the process of taking a function with elements $\{f_j; j = 1, 2, \dots N\}$ and by DFT, converting it into it’s signal or spectrum $\{\hat{f}_n; n = 1, 2, \dots N\}$. It is then possible to extend the signal to a size M , where $M > N$, by padding the center of the signal, $N/2$ with $M - N$ zeros. We have

$$K = M - N$$

$$f_j = \{f_j \mid j = 1, 2, \dots N\}$$

The data is converted into its signal by the function *ifft*, which stands for inverse fast fourier transform. It is separated into its real and imaginary parts and then flipped inside out, by *fftshift* so that that the sequece is ordered from $N/2, \dots, 0, N, \dots, (N+1)/2$.

$$\hat{f}_n = \text{ifft}(f_j)$$

$$\hat{f}_{temp,real} = \text{fftshift}(\text{real}(\hat{f}_n))$$

$$\hat{f}_{temp,imag} = \text{fftshift}(\text{imag}(\hat{f}_n))$$

Now $(M - N)/2$ zeros are added to the beginning of the array, and also the end, so that $M - N$ zeros are added in total. The array is then shifted back, and converted back into function samples with *fft*, fast fourier transform.

$$\begin{aligned}\hat{f}_{m,real} &= \text{fftshift}(\text{real}(\hat{f}_{zeropad,real})) \\ \hat{f}_{m,imag} &= \text{fftshift}(\text{real}(\hat{f}_{zeropad,imag})) \\ \hat{f}_m &= \hat{f}_{m,real} + i\hat{f}_{m,imag} \\ f_m &= \text{fft}(\hat{f}_m)\end{aligned}$$

The function is now resampled.

DFT interpolation

DFT interpolation is a method of constructing or ‘shifting’ data points. We have a function $f(x)$ which is sampled at N points. The difference between DFT resampling and DFT interpolation is that with resampling we want to increase N , with DFT interpolation we want to change the rate at which the function is sampled, without necessarily increasing N . To numerically DFT interpolate with a specific lag we start with a sequence of a function $f(x)$ and convert it into its signal via *ifft*.

$$\begin{aligned}f_j &= \{f_j \mid j = 1, 2, \dots, N\} \\ \hat{f}_n &= \text{ifft}(f_j)\end{aligned}$$

We now use the loop

$$\begin{aligned}\text{for } k &= 1 : N \\ \text{if } k &< N/2 \\ b &= k - 1 \\ ik &= -1j \cdot b \cdot lag \\ \hat{f}_{n,k} &\cdot \exp(ik) \\ \text{else} \\ b &= k - 1 \\ L &= b - N \\ ik &= -1j \cdot L \cdot lag \\ \hat{f}_{n,k} &\cdot \exp(ik)\end{aligned}$$

Now all that is left is to shift the signal back into the function values.

2.3 Hilbert Envelopes

There are many versions of definitions of envelopes of stochastic processes and none of them are presented here. A thorough theoretical understanding of Hilbert envelopes is not relevant for the research. This thesis will test whether implementing Hilbert envelopes makes the data less sensitive to the lag.

However there are a few aspects of Hilbert envelopes which are vital to this thesis. The first is that the surface displacement can have both positive and negative values. The Hilbert envelope can only have positive values. Therefore, the Hilbert envelope will never describe the surface displacement of the wave itself. The Hilbert envelope is similar to the crest height. This can very easily be seen from Figure 4

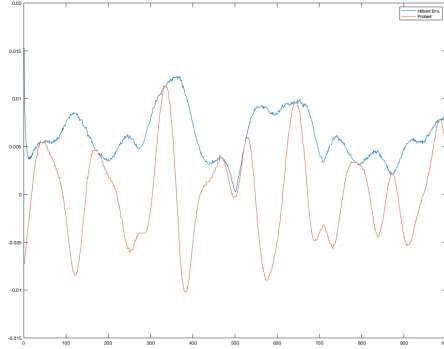


Figure 4: The Hilbert envelope of surface displacement compared with the actual surface displacement, Probe 4. This is a sample extracted from run nr. 96 and has a sample size of 1000 data points.

Secondly, if the original stochastic process is described by a Gaussian distribution then the Hilbert envelope is describe by a Rayleigh distribution. (Trulsen 2019b)

The algorithm this thesis has used to generate the Hilbert Envelope is

$$\begin{aligned} &\text{for } i = 1 : N \\ &\quad \hat{x}_i = x_i - \mu_x \\ &\quad \text{hilbert}_x = \text{abs}(\text{hilbert}(\hat{x}_i)) \end{aligned}$$

2.4 Higher Order Comoments

Coskewness measures the asymmetry of the simultaneous distributions of random variables. If the random variables have a positive coskewness then they exhibit positive asymmetry simultaneously. The reverse is true for negative coskewness. For random variables x and y coskewness can be expressed as, from (Miller 2013),

$$s(X, X, Y) = \frac{E[(x - E(X))^2(y - E(y))]}{\sigma_x^2 \sigma_y} \quad (2)$$

$$s(X, Y, Y) = \frac{E[(x - E(X))(y - E(y))^2]}{\sigma_x \sigma_y^2} \quad (3)$$

The coskewness or autoskewness of a univariate normal distribution is 0.

Cokurtosis is a statistical measure that identifies whether the tails of a simultaneous distribution contain more or less extreme values, i.e. outliers. A high cokurtosis means that the distribution contains more outliers and is therefore ‘thicker tailed’. A lower cokurtosis indicates that the distribution contains less outliers and is ‘thinner tailed.’ (Miller 2013)

$$k(X, X, Y, Y) = \frac{E[(x - E(X))^2(y - E(y))^2]}{\sigma_x^2 \sigma_y^2} \quad (4)$$

$$k(X, X, X, Y) = \frac{E[(x - E(X))^3(y - E(y))]}{\sigma_x^3 \sigma_y} \quad (5)$$

$$k(X, Y, Y, Y) = \frac{E[(x - E(X))(y - E(y))^3]}{\sigma_x \sigma_y^3} \quad (6)$$

Kurtosis is a special case of Cokurtosis where there is only one random variable. To make this distinction clear this thesis will utilize the term autokurtosis. The autokurtosis of a univariate Gaussian normal distribution is 3. If a univariate distribution of a random variable has an autokurtosis greater than 3, it is said to be leptokurtic. Similarly, if the univariate distribution of a random variable has an autokurtosis less than 3 it is platykurtic.

For a bivariate normal distribution, where X and Y are normally distributed variables with a correlation coefficient ρ , the cokurtosis can be calculated by, (Wikipedia 2020),

$$k(X, X, Y, Y) = 1 + 2\rho^2 \quad (7)$$

$$k(X, X, X, Y) = k(X, Y, Y, Y) = 3\rho \quad (8)$$

2.5 A brief introduction to Finance

Naturally, it is not possible to include a full introduction to the field of Finance within a few pages of a bachelor thesis. Therefore, this thesis will only briefly introduce a few topics relevant to asset pricing, which is the study of how financial assets are priced. Examples of financial assets are cash, stocks, bonds, mutual funds, derivatives etc.

Risk

The Cambridge English Dictionary defines risk as ‘the possibility of something bad happening.’ (Cambridge English Dictionary 2020). In Finance, the term

is much more complex. Controlling, understanding, modelling and describing risk is a separate field within finance called Risk Management.

In finance, risk is the possibility that the outcome will differ from the expected outcome. ‘Upside risk’ is the possibility of an increased expected return. In contrast, ‘Downside risk’ is the possibility of a decreased expected return.

Systematic risk or aggregate risk refers to the inherent risk in the market which effects the entire market. This risk could be attributed to broad economic, political or social factors such as i.e. a global pandemic. Unsystematic risk or idiosyncratic risk only effects specific individuals or assets and is not correlated to broad market returns.

The Capital Asset Pricing model

Although there are a number of asset pricing models the most famous and the most widely used is known simply as the Capital Asset Pricing Model, (CAPM). Most students of finance are presented with CAPM at an early stage in their academic careers. It describes the relationship between systematic risk and expected returns of an asset, in particular stocks. It is given by,

$$E(r_i) = r_f + [r_m - r_f]\beta_i \quad (9)$$

where

$$\begin{aligned} E(r_i) &= \text{The expected rate of return of asset } i \\ r_f &= \text{The risk free rate of the market} \\ \beta_i &= \text{The 'beta' of the investment} \\ [r_m - r_f] &= \text{The market risk premium} \end{aligned}$$

In finance the beta of an asset is a measure of how risky that investment is. The beta usually used in the CAPM is calculated by

$$\beta_i = \frac{\text{Covariance}(r_i, r_m)}{\text{variance}(r_i)} \quad (10)$$

There are naturally many different ways to calculate ‘betas’. The beta in Equation (10) is just the most common method that is taught to new students of finance.

A common critique of this type of beta estimation, and the CAPM, in general is that the model implies that variance alone is an effective measure of systematic risk. This implies that systematic risk is normally distributed, however previous research has shown this may not be the case e.g. it is documented that the distributions of price changes of British common stock are leptokurtic. (Fama 1965) Therefore, academics and financial analysts are on the hunt for models that can aptly describe the deviations from Gaussian statistics. Moreover, CAPM fails to describe the cross-section variation of risky asset return. Thus, other models have been created to study asset pricing.

Arbitrage Pricing Theory

The Arbitrage Pricing theory is a generalized linear model that is based on the principal that asset prices can be model by the linear relationship between the risk-free rate of return and a combination of unspecified macroeconomic variables. These macroeconomic variables are often called factors. The sensitivity to those macroeconomic variables is captured by a factor-specific beta coefficient.

$$E(r_i) = r_f + \sum_{j=1}^N [r_j - r_f] \beta_j + \epsilon_i \quad (11)$$

where

$E(r_i)$ = The expected rate of return of asset i

r_f = The risk free rate of the market

β_j = The 'beta' of the macroeconomic factor j

$[r_j - r_f]$ = The macroeconomic factor j risk premium

If $N > 1$ then model is called a multi factor model. The factor-specific beta coefficient is usually estimated via linear regression.

Fama - French three factor models

A model inspired by CAPM and APT is the Fama-French three factor model which links the risk market premium, size premium, and book-to-market premium, also called the value premium. It is a classic example of a multi factor model.

$$E(r_i) = r_f + [r_m - r_f] \beta_1 + SMB \beta_2 + HML \beta_3 \quad (12)$$

$E(r_i)$ = The expected rate of return of asset i

r_f = The risk free rate of the market

$\beta_{1,2,3}$ = Factor coefficients

$[r_m - r_f]$ = The market risk premium

SMB = Size premium

HML = Value premium

Higher Order Comoments and multi factor models

Unlike the asset pricing models presented above there is no specific higher order comoment asset pricing model that everyone adheres to. Multi factor models that implement higher order comoments are still subject to comprehensive research. The appeal of these models is clear. The distribution of asset price returns is usually assymetric and leptokurtic. (Boudt, Lu and Peeters 2015). Thus, it is also evident that the distribution of asset price returns is non - Gaussian.

(Kraus and Litzenberger 1976) were the first to suggest that higher comoments should also be priced, they specifically focused their research on coskewness. (Harvey and Siddique 2000) have also developed an asset pricing model that implements coskewness. (Dittmar 2002) constructed an asset pricing model that utilizes cokurtosis.

It is clear that the ‘true’ distribution of asset returns can never truly be known, (Chung, P. Johnson and Schill 2006) state that it is unlikely that the distribution of asset returns is fully described by mean and variance.

3 Experimental Setup

This thesis uses the experimental data produced by Stian Jorde and published in (Trulsen et al. 2020) and (Jorde 2018). This chapter will present a brief summary of the experimental setup, for a detailed description the reader is recommended to read (Jorde 2018).

The experiments were performed in the Hydrodynamics Laboratory of the Department of Mathematics at the University of Oslo. The tank is 24.5 m long with a ‘wave maker’ on the left end of the tank and a beach damping on the right end of the tank. The beach is 21.5 m away from the ‘wave maker’.

The start of the slope of the shoal is 10.6 m from the wave maker. The height from the bottom of the tank to the equilibrium surface level is $h_1 = 0.53$ m. The height from the top of the shoal to the equilibrium surface level is $h_2 = 0.11$ m. Figure 5 below details the experimental setup. The coordinate system is chosen such that $x = 0$ at the start of the shoal and $y = 0$ at the equilibrium surface.

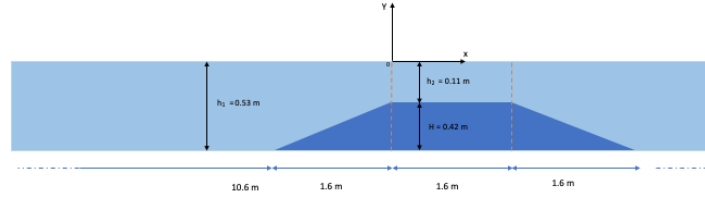


Figure 5: Experimental setup and coordinate system

Since the Hydrodynamic Laboratory only has one ADV, used to measure water velocity, and four ultrasound probes, used to measure surface displacement, the experiments had to be repeated several times along the tank. The ultrasound probes were placed with an internal distance of 25 cm with the last probe, hereafter called probe 4 and is the one furthest away from the wave maker, placed directly above the ADV.

The water height can be calculated through simple algebra and is defined as,

$$\begin{aligned}
 h &= -0.53 & \text{for } x < -1.6 \\
 h &= -0.11 + 0.2625x & \text{for } -1.6m < x < 0 \\
 h &= -0.11 & \text{for } 0 < x < 1.6 \\
 h &= -0.31 + 0.2625x & \text{for } 1.6 < x < 3.2 \\
 h &= -0.53 & \text{for } 3.2 < x
 \end{aligned}$$

The wave period is $T_p(s) = 1.1$

3.1 The lag

The surface displacement measurements were made with ultrasound probes from General Acoustics. Whilst the water velocity measurements were made

with a 'vectrino' Acoustic Velocimeter (ADV) from Nortek. The measurements are represented in separate time series arrays.

Each run of the experiment is initiated at a point along the tank and produces two time series arrays for water velocity and a time series array for surface displacement. The measurement equipment is not synchronised in the sense that the ADV and the ultra sound probes has to be initiated separately. Although the measurement equipment is initialised as simultaneously as possible, human error means that there is an unknown variant lag between the water velocity and the surface displacement.

4 Methodology

This chapter presents the structure of the research methodology applied and presents the hypothesis that are tested. Furthermore, this chapter reviews the limitations and validity of the study.

4.1 Calculation of comoments

Calculating the comoments is more challenging than repeatedly adding values to a formula. This is partly due to the fact that surface displacement and water velocity are sampled at different rates. The water velocity $v(t + \xi)$ is sampled with around 1 million data points, and the surface displacement, $\eta(t)$ is sampled with around 600000 data points. Therefore the first step is to use DFT resampling, Section 2.2, to resample the surface displacement to match the sample rate of the water velocity so that they both have the same length N . The time series for the surface displacement is denoted Probe4.

An additional complication is that the water velocity measured by the vectrino is not completely accurate, the water velocity is measured by two separate time series arrays. The average of these times series arrays is the array ADV which is used in the formula.

Due to the unknown lag between the times series ADV and Probe4 the comoments are calculated with and without Hilbert envelopes in the hope that by implementing the Hilbert envelopes the data will become less sensitive to the lag.

Now that the data is adequately adjusted the following comoments are calculated, ADV autoskewness and autokurtosis, Probe4 autoskewness and autokurtosis, cokurtosis, coskewness, covariation and correlation. Coskewness has two different variants, (2,1)coskewness,(2), and (1,2)coskewness, (3). Cokurtosis has three variants, (2,2)cokurtosis,(4), (3,1)cokurtosis,(5), and (1,3)cokurtosis,(6). All variants are calculated.

4.2 Time sensitivity analysis

To understand how the unknown lag between the time series affects the comoments we perform a time sensitivity analysis on the comoments with and without the Hilbert envelope. To do this effectively the Probe4 times series is resampled, and an average times series is calculated for the water velocity. The same procedure as in section 4.1.

Before the comoments are calculated we enforce a lag on the water velocity i.e. the ADV time series, $v(t + lag \cdot \Delta t)$. The lag is in the range $(-2, 2)$ with 0.05 intervals. The lag is constructed by using DFT interpolation, Section 2.2. It is important to note that the lag represents a shift in data points, not time. A lag of 1 represents shifting the data set by one complete data point, and not by one second.

After implementing the lag the following comoments are calculated. (2,2) cokurtosis, (2,1) coskewness, and correlation.

The time sensitivity analysis is performed along twelve different points along the tank, with and without the Hilbert Envelope. This produces three 22×111 matrices. One for each of the three calculated comoments.

4.3 Hypothesis

The goal of this research is to understand how rouge waves can be described by mathematical finance. This resarch is clearly exploratory since the previous research is highly limited. Futhermore, it is vital to how the unknown lag effects the data.

Comoment analysis

From, (Trulsen et al. 2020), we see that the autokurtosis and the autoskewness, of both the surface displacement and water velocity, show significant deviations from gaussian behavior. Therefore it is interessting to test whether the higher order comoments, cokurtosis and coskewness, of the simultaneous distribution of the water velocity and surface displace will also display non-gaussian behaviour.

Contrary to custom, this study presents three tested hypothesis. This is due to the lack of understanding of how the lag effects the data. We may not be able to conclude that the data shows Gaussian or non-Gaussian behavior, as there is the distinct possiblitiy that we may not be able to aptly correct the lag.

We have the following hypothesis

H_0 : *The higher order comoments are inconclusive.*

H_{a1} : *The higher order comoments show gaussian behavior.*

H_{a2} : *The higher order comoments show non-gaussian behavior.*

Time sensitivity analysis

The time sensitivity analyses will test two different hypothesis, the first is *if* the unknown variant lag between time series effects the data. This provides the following hypothesis,

$H_{0,1}$: *The unknown variant lag does not significantly effect the data.*

$H_{a,2}$: *The unknown variant lag does significantly effect the data.*

The second hypothesis is that the Hilbert envelope makes the data less sensitive to lag.

$H_{0,2}$: *The Hilbert envelope does not reduce the datas sensitivity to the lag.*

$H_{a,2}$: *The Hilbert envelope reduces the datas sensitivity to the lag.*

4.4 Limitations and Validity

External validity is the ability to generalise the results beyond the setting of the conducted research. (Easterby-Smith, Thorpe and Jackson 2010). The external

validity of this research is limited by the way in which the experiments are conducted. The way in which the shoal is constructed, the media in which the waves propagate and the wave spectrum along with countless other major and minor factors will impede any form of pure generalisation to other environments. Yet, the research in this study may be able to provide an indication of interesting research fields to other environments and may provide a direction for further inquiry.

Internal validity denotes how well the results of the study match reality. (Easterby-Smith, Thorpe and Jackson 2010). The largest limitation of internal validity is the lag between the time series. This is due to the measurement apparatus not being synchronised. If the lag cannot be sufficiently controlled the internal validity will depreciate.

The research is limited by the lack of previous studies using financial mathematics to analyse rouge waves. The study is also limited to describing rouge waves in a specific experimental setting.

5 Results

This chapter presents the results of the two different analyses performed in the study. The first is the comoment analysis. The second is the time sensitivity analysis.

5.1 Comoments analysis

The comoment analysis was successful in the sense that it was able to recreate the finding in (Trulsen et al. 2020). Because of the unknown variant lag the higher order comoments are highly unstable, with and without the Hilbert Envelope.

Correlation

From numerical analyses performed by Ph.D candiate Christopher Lawrence at the University of Oslo the expected correlation between the surface displacement and water velocity should be between 0.98 and 1. This is clearly not the case with the experimental data in Figure 6.

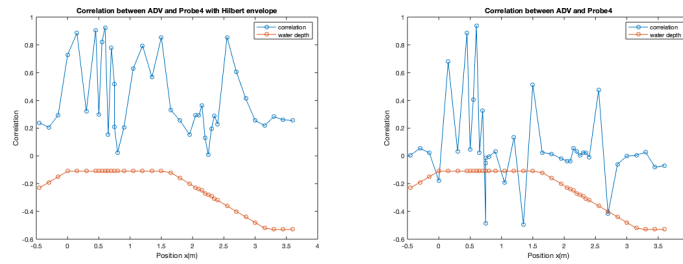


Figure 6: Comparison of correlation between ADV and Probe4 with and without Hilbert envelope

It is clear that the Hilbert envelope increases the correlation between the surface displacement, Probe4, and the water velocity, ADV, but not sufficiently. The data set with the Hilbert envelope has more correlation data points above 0.8 than the data set without the Hilbert envelope.

Coskewness

A normal distribution has a skewness of 0. The graphic representation of the data without the Hilbert envelope shows clearly that we are able to recreate the autoskewness of the surface displacement and water velocity presented in (Trulsen et al. 2020). It is also apparent that the variant unknown lag effects the coskewness as the coskewness appears ‘noisy’, i.e. highly variant.

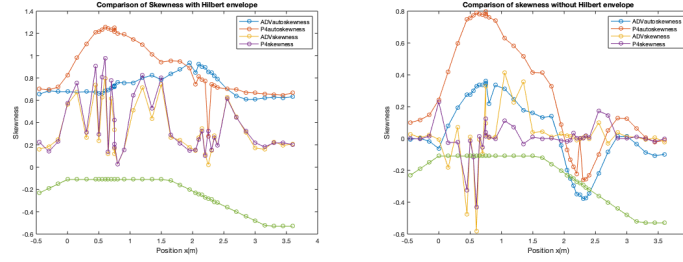


Figure 7: Comparison of coskewness with and without Hilbert envelope.

Cokurtosis

For a gaussian normal distribution the expected autokurtosis of a variable is 3. We can see from Figure 8 that the autokurtosis of the water velocity and the surface displacement clearly show deviations from gaussian statistics. However the cokurtosis of the simultaneous distribution is ‘noisy’. It varies violently between 1 and 3. It is suspected that this is due to the lag between time series not being adequately adjusted.

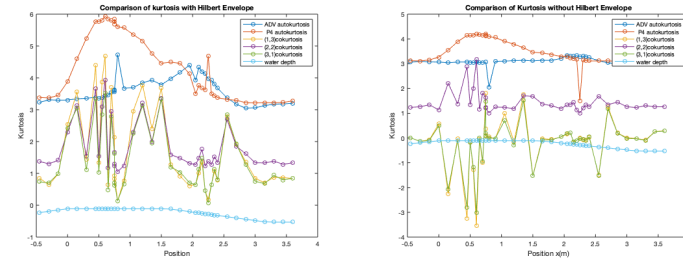


Figure 8: Comparison of cokurtosis with and without Hilbert envelope.

It is also clear that the Hilbert envelope amplifies the value of the autokurtosis. The maximal autokurtosis of the surface displacement is 5.93 with the Hilbert envelope. In comparison the without the Hilbert envelope the maximal autokurtosis of the surface displacement is 4.19. It is suspected that this increased autokurtosis, is due to the Hilbert envelope not describing the surface displacement, but rather the crest height.

Analysis

This thesis will only analyse the Gaussanity of the data without the Hilbert envelope. This is due to the fact that we seriously lack benchmarks. We only have a benchmark for the cokurtosis of a bi-variate Gaussian normal distribution. We do not have a benchmark for the cokurtosis or coskewness of a bi-variate Reyleigh distribution. This is important as if the Hilbert envelope is described by a Reyleigh distribution, then the underlying surface displacement is described by a Gaussian distribution.

It is also very frustrating that we do not have a benchmark for the coskewness of a bi-variate Gaussian normal distribution. Out of four possible benchmarks, we only have one. Moreover we will only analyse data points where the correlation between the surface displacement and water velocity is above 0.8. It is clear that this is far from perfect and certainly reduces validity of the results. Yet, it may be a useful indication for further research.

Run nr. with a correlation greater than 0.8			
Run nr.	Position $x(m)$	Water depth $y(m)$	Correlation
59	0.45	-0.11	0.8874
57	0.60	-0.11	0.9388

Table 1: This table show the run nr. with a correlation between ADV and Probe4 greater than 0.8.

The number of runs is greatly reduced, to only two runs, when a lower boundary of a correlation greater than 0.8 is implemented.

Run nr.	Position $x(m)$	Water depth $y(m)$	(2,2)Cokurtosis	Bi-variate normal (2,2)cokurtosis	Excess cokurtosis
59	0.45	-0.11	2.8814	2.5749	0.3064
57	0.60	-0.11	3.1698	2.7626	0.4073

Table 2: Comparison of the (2,2)cokurtosis of the experimental data and the (2,2)cokurtosis of a bi-variate normal distribution

Run nr.	(1,3)cokurtosis	(3,1)cokurtosis	Bi. Var. Normal cokurtosis	Excess(1,3)	Excess(3,1)
59	3.2428	2.7944	2.6622	0.5807	0.1323
57	3.5342	3.0141	2.8163	0.7179	0.1978

Table 3: Comparison of the (1,3)cokurtosis and (3,1)cokurtosis of the experimental data and the (1,3)/(3,1)cokurtosis of a bi-variate normal distribution

The benchmarks for the cokurtosis of a bi-variate Gaussian normal distribution are calculated using Equation (7) and Equation (8)

It is evident from Table 2 and Table 3 that the different runs show notable deviations from Gaussainity, with significant excess cokurtosis. This may imply that the different time series show leptokurtic behaviour. Notably, the (1,3)cokurtosis where Probe4, the surface displacement, is weighted to the power of three has more excess cokurtosis than the (3,1)cokurtosis. This may suggest that the surface displacement displays more lepokurtic behavior than the water velocity.

It is important to remind the reader at this stage that it is not possible to decisively conclude whether or not the cokurtosis of the simultaneous distribution of water velocity and surface displacement deviates from Gaussian statistics.

The correlation between time series is much lower than we would expect, due to the unknown variant lag. Therefore we have to keep our null hypothesis. The higher order comoments are inconclusive.

However, the runs presented in the tables above may imply that the simultaneous distribution between the water velocity and surface displacement is leptokurtic. This might point towards some form of deviation from Gaussian statistics. To be able to make a categorical conclusion the lag must be controlled, or the experiments redone with absolute synchronisation between measurement apparatus.

5.2 Time sensitivity analysis

The time sensitivity analysis data sets are quite large, 22×111 - matrices. The full data sets can be found in the appendices. Section 7.2

The major conclusion from the time sensitivity analysis is that the comoments are more stable with lag = 0. Moreover, with or without the Hilbert envelope the data is defenseless against a lag enforced through DFT interpolation. It is clear from the time sensitivity analysis of the correlation that as soon as lag deviates from lag = 0 the correlation drops to zero.

Time sensitivity of correlation				
lag	run 96 - with Hilbert	run 96 - without Hilbert	run 68 - with Hilbert	run 68 - without Hilbert
-1	0.0056	0.0040	-0.0201	0.0128
-0.5	0.0204	-0.0056	0.0225	0.0070
0,00	0,2391	0,0061	0,3224	0,0339
0.5	-0.0018	0.0007	0.0318	-0.0011
1	-0.0285	0.0091	-0.0179	-0.0179

Table 4: Table displaying an extract of the time sensitivity analysis of correlation

The time sensitivity analysis of correlation clearly shows that the Hilbert envelope reduces the data's sensitivity to the lag by increasing the correlation between surface displacement and the water velocity. However, not enough. The data is still very unsynchronised.

Moreover, we see from the time sensitivity analysis of the coskewness and the cokurtosis that comoments are very low and quite unstable. This clearly shows that the variant unknown lag between the surface displacement and water velocity has a significant affect on the higher order comoments.

Time sensitivity of coskewness				
lag	run 96 - with Hilbert	run 96 - without Hilbert	run 68 - with Hilbert	run 68 - without Hilbert
-1	-0.0107	-0.0056	-0.0428	-0.0092
-0.5	0.0381	0.0023	0.0180	0.0013
0.00	0.1630	-0.0011	0.2649	0.0218
0,5	-0.0056	0.0042	0.0363	0.0025
1	-0.0342	0.0033	-0.0211	-0.0120

Table 5: Table displaying an extract of the time sensitivity analysis of coskewness

Time sensitivity of cokurtosis				
lag	run 96 - with Hilbert	run 96 - without Hilbert	run 68 - with Hilbert	run 68 - without Hilbert
-1	1.032	0.996	0.935	1.035
-0.5	1.048	1.002	1.040	1.027
0.00	1.373	1.238	1.548	1.378
0.5	0.980	0.995	1.057	1.025
1	0.956	0.974	0.938	0.970

Table 6: Table displaying an extract of the time sensitivity analysis of cokurtosis

Therefore the time sensitivity analysis leads to the conclusion that the first null hypothesis, must be rejected. It is clear that the unknown variant lag significantly effects the data. There we accpect the first alternative hypothesis.

Futhermore we must reject the second null hypothesis, and accept the second alternative hypothesis. The Hilbert envelope makes the data less sensitive to the lag. However, it is not sufficient. Even with the Hilbert envelope the data is still to unsynchronised to make a categorical conclusion on the behaviour of the higher order comoments.

6 Conclusion

Rouge waves are inherently fascinating. From the doom-impending monster waves threatening maritime structures and ships to capillary waves in the blood, rouge waves are intrinsically suprising. They are an anomaly.

Studying rouge waves experimentally has proved to be a challenge. The two variables that this thesis has focused on describing is water velocity and surface displacement, using data measured at the Hydrodynamics labratory at the University of Oslo. Unfortunately the measurement equipment is not synchronised meaning there is a variant unknown lag between the variables.

This thesis has shown that the lag between the data sets significantly effects the higher order comoments, even with a Hilbert envelope. This means that the comoment analysis was inconclusive. However, if we isolate the ‘runs’ with a correlation above 0.8, meaning the ‘runs’, that are the most synchronised, then we see an indication of leptokurtic behavior.

6.1 Finance and Mechanics

Financial mathematics and Rouge waves in Hydrodynamic wave theory seem like unusual partners. Yet there are several obvious similarities. Financial analysts are interested in studying the anomalies in market data for a multitude of reasons, whether it is to hedge ‘down-side risk’, the risk of an asset suddenly losing value, or to sepeculate and find underpriced assets.

In very general terms, financial analysis is the art of studying anomalies in times series data and ‘trying’ to understand the reasons behind those anomalies. Therefore, some of the tools in finance used to understand asset return distributions may be applied to describe the behavior rouge waves.

The link between finance and rouge waves in hydrodynamic wave theory becomes even clearer when we learn that experimental data shows that the surface displacement and water velocity of waves, in a specific wave specturm, displays deviations from Gaussian behavior. The autoskewness of water velocity and the autoskewness of surface displacement clearly show assymmetric tendencies. Whilst the autokurtosis of water velocity and autokurtosis of surface displacement are leptokurtic. The distribution of asset price returns are assymmetric and leptokurtic. (Boudt, Lu and Peeters 2015)

Not to mention that the ‘true’ distribution of asset price returns can never really be known, and may be described by several macroeconomic factors whose interrelationship we do not fully understand. This also applies to rouge waves. We do not fully understand the behaviour of rouge waves, yet we know that they are described by water velocity and surface displacement. The interrelationship between water velocity and surface displacement is not fully understood. Therefore, multi factor asset pricing models that use higher order comoments may have the potential to better the understanding of rouge waves.

6.2 Further research

The experiments done by Stian Jorde should be repeated with absolutely synchronised measurement equipment. Benchmarks for higher order comoments of a bi-variate Rayleigh distribution should be found or developed along with a benchmark for the coskewness of a bi-variate Gaussian normal distribution.

Futhermore, an empirical joint distribution for surface elevation and water velocity should be implemented. This joint distribution should place emphasis on describing joint rogue wave behavior.

6.3 Closing remarks

While completing my masters degree in Business with a Major in Finance and Minor in Economics my risk management professor boldly stated that ‘risk management and risk theory applies wherever you find risk.’ By studying rouges waves through the lens of finance I have now been throughly convinced that he was right.

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7 Appendices

Code files and datasets can be found in the following GitHub repo:
<https://github.uio.no/evacbe/MEK3200>

7.1 MATLAB Code

Code - DFT resampling:

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Fourier analyse av Probe4 - Zeropadding
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%Sizes
N = size(Z1,1);
M = size(Probe4,1);

K = (N-M)/2;
a = ceil(K);
b = floor(K);

%IFFT and separation into real and imag
fn_hat = ifft(Probe4);
fn_real = real(fn_hat);
fn_imag = imag(fn_hat);

%FFTshift
fn_2real = fftshift(fn_real);
fn_2imag = fftshift(fn_imag);

%Zeropadding
before = zeros(a,1);
after = zeros(b,1);

temp_real = cat(1,before,fn_2real);
temp_imag = cat(1,before,fn_2imag);

temp_real = cat(1,temp_real,after);
temp_imag = cat(1,temp_imag,after);

%FFTshift back
fn_real = fftshift(temp_real);
fn_imag = fftshift(temp_imag);

%Combining real and imag
fn_hat = fn_real + 1i*fn_imag;

%FFT back
Probe4 = real(fft(fn_hat));
```

```

%Clearing temporary variables
clear a
clear b
clear before
clear after
clear K
clear M
clear fn_2imag
clear fn_2real
clear fn_hat
clear fn_imag
clear fn_real
clear temp_imag
clear temp_real

disp('Done!')

```

Code - Comoment calculation with Hilbert envelope:

```

%%%%%%%%%%%%%%
%Skript for å regne ut comomenter
%%%%%%%%%%%%%%

%Laster oppdata from SJ ved "ImportData" siden filformatet er
% .CSV. Det lagres i en tabell som kan omgjøres til numerisk array

% Bruker fourier.m for å interpolerer Probe4 først, FØR jeg kjører
% comoments.m

N = size(Z1, 1);
ADV = zeros(N,1);

%Finner Median Z for ADV
for i = 1:N
    ADV(i,1) = (Z1(i,1) + Z2(i,1))/2;
end

%Hilbert transform
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
meanADV = mean(ADV);
meanP4 = mean(Probe4);

```

```

tempADV = zeros(N,1);
tempP4 = zeros(N,1);

for i = 1:N
tempADV(i,1) = ADV(i,1) - meanADV;
tempP4(i,1) = Probe4(i,1) - meanP4;
end

%Hilbert transform av daten
HilbertADV = abs(hilbert(tempADV));
HilbertProbe4 = abs(hilbert(tempP4));

clear tempADV
clear tempP4

%Uregning av comomenter
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Gjennomsnittet av Hilbertenvelopen brukes til å regne ut cokurtosis
ExpectedHilbertADV = mean(HilbertADV);
ExpectedHilbertProbe4 = mean(HilbertProbe4);
StdHilADV = std(HilbertADV);
StdHilProbe4 = std(HilbertProbe4);

%Mellomregning for å regne ut cokurtosis
T0_T0nestenkurtosis = zeros(N,1);
EN_TREnestenkurtosis = zeros(N,1);
TRE_ENnestenkurtosis = zeros(N,1);

for j = 1:N
T0_T0nestenkurtosis(j,1) = ((HilbertADV(j,1) - ExpectedHilbertADV)^2 *
    (HilbertProbe4(j,1) - ExpectedHilbertProbe4)^2)
    /(StdHilADV^2 * StdHilProbe4^2);
EN_TREnestenkurtosis(j,1) = ((HilbertADV(j,1) - ExpectedHilbertADV) *
    (HilbertProbe4(j,1) - ExpectedHilbertProbe4)^3)
    /(StdHilADV * StdHilProbe4^3);
TRE_ENnestenkurtosis(j,1) = ((HilbertADV(j,1) - ExpectedHilbertADV)^3 *
    (HilbertProbe4(j,1) - ExpectedHilbertProbe4))
    /(StdHilADV^3 * StdHilProbe4);
end

%Den faktiske cokurtosen
T0_T0cokurtosis = mean(T0_T0nestenkurtosis)
EN_TREcokurtosis = mean(EN_TREnestenkurtosis)
TRE_ENcokurtosis = mean(TRE_ENnestenkurtosis)

clear T0_T0nestenkurtosis
clear EN_TREnestenkurtosis
clear TRE_ENnestenkurtosis

```

```

%autokurtose
ADVnestenkartose = zeros(N,1);
P4nestenkartose = zeros(N,1);

for i = 1:N
    ADVnestenkartose(i,1) = (HilbertADV(i,1) - ExpectedHilbertADV)^4
    /StdHilADV^4;
    P4nestenkartose(i,1) = (HilbertProbe4(i,1) - ExpectedHilbertProbe4)^4
    /StdHilProbe4^4;
end

ADVautokurtose = mean(ADVnestenkartose)
P4autokurtose = mean(P4nestenkartose)

%Mellomregning for å finne skewness
ADVnestenskartose = zeros(N,1);
P4nestenskartose = zeros(N,1);

for j = 1:N
    ADVnestenskartose(j,1) = ((HilbertADV(j,1) - ExpectedHilbertADV)^2 *
    (HilbertProbe4(j,1) - ExpectedHilbertProbe4))/(StdHilADV^2 * StdHilProbe4);
    P4nestenskartose(j,1) = ((HilbertADV(j,1) - ExpectedHilbertADV) *
    (HilbertProbe4(j,1) - ExpectedHilbertProbe4)^2)/(StdHilADV * StdHilProbe4^2);
end

%Skewness
ADVskewness = mean(ADVnestenskartose)
P4skewness = mean(P4nestenskartose)

%autoskewness

tmpADVautoskewness = zeros(N,1);
tmpP4autoskewness = zeros(N,1);

for i = 1:N
    tmpADVautoskewness(i,1) = (HilbertADV(i,1) - ExpectedHilbertADV)^3
    /StdHilADV^3;
    tmpP4autoskewness(i,1) = (HilbertProbe4(i,1) - ExpectedHilbertProbe4)^3
    /StdHilProbe4^3;
end

ADVautoskewness = mean(tmpADVautoskewness)
P4autoskewness = mean(tmpP4autoskewness)

%correlation

almostcovariance = cov(HilbertADV, HilbertProbe4)
almostcorrelation = corrcoef(HilbertADV, HilbertProbe4)
correlation = almostcorrelation(1,2)

```

```
covariance = almostcovariance(1,2)
disp('Done!')
```

```
%REMEMBER TO SAVE TO TABLE!
```

```
% -- FIRST: Import table
```

```
%cellcomo = {filenumber, posi, vann, ADVautokurtose, P4autokurtose, EN_TREcokurtosis, T
```

```
%como = [como; cellcomo];
```

```
cellcorr = {filenumber, covariance, correlation}
```

```
corr = [corr; cellcorr];
```

Code - Comoment calculation without Hilbert envelope

```
%Skript for å regne ut comomenter uten Hilbert envelope
```

```
%%%%%%%%%%
```

```
%Laster oppdata from SJ ved "ImportData" siden filformatet er
```

```
% .CSV. Det lagres i en tabell som kan omgjøres til numerisk array
```

```
% Bruker fourier.m for å interpolerer Probe4 først, FØR jeg kjører
```

```
% comoments.m
```

```
N = size(Z1, 1);
```

```
ADV = zeros(N,1);
```

```
%Finner Median Z for ADV
```

```
for i = 1:N
```

```
ADV(i,1) = (Z1(i,1) + Z2(i,1))/2;
```

```
end
```

```
%utregning av comomenter
```

```
%%%%%%%%%%
```

```
meanADV = mean(ADV);
```

```
meanP4 = mean(Probe4);
```

```
stdP4 = std(Probe4);
```

```
stdADV = std(ADV);
```

```
tempADV = zeros(N,1);
```

```
tempP4 = zeros(N,1);
```

```
for i = 1:N
```

```
tempADV(i,1) = ADV(i,1) - meanADV;
```

```
tempP4(i,1) = Probe4(i,1) - meanP4;
```

end

%Mellomregning for å regne ut cokurtosis

T0_T0nestenkurtosis = zeros(N,1);

EN_TREnestenkurtosis = zeros(N,1);

TRE_ENnestenkurtosis = zeros(N,1);

for j = 1:N

T0_T0nestenkurtosis(j,1) = (tempADV(j,1)^2 * tempP4(j,1)^2)/(stdADV^2 * stdP4^2);

EN_TREnestenkurtosis(j,1) = (tempADV(j,1) * tempP4(j,1)^3)/(stdADV * stdP4^3);

TRE_ENnestenkurtosis(j,1) = (tempADV(j,1)^3 * tempP4(j,1))/(stdADV^3 * stdP4);

end

%Den faktiske cokurtosen

T0_T0cokurtosis = mean(T0_T0nestenkurtosis)

EN_TREcokurtosis = mean(EN_TREnestenkurtosis)

TRE_ENcokurtosis = mean(TRE_ENnestenkurtosis)

clear T0_T0nestenkurtosis

clear EN_TREnestenkurtosis

clear TRE_ENnestenkurtosis

%autokurtose

ADVautokurtose = kurtosis(ADV)

P4autokurtose = kurtosis(Probe4)

%Mellomregning for å finne skewness

ADVnestensskewness = zeros(N,1);

P4nestensskewness = zeros(N,1);

for j = 1:N

ADVnestensskewness(j,1) = (tempADV(j,1) * tempP4(j,1)^2)/(stdADV * stdP4^2);

P4nestensskewness(j,1) = (tempADV(j,1)^2 * tempP4(j,1))/(stdADV^2 * stdP4);

end

%Skewness

ADVskewness = mean(ADVnestensskewness)

P4skewness = mean(P4nestensskewness)

%autoskewness

tmpADVautoskewness = zeros(N,1);

tmpP4autoskewness = zeros(N,1);

for i = 1:N

tmpADVautoskewness(i,1) = tempADV(j,1)^3/stdADV^3;

```

tmpP4autoskewness(i,1) = tempP4(j,1)^3/stdP4^3;
end

ADVautoskewness = skewness(ADV)
P4autoskewness = skewness(Probe4)

%correlation

almostcovariance = cov(ADV, Probe4)
almostcorrelation = corrcoef(ADV, Probe4)
correlation = almostcorrelation(1,2)
covariance = almostcovariance(1,2)
disp('Done!')

%REMEMBER TO SAVE TO TABLE!
% -- FIRST: Import table
cellcomo = {filenumber, ADVautokurtose, P4autokurtose, EN_TREcokurtosis,
    TO_T0cokurtosis, TRE_ENcokurtosis, ADVautoskewness, P4autoskewness,
    ADVskewness, P4skewness, covariance, correlation};
UHcomo = [UHcomo; cellcomo];

```

Code - Time sensitivity analysis

```

%Tidsfølsomhets analyse

%Kjør fourier.m som vanlig
%så kjører du dette scriptet

for f = -2:+0.05:3.5
    lag = f

    N = size(Z1, 1);
    ADV = zeros(N,1);

    %Finner Median Z for ADV
    for i = 1:N
        ADV(i,1) = (Z1(i,1) + Z2(i,1))/2;
    end

    ADV_hat = ifft(ADV);

    gADV_hat = zeros(N,1);

```

```

for k = 1:N
if k< N/2
b = k-1;
ik = -1j*b*lag;
gADV_hat(k,1) = ADV_hat(k,1) * exp(ik);
else
b = k-1;
l = b-N;
ik = -1j*l*lag;
gADV_hat(k,1) = ADV_hat(k,1) * exp(ik);
end
end

ADV = real(fft(gADV_hat));

%clearing variables
clear ADV_hat
clear b
clear gADV_hat
clear gP4_hat
clear i
clear ik
clear k
clear l
clear P4_hat

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% comoments
meanADV = mean(ADV);
meanP4 = mean(Probe4);
stdADV = std(ADV);
stdP4 = std(Probe4);

for i = 1:N
tempADV(i,1) = ADV(i,1) - meanADV;
tempP4(i,1) = Probe4(i,1) - meanP4;
end

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Hilbert transform av daten
HilbertADV = abs(hilbert(tempADV));
HilbertProbe4 = abs(hilbert(tempP4));

%Utgangning av comomenter
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Gjennomsnittet av Hilbertenvelopen brukes til å regneut cokurtosis
ExpectedHilbertADV = mean(HilbertADV);
ExpectedHilbertProbe4 = mean(HilbertProbe4);
StdHilADV = std(HilbertADV);
StdHilProbe4 = std(HilbertProbe4);

```

```

%Mellomregning for å regne ut comomenter
T0_TOHilbertnestenkurtosis = zeros(N,1);
T0_TOUtennestenkurtosis = zeros(N,1);
T0_ENHilbertnestenSkewness = zeros(N,1);
T0_ENnestenSkewness = zeros(N,1);

for j = 1:N
T0_TOHilbertnestenkurtosis(j,1) = ((HilbertADV(j,1) - ExpectedHilbertADV)^2 *
(HilbertProbe4(j,1) - ExpectedHilbertProbe4)^2)
/(StdHilADV^2 * StdHilProbe4^2);

T0_TOUtennestenkurtosis(j,1) = ((ADV(j,1) - meanADV)^2*(Probe4(j,1)-meanP4)^2)
/(stdADV^2 * stdP4^2);

T0_ENHilbertnestenSkewness(j,1) = ((HilbertADV(j,1) - ExpectedHilbertADV)^2 *
(HilbertProbe4(j,1) - ExpectedHilbertProbe4))
/(StdHilADV^2 * StdHilProbe4);
T0_ENnestenSkewness(j,1) = ((ADV(j,1) - meanADV)^2*
(Probe4(j,1)-meanP4))
/(stdADV^2 * stdP4);
end

%De faktiske comomentene
T0_TOHilbertcokurtosis = mean(T0_TOHilbertnestenkurtosis)
T0_TOUtenncokurtosis = mean(T0_TOUtennestenkurtosis)

T0_ENHilbertSkewness = mean(T0_ENHilbertnestenSkewness);
T0_ENUtenSkewness = mean(T0_ENnestenSkewness)

almostcorrelationUTEN = corrcoef(ADV, Probe4);
correlationUTEN = almostcorrelationUTEN(1,2)

almostcorrelationHilbert = corrcoef(HilbertADV, HilbertProbe4);
correlationHilbert = almostcorrelationHilbert(1,2)

clear T0_TOHilbertnestenkurtosis
clear T0_TOUtennestenkurtosis
clear T0_ENHilbertnestenSkewness
clear T0_ENnestenSkewness

celltimesensT0_TOcokurtosis = {lag,T0_TOHilbertcokurtosis, T0_TOUtenncokurtosis};
timesensT0_TOcokurtosis = [timesensT0_TOcokurtosis; celltimesensT0_TOcokurtosis];

celltimesensT0_ENSkewness = {lag,T0_ENHilbertSkewness, T0_ENUtenSkewness};
timesensT0_ENSkewness = [timesensT0_ENSkewness; celltimesensT0_ENSkewness];

celltimesensCorr = {lag,correlationUTEN,correlationHilbert};

```

```
timesensCorr = [timesensCorr; celltimesensCorr];  
end
```

```
disp('Done!')  
%%% Når man har kjørt analysen fra -2 - 3.5  
% Kan man regne ut variansen og standard avvik
```

7.2 Datasets

Comoments with Hilbert Envelope

Note: I organised the dataset that (ADV/4)

ADV: Water velocity

P4 - Problem 4 - Surface displacement

run #	position x (m)	water depth y (m)	ADV autocorrelation	P4 autocorrelation	(1,2) cokurtosis	(2,2) cokurtosis	(3,1) cokurtosis	ADV autocorrelation	P4 autocorrelation	(2,1) skewness	(1,2) skewness	covariance	correlation
96	-0.45	-0.23	3.2279	3.3832	0.8541	1.3727	1.3727	0.7852	0.6552	0.1530	0.1241	-0.00042951	0.2300976
95	-0.10	-0.19	3.3100	3.6376	0.6396	1.3007	1.3007	0.7024	0.6859	0.1849	0.1419	-0.00008167	0.2952720
71	-0.15	-0.15	3.2991	3.4515	0.9830	1.4110	0.9918	0.9918	0.6774	0.2491	0.2289	-0.00098038	0.2948387
69	0.00	-0.11	3.3038	3.4788	2.5411	2.2944	2.4220	2.4220	0.6776	0.5655	0.5758	-0.00006489	0.7275171
60	0.15	-0.11	3.3423	4.5925	3.5663	3.1357	3.0520	3.0520	0.6736	0.9803	0.7559	0.00001054	0.8850474
68	0.30	-0.11	3.3599	5.2383	1.4288	1.5478	1.1135	1.1135	0.6772	0.2649	0.3132	0.00002589	0.3223806
59	0.45	-0.11	3.3870	5.7746	4.3978	3.6571	3.3300	3.3300	0.6747	0.7407	0.9059	0.00054207	0.9059043
56	0.50	-0.11	3.3576	5.7656	1.3386	1.5392	1.3386	1.0256	0.6632	0.2367	0.2959	0.000021899	0.2961005
57	0.55	-0.11	3.3693	5.8095	3.8728	3.0836	2.8560	2.8560	0.6609	0.6769	0.8055	-0.00000162	0.8197877
58	0.60	-0.11	3.4317	5.9349	4.6899	3.9369	3.5294	3.5294	0.6843	0.7944	0.9798	-0.00003801	0.9251675
76	0.65	-0.11	3.4645	5.8431	0.6357	1.1651	0.4867	0.4867	0.6919	0.1173	0.1376	0.00030184	0.1512164
77	0.70	-0.11	3.5335	5.8025	3.6943	2.9529	2.7854	2.7854	0.7116	0.6178	0.7778	0.00002201	0.7789201
67	0.75	-0.11	3.5696	5.6933	2.1246	1.6573	1.6215	1.6215	0.7209	0.3338	0.4234	-0.00029091	0.5187000
80	0.75	-0.11	3.6012	5.7630	0.8347	1.2288	0.6155	0.6155	0.7281	0.1201	0.1768	0.00000740	0.2070233
87	0.75	-0.11	3.6203	5.8393	0.9347	1.3021	1.2288	0.7100	0.7345	0.1643	0.2095	-0.00012174	0.2094467
72	0.80	-0.11	3.6226	5.6020	0.1352	1.0533	0.1349	0.1349	0.7624	0.0259	0.0292	0.00002350	0.0247586
66	0.90	-0.11	3.6725	5.5726	0.7707	1.2430	0.6684	0.6684	0.7570	0.1533	0.1555	0.00004264	0.2031614
64	1.05	-0.11	3.6943	5.3571	2.9560	2.3001	2.2480	2.2480	0.7581	0.5098	0.6437	-0.00007422	0.6297186
61	1.20	-0.11	3.8465	5.1632	3.7721	3.2111	3.1331	3.1331	0.8009	0.7163	0.8256	-0.000035139	0.7941100
62	1.35	-0.11	3.9275	4.7649	2.3993	1.9989	1.9567	1.9567	0.8245	0.4360	0.5284	-0.00006497	0.5662815
63	1.50	-0.11	3.7845	4.4568	3.6843	3.3638	3.3398	3.3398	0.7828	0.7463	0.8051	-0.00004670	0.8848045
65	1.65	-0.12	3.9728	4.4932	1.2755	1.5904	1.2026	1.2026	0.8361	0.2884	0.2888	-0.00004116	0.3301264
73	1.80	-0.16	4.1729	4.4545	0.9159	1.4767	1.0405	1.0405	0.8759	0.2417	0.2136	-0.00003108	0.2544855
74	1.95	-0.20	4.4001	4.1261	0.6122	1.3199	0.8921	0.7080	0.9339	0.1787	0.1477	-0.00005754	0.1538763
86	2.05	-0.23	3.9227	3.4988	0.6501	1.2745	0.6410	0.6410	0.8484	0.1488	0.1552	-0.00005032	0.2947939
75	2.10	-0.24	4.5846	3.7685	1.0094	1.4648	1.1345	1.1345	0.8268	0.2657	0.2506	0.00016389	0.2312065
82	2.15	-0.25	4.1548	3.6785	0.6783	1.1578	0.6783	0.6783	0.8361	0.3146	0.3065	-0.00003615	0.3463615
83	2.20	-0.27	4.1321	3.6178	1.2698	1.2288	0.9332	0.9332	0.8931	0.158	0.1605	-0.00002365	0.2753238
78	2.25	-0.28	3.9860	4.8651	0.1774	1.2880	0.1774	0.1774	0.8931	0.158	0.1605	-0.00002365	0.2753238
78	2.30	-0.29	3.9227	3.4988	0.6501	1.2745	0.6410	0.6410	0.8484	0.1488	0.1552	-0.00005032	0.1938585
85	2.35	-0.31	3.8021	3.4399	1.0620	1.2745	0.6410	0.6410	0.8484	0.1488	0.1552	-0.00005032	0.1938585
79	2.40	-0.32	3.6741	3.3787	0.7899	1.5257	0.7300	0.7300	0.7900	0.2419	0.2641	-0.00000255	0.2897019
81	2.55	-0.36	3.3723	3.3211	2.7850	1.3384	0.8014	0.8014	0.7900	0.1933	0.1933	0.00002802	0.2289436
88	2.70	-0.40	3.1729	3.2955	1.9120	2.6989	1.9235	1.9235	0.7014	0.7022	0.6800	0.00002071	0.8553487
89	2.85	-0.44	3.0468	3.2205	1.3584	1.8513	1.2775	1.2775	0.6400	0.4260	0.4470	0.00045747	0.6057097
90	3.00	-0.48	3.0614	3.2136	0.8502	1.6155	0.6081	0.6081	0.6095	0.3124	0.3258	0.00051274	0.4126315
91	3.15	-0.52	3.1266	3.2219	0.7037	1.3343	0.6657	0.6657	0.6095	0.1712	0.2206	-0.00042250	0.2554574
93	3.30	-0.53	3.1748	3.2197	0.8763	1.3281	0.6771	0.6771	0.6201	0.1610	0.1826	0.00040280	0.2176613
92	3.45	-0.53	3.1802	3.2281	0.8696	1.3835	0.9396	0.9396	0.6303	0.2277	0.2167	0.00001016	0.2823403
93	3.45	-0.53	3.1802	3.2281	0.8696	1.3835	0.9396	0.9396	0.6303	0.2277	0.2167	0.00001016	0.2823403
94	3.60	-0.53	3.2007	3.2750	0.8416	1.3349	0.8483	0.8483	0.6324	0.1964	0.2189	0.00001113	0.2598704
										0.2061	0.2040	0.00005085	0.2559179

Comoments uten Hilbert

Note: I organised the data so that (ADV,P4)

ADV - Water velocity

P4 - Problem 4 - Surface displacement

run #	position	water depth	ADVautokurtose	P4autokurtose	(1,3) cokurtosis	(2,2) cokurtosis	(3,1) cokurtosis	ADV autoskewness	P4 autoskewness	(2,1) skewness	(1,2) skewness	covariance	correlation
96	-0.45	-0.23	3.0585	3.1214	-0.0119	1.2377	-0.0116	-0.0045	0.1007	0.0268	0.0011	-0.000001	0.0061
95	-0.30	-0.19	3.0995	3.1100	0.1358	1.2610	0.1371	0.0009	0.1167	0.0064	-0.0026	-0.000013	0.0541
71	-0.15	-0.15	3.0728	3.1501	0.0707	1.3408	0.0937	-0.0174	0.1478	0.0220	0.0144	-0.000006	0.0220
69	0.00	-0.11	3.0674	3.2676	-0.5716	1.1324	-0.4895	0.2430	0.2430	-0.0046	0.2293	0.000059	-0.1784
60	0.15	-0.11	3.0354	3.5471	2.2532	2.2131	2.0711	0.0802	0.4203	-0.1829	-0.0269	-0.000222	0.6783
68	0.30	-0.11	3.0658	3.8874	0.0218	1.3779	0.1105	0.1922	0.5959	0.0716	-0.0218	-0.000011	0.0339
59	0.45	-0.11	3.0706	4.1412	3.2428	2.8814	2.7944	0.2757	0.7481	-0.4764	-0.3238	-0.000283	0.8874
56	0.50	-0.11	3.0572	4.1358	0.1504	1.3443	0.1840	0.2740	0.7581	0.0116	-0.0134	-0.000015	0.0465
57	0.55	-0.11	3.0442	4.1548	1.2727	1.9985	1.1674	0.3004	0.7722	-0.1179	-0.1151	-0.000127	0.4040
58	0.60	-0.11	3.0613	4.1939	3.5342	3.1698	3.0141	0.3291	0.7888	-0.5806	-0.4321	-0.000290	0.9388
76	0.65	-0.11	3.0453	4.1675	0.0639	1.1593	-0.0003	0.3347	0.7889	-0.0080	0.0136	-0.000007	0.0232
77	0.70	-0.11	3.0552	4.1554	1.0001	1.8161	0.9301	0.3360	0.7780	-0.0941	-0.0532	-0.000101	0.3280
67	0.75	-0.11	3.0603	4.1202	-1.8157	1.6319	-1.4672	0.3426	0.7691	0.3292	0.1245	0.000149	-0.4865
80	0.75	-0.11	3.0621	4.1557	-0.3767	1.2305	-0.1914	0.3480	0.7819	0.0943	0.0140	0.000016	-0.0520
87	0.75	-0.11	3.0706	4.2005	-0.0963	1.2108	-0.0797	0.3607	0.7964	0.0228	0.0367	0.000004	-0.0143
72	0.80	-0.11	2.0442	4.0942	-0.0461	1.0055	-0.0087	0.2188	0.7606	0.0052	0.0096	0.000001	-0.0041
66	0.90	-0.11	3.0956	4.0557	0.0344	1.2502	0.0185	0.3348	0.7420	0.0104	-0.0040	-0.000010	0.0308
64	1.05	-0.11	3.1048	3.9038	-0.9902	1.2400	-0.7070	0.3124	0.6292	0.4130	0.1114	0.000059	-0.1936
61	1.20	-0.11	3.1233	3.7881	0.1604	1.1764	0.2978	0.2476	0.5803	0.2284	0.0733	-0.000040	0.1333
62	1.35	-0.11	3.1338	3.6431	-1.7564	1.7024	-1.5191	0.1786	0.5170	0.3563	-0.0331	-0.000144	-0.4931
63	1.50	-0.11	3.1145	3.4618	1.5203	1.6859	1.5299	0.1609	0.4142	0.0375	0.0084	-0.000149	0.5126
65	1.65	-0.12	3.1355	3.4352	0.0239	1.3772	0.0764	0.1323	0.4122	0.0439	0.0000	-0.000007	0.0250
73	1.80	-0.16	3.1327	3.3714	0.0578	1.3005	0.0767	0.1391	0.3267	0.0107	0.0008	-0.000003	0.0138
74	1.95	-0.20	3.2144	3.2896	-0.0423	1.1898	-0.0510	-0.0425	0.0877	0.0288	-0.0124	0.000004	-0.0187
86	2.05	-0.23	3.3297	3.2856	-0.1596	1.3366	-0.1896	-0.1991	-0.0719	0.0193	-0.0185	0.000007	-0.0378
75	2.10	-0.24	3.3102	3.2329	-0.2051	1.3416	-0.2086	-0.2518	-0.1336	0.0147	-0.0121	0.000007	-0.0375
82	2.15	-0.25	3.2988	3.2045	0.1752	1.4382	0.1613	-0.2977	-0.1762	0.0108	0.0344	-0.000010	0.0555
83	2.20	-0.27	3.3250	3.1872	0.0916	1.1372	0.0905	-0.3490	-0.2214	-0.0111	0.0036	-0.000005	0.0301
78	2.25	-0.28	3.2807	1.5065	0.0011	1.0021	0.0240	-0.3510	0.0002	-0.0032	0.0022	-0.000010	0.0027
84	2.30	-0.29	3.2955	3.1456	0.0683	1.2042	0.0432	-0.3781	-0.2599	0.0059	0.0008	-0.000004	0.0242
85	2.35	-0.31	3.2801	3.1277	0.0720	1.3474	0.1031	-0.3733	-0.2532	0.0150	0.0195	-0.000004	0.0224
79	2.40	-0.32	3.2429	3.1116	-0.0298	1.2615	-0.0532	-0.3448	-0.2290	-0.0011	0.0051	0.000002	-0.0098
81	2.55	-0.36	3.1218	3.1123	1.4899	1.6896	1.5105	-0.2189	-0.1801	0.0990	0.1735	-0.000078	0.4746
88	2.70	-0.40	3.0343	3.1161	-1.2498	1.3470	-1.1811	-0.0843	0.0503	-0.0321	0.1469	0.000068	-0.4153
89	2.85	-0.44	2.9984	3.0922	-0.2042	1.4495	-0.1975	-0.1975	0.1277	0.0376	0.0010	0.000010	-0.0603
90	3.00	-0.48	2.9877	3.0834	-0.0125	1.2621	0.1662	0.0147	0.1244	0.0108	0.0000	0.000000	-0.0010
91	3.15	-0.52	2.9968	3.0694	0.0204	1.2310	0.0301	-0.0334	0.0650	0.0115	0.000001	-0.000001	0.0049
92	3.30	-0.53	3.0163	3.0550	0.0786	1.3086	0.0938	-0.0870	0.0660	-0.0074	-0.0008	-0.000004	0.0266
93	3.45	-0.53	2.9992	3.0438	-0.2643	1.2382	-0.2550	-0.1076	-0.0219	0.0047	-0.0197	0.000013	-0.0616
94	3.60	-0.53	3.0063	3.0546	-0.2887	1.2641	-0.2771	-0.0986	-0.0119	-0.0215	-0.0006	0.000011	-0.0691

(2,2) Cokurtosis WITH Hilbert Envelope - Negative Lag												
lag	x(m) = -0,45 Ekte96_Hilbe	x(m) = 0 Ekte69_Hilbe	x(m) = 0,30 Ekte68_Hilbe	x(m) = 0,50 Ekte56_Hilbe	x(m) = 0,60 Ekte58_Hilbe	x(m) = 0,70 Ekte77_Hilbe	x(m) = 0,75 Ekte80_Hilbe	x(m) = 0,80 Ekte72_Hilbe	x(m) = 1,35 Ekte62_Hilbe	x(m) = 1,95 Ekte74_Hilbe	x(m) = 2,20 Ekte83_Hilbe	x(m) = 2,40 Ekte79_Hilbe
-2,00	0,993	0,959	0,983	1,006	0,960	0,994	0,969	0,984	0,969	1,023	1,019	0,988
-1,95	0,988	1,044	0,960	0,952	1,045	1,030	1,004	1,016	1,043	0,964	0,988	1,002
-1,90	0,997	0,984	0,980	1,041	0,990	1,002	0,968	0,996	0,992	1,038	1,023	0,999
-1,85	1,038	1,070	1,051	1,035	1,021	1,034	1,041	1,007	1,034	1,028	0,996	1,021
-1,80	1,032	0,997	1,024	1,063	1,046	1,043	1,078	1,015	1,016	1,015	1,048	1,017
-1,75	1,008	1,075	1,034	0,996	1,012	1,014	1,027	1,034	1,024	0,999	0,989	1,005
-1,70	1,211	1,237	1,149	1,044	0,965	1,000	1,352	0,950	1,451	1,130	1,062	1,171
-1,65	1,042	0,961	0,995	1,050	0,988	0,987	1,032	1,004	0,965	0,988	1,010	1,051
-1,60	1,036	1,027	1,020	1,062	1,045	1,043	1,058	1,004	1,009	0,994	1,026	1,047
-1,55	0,995	1,062	1,017	1,024	1,032	1,039	1,059	1,032	1,096	1,025	1,022	1,009
-1,50	1,015	0,974	1,034	0,995	0,993	0,998	1,002	0,997	0,965	0,971	0,984	1,032
-1,45	0,968	1,007	1,040	0,973	1,035	1,028	1,002	1,042	0,971	1,027	0,987	0,993
-1,40	1,009	0,977	0,990	1,031	0,979	1,014	1,013	1,005	1,021	1,027	1,014	0,996
-1,35	1,007	0,979	1,025	1,008	0,995	1,003	1,003	1,037	0,980	0,983	1,019	0,992
-1,30	0,981	1,023	1,055	1,006	1,003	1,013	0,977	1,016	0,978	1,051	1,050	0,988
-1,25	0,996	1,022	0,947	1,027	0,989	0,984	0,977	1,022	1,021	1,001	1,043	0,993
-1,20	1,000	1,096	1,022	1,011	1,065	1,074	1,019	1,011	1,091	1,011	1,005	0,999
-1,15	0,983	1,060	0,978	1,022	1,070	1,067	0,987	0,995	1,056	1,038	0,974	0,997
-1,10	1,023	0,955	1,003	0,992	0,963	0,963	1,059	1,004	1,003	0,980	0,983	1,006
-1,05	0,970	0,925	0,977	1,004	0,944	0,954	1,008	0,988	0,934	1,002	0,985	0,977
-1,00	1,000	0,964	0,935	0,952	1,000	0,967	1,012	1,040	0,936	0,962	0,948	0,964
-0,95	0,980	0,985	0,987	0,963	1,000	0,978	0,946	0,975	0,967	1,006	0,945	0,980
-0,90	1,013	0,935	0,978	0,963	0,961	0,951	0,991	0,977	0,953	0,980	0,971	0,976
-0,85	1,006	0,956	0,987	0,976	0,963	1,011	1,006	1,018	0,944	1,009	0,988	0,976
-0,80	1,009	0,977	1,006	1,004	1,037	1,029	0,975	1,005	0,984	0,987	0,984	1,017
-0,75	0,948	0,950	0,952	0,954	0,985	0,973	0,968	0,994	0,942	0,960	0,988	0,970
-0,70	0,950	0,916	1,004	0,952	0,923	0,934	0,955	0,975	0,892	1,033	1,009	0,972
-0,65	0,953	0,943	0,987	0,951	0,976	0,955	0,974	1,003	0,946	1,001	0,979	0,954
-0,60	0,986	0,983	0,984	1,025	1,026	1,041	1,009	0,999	1,004	1,017	1,008	1,006
-0,55	1,008	0,977	0,993	1,005	0,985	0,992	0,953	1,003	0,999	1,036	0,979	0,988
-0,50	1,048	1,064	1,040	1,027	1,076	1,066	1,034	0,987	1,086	0,962	0,978	1,043
-0,45	0,999	1,025	0,997	1,014	0,999	0,990	1,018	1,020	0,973	1,056	1,029	1,008
-0,40	1,000	0,933	0,998	1,027	0,918	0,944	1,055	0,985	0,941	0,975	0,972	1,027
-0,35	1,033	1,045	1,014	1,047	1,036	1,024	1,047	1,022	1,036	1,032	1,053	1,044
-0,30	1,005	0,965	0,988	0,998	1,036	0,986	0,968	0,989	0,993	0,997	1,029	1,000
-0,25	1,007	0,972	1,000	1,060	0,989	0,987	1,059	0,989	1,001	0,978	1,012	0,990
-0,20	1,015	1,022	0,952	0,987	0,983	0,991	0,989	1,002	1,001	1,007	1,031	0,984
-0,15	1,003	1,065	1,048	0,986	1,082	1,070	1,035	0,995	1,075	1,018	1,012	1,011
-0,10	1,032	0,985	1,020	1,035	0,976	0,987	1,004	1,009	0,979	1,049	1,055	1,021
-0,05	1,006	1,025	0,988	1,073	1,044	1,000	1,023	1,032	1,007	0,999	1,012	0,990
0,00	1,373	2,294	1,548	1,539	3,937	2,953	1,229	1,053	1,999	1,320	1,229	1,338

(2,2) Cokurtosis WITH Hilbert Envelope - Positive Lag												
lag	x(m) = -0,45 Ekte96_Hilbe	x(m) = 0 Ekte69_Hilbe	x(m) = 0,30 Ekte68_Hilbe	x(m) = 0,50 Ekte56_Hilbe	x(m) = 0,60 Ekte58_Hilbe	x(m) = 0,70 Ekte77_Hilbe	x(m) = 0,75 Ekte80_Hilbe	x(m) = 0,80 Ekte72_Hilbe	x(m) = 1,35 Ekte62_Hilbe	x(m) = 1,95 Ekte74_Hilbe	x(m) = 2,20 Ekte83_Hilbe	x(m) = 2,40 Ekte79_Hilbe
0,00	1,373	2,294	1,548	1,539	3,937	2,953	1,229	1,053	1,999	1,320	1,229	1,338
0,05	1,044	1,084	1,098	1,005	1,035	1,045	1,050	1,007	1,014	1,018	1,009	1,034
0,10	1,028	0,999	1,031	1,044	0,993	1,002	1,054	1,019	0,990	1,024	1,013	1,022
0,15	0,977	1,046	1,079	1,001	1,074	1,071	1,036	1,012	1,076	1,051	0,998	1,008
0,20	1,008	0,998	1,009	0,999	0,978	0,977	1,044	1,007	1,029	1,028	0,973	1,009
0,25	0,982	0,998	1,004	1,003	0,991	0,983	0,984	1,008	1,028	1,064	1,007	0,985
0,30	0,998	0,987	1,001	0,965	1,009	1,015	0,981	0,997	0,958	0,979	0,993	0,969
0,35	1,013	1,027	1,024	1,015	1,037	1,032	0,990	0,989	1,026	0,975	1,049	1,045
0,40	0,982	0,955	0,975	1,059	0,952	0,929	0,983	0,999	0,968	0,998	1,041	1,026
0,45	1,022	0,964	1,005	1,002	0,952	0,982	1,030	1,005	0,986	0,996	1,019	0,997
0,50	0,980	1,017	1,057	1,045	1,089	1,062	0,996	1,010	1,026	0,982	1,042	1,014
0,55	0,953	0,987	0,988	0,972	0,992	0,961	0,977	1,001	0,993	1,045	1,011	1,002
0,60	1,032	1,009	0,967	1,004	1,052	1,037	1,031	1,004	1,016	0,988	1,023	1,003
0,65	0,987	0,969	0,978	0,975	0,987	0,982	0,996	1,013	0,983	0,996	0,943	0,971
0,70	0,996	0,906	0,990	0,974	0,928	0,913	0,949	1,004	0,969	0,967	0,930	1,000
0,75	0,970	0,982	0,937	0,924	0,981	0,949	0,951	1,006	0,997	1,032	0,976	0,990
0,80	1,009	1,105	0,970	0,977	1,087	1,021	1,018	0,962	0,998	0,975	0,959	0,993
0,85	0,994	1,048	1,005	0,995	1,009	0,969	0,975	0,982	1,011	0,947	0,952	0,994
0,90	0,979	0,918	0,959	0,940	0,964	0,937	0,932	1,003	0,927	0,994	0,956	1,000
0,95	0,972	0,943	0,986	0,959	0,986	0,983	0,970	0,982	0,928	0,940	0,980	0,985
1,00	0,956	0,972	0,938	0,967	0,991	0,983	1,003	0,994	0,956	1,031	1,007	0,961
1,05	0,962	0,922	0,963	0,984	0,918	0,930	0,968	1,001	0,920	0,972	0,989	0,983
1,10	1,002	0,982	1,030	1,009	0,990	0,971	1,002	0,988	0,965	1,015	1,006	0,970
1,15	0,982	1,005	0,986	0,990	1,047	1,064	0,994	0,982	1,029	1,005	1,004	1,004
1,20	1,033	1,101	1,010	1,001	1,066	1,104	1,026	0,997	1,065	0,982	1,026	1,041
1,25	1,005	1,004	0,985	0,968	0,973	0,996	1,045	0,976	1,022	1,022	1,044	0,991
1,30	1,022	1,042	0,967	0,962	1,020	1,019	0,989	0,993	1,106	1,001	0,963	1,036
1,35	1,015	0,985	1,019	1,016	1,010	0,979	1,039	0,987	1,014	1,056	1,008	1,034
1,40	0,985	1,014	1,017	0,976	0,932	0,952	1,010	0,984	0,988	1,016	1,009	1,036
1,45	0,978	1,004	1,028	1,012	1,024	0,991	0,946	0,995	1,023	0,981	1,014	0,974
1,50	1,003	0,962	0,996	1,017	0,978	0,952	0,987	1,008	1,007	0,984	1,011	1,012
1,55	1,001	0,997	1,010	1,031	1,034	1,081	1,025	0,995	0,994	1,052	1,029	1,043
1,60	1,027	1,097	1,021	1,033	1,056	1,045	1,039	1,027	1,092	1,092	1,055	1,019
1,65	0,984	1,042	1,026	1,019	1,009	1,009	0,992	1,029	1,019	0,998	1,030	0,989
1,70	1,022	1,152	1,397	1,212	0,972	1,105	1,064	0,988	1,120	1,143	1,100	1,106
1,75	1,040	1,045	1,014	0,978	0,993	1,000	1,062	0,999	1,076	1,033	1,005	1,000
1,80	1,019	1,065	1,047	1,056	1,032	1,043	1,038	0,993	1,080	1,028	0,999	1,046
1,85	1,012	1,039	1,045	1,055	1,038	1,066	1,060	1,015	1,031	1,012	1,046	0,994
1,90	0,983	1,002	1,014	0,987	0,981	0,977	1,014	0,983	0,979	1,049	0,998	0,994
1,95	0,983	0,996	0,992	0,984	1,027	1,043	0,989	1,007	0,984	1,019	0,992	0,989
2,00	0,986	0,972	0,976	0,996	0,944	0,953	1,015	0,999	0,970	0,954	0,994	1,013
2,05	0,990	1,019	0,978	0,998	0,992	1,006	0,997	0,990	1,005	0,974	1,017	0,996
2,10	0,978	1,007	0,980	1,037	0,963	0,956	1,029	0,978	1,018	1,021	1,025	0,990
2,15	1,015	0,980	1,001	1,021	0,991	0,983	1,021	0,979	1,006	0,979	1,013	1,010
2,20	0,978	0,972	1,043	1,031	0,965	0,956	1,004	0,997	0,972	0,993	1,051	1,029
2,25	0,984	1,003	0,993	1,014	0,994	0,971	0,983	1,001	0,992	0,995	0,989	0,973
2,30	1,031	1,018	0,984	0,998	1,027	1,029	0,996	1,008	1,040	1,012	0,956	0,975
2,35	0,993	1,047	0,989	0,984	1,011	1,031	1,008	0,988	1,062	0,982	0,954	0,961
2,40	0,988	1,024	0,961	0,967	0,989	0,976	1,007	0,986	1,004	1,067	0,967	0,997
2,45	0,971	0,915	0,975	0,932	0,936	0,931	0,984	1,014	0,932	0,997	0,929	0,978
2,50	0,973	0,957	0,999	1,046	0,968	0,986	1,004	0,963	0,934	0,963	1,006	0,987
2,55	0,976	0,996	0,974	0,984	0,995	1,010	0,993	0,998	0,962	0,954	0,955	1,000
2,60	0,990	0,957	0,972	0,996	0,946	0,935	0,980	0,984	0,987	0,972	0,964	0,974
2,65	0,956	0,922	0,976	0,974	0,912	0,906	0,973	0,981	0,913	0,995	0,976	0,973
2,70	0,993	0,992	0,988	1,001	0,996	0,970	0,961	1,013	1,008	0,993	1,018	0,996
2,75	1,002	0,950	0,968	0,984	0,976	0,978	0,991	1,011	0,960	0,992	0,971	0,966
2,80	1,008	1,011	0,982	0,951	0,949	0,964	0,965	1,041	1,014	0,959	1,018	0,945
2,85	0,967	1,036	0,993	0,988	1,048	1,042	0,944	1,011	1,042	1,004	1,033	1,022
2,90	1,023	1,046	1,025	1,031	1,061	1,061	0,990	0,996	1,053	0,998	0,994	1,015
2,95	1,052	1,020	1,021	1,040	0,987	0,979	1,051	1,015	1,010	1,016	1,009	1,030
3,00	1,025	1,020	0,980	1,045	1,054	1,018	1,011	0,996	0,960	1,010	0,955	1,020
3,05	1,010	1,003	1,049	1,019	0,987	0,995	1,069	1,019	0,982	1,004	1,035	1,016
3,10	0,983	1,039	0,992	1,023	1,008	1,040	0,985	0,997	1,033	0,992	1,003	1,010
3,15	0,975	1,037	0,963	0,968	1,017	1,051	0,940	1,024	0,986	1,002	0,971	0,964
3,20	0,989	0,986	0,997	0,962	0,953	0,997	1,005	0,991	0,993	1,026	1,054	1,021
3,25	1,025	0,966	0,972	0,980	0,974	0,955	0,965	0,994	0,954	0,984	1,022	1,031
3,30	1,006	1,055	1,043	1,064	1,053	1,043	0,970	1,029	1,052	0,944	1,062	1,022
3,35	0,985	1,020	1,049	1,030	1,023	1,025	1,012	1,009	1,023	1,057	1,025	0,999
3,40	0,985	0,997	1,104	1,051	1,062	1,018	0,987	0,999	0,955	1,049	1,068	1,019
3,45	1,018	1,079	1,074	1,062	1,128	1,098	0,985	1,008	1,076	0,999	1,014	0,992
3,50	1,015	1,060	1,003	1,056	1,024	1,022	1,065	0,986	1,093	1,039	0,987	1,014

lag	(2,2) Cokurtosis WITHOUT Hilbert Envelope - Negative Lag																							
	$x(m) = -0,45$		$x(m) = 0,30$		$x(m) = 0,50$		$x(m) = 0,60$		$x(m) = 0,70$		$x(m) = 0,75$		$x(m) = 0,80$		$x(m) = 1,35$		$x(m) = 1,95$		$x(m) = 2,20$		$x(m) = 2,40$			
	Ekte96_Uten	Ekte69_Uten	Ekte68_Uten	Ekte56_Uten	Ekte58_Uten	Ekte77_Uten	Ekte80_Uten	Ekte72_Uten	Ekte62_Uten	Ekte74_Uten	Ekte83_Uten	Ekte79_Uten	Ekte96_Uten	Ekte69_Uten	Ekte68_Uten	Ekte56_Uten	Ekte58_Uten	Ekte77_Uten	Ekte80_Uten	Ekte72_Uten	Ekte62_Uten	Ekte74_Uten	Ekte83_Uten	Ekte79_Uten
-2,00	1,006	0,975	0,960	0,989	0,962	0,987	0,989	1,002	0,989	1,013	0,988	0,987	1,002	0,993	0,981	1,014	1,003	0,993	1,002	0,991	1,001	0,967	1,008	1,016
-1,95	0,998	1,004	0,999	0,999	1,002	1,007	1,014	0,988	1,007	1,013	0,993	1,004	0,992	1,003	0,981	1,014	0,993	0,993	1,002	0,992	1,001	0,967	1,008	1,016
-1,90	0,991	1,003	0,993	1,019	0,988	0,988	0,977	0,988	0,988	1,002	1,019	1,006	0,992	1,006	0,919	1,009	1,006	1,006	1,002	0,992	1,001	0,967	1,008	1,016
-1,85	1,021	1,038	1,006	1,018	1,018	1,021	1,011	1,013	1,021	1,013	1,053	0,992	1,013	1,053	0,998	0,992	1,021	1,021	1,013	1,011	1,001	0,967	1,008	1,016
-1,80	0,985	1,029	1,003	1,022	0,996	1,016	1,020	1,011	1,016	1,011	1,015	1,025	1,006	1,015	1,013	1,025	1,008	1,008	1,011	1,011	1,001	0,967	1,008	1,016
-1,75	0,975	1,004	0,971	0,975	0,998	1,001	0,993	1,001	0,993	1,008	0,997	1,017	1,008	0,997	0,999	1,022	1,017	1,017	1,008	1,008	1,001	0,967	1,008	1,016
-1,70	1,179	1,113	1,111	1,080	1,149	1,164	1,229	1,018	1,207	1,067	1,045	1,123	1,018	1,207	1,067	1,045	1,123	1,123	1,018	1,018	1,001	0,967	1,008	1,016
-1,65	0,978	0,964	0,981	1,000	1,000	1,001	0,999	1,001	0,989	0,967	1,008	1,016	1,001	0,989	0,967	1,008	1,016	1,016	1,001	1,001	0,967	1,008	1,016	1,016
-1,60	1,014	0,998	0,988	1,018	1,020	1,004	1,035	0,991	1,001	1,004	0,985	1,024	0,991	1,001	1,004	0,985	1,024	1,024	0,991	0,991	1,001	0,967	1,008	1,016
-1,55	0,985	1,043	1,001	1,028	0,988	1,010	1,001	0,988	1,010	1,003	0,993	1,005	0,992	1,032	1,003	0,993	1,005	1,005	0,992	0,992	1,001	0,967	1,008	1,016
-1,50	1,010	0,995	1,033	0,998	1,005	1,003	1,001	0,980	0,988	1,022	1,006	1,026	0,980	0,988	1,022	1,006	1,026	1,026	0,980	0,980	1,001	0,967	1,008	1,016
-1,45	1,002	0,993	0,996	0,997	0,987	0,994	1,010	1,009	0,994	1,030	1,009	1,011	1,009	0,994	1,030	1,009	1,011	1,011	1,009	1,009	1,001	0,967	1,008	1,016
-1,40	0,995	1,021	1,025	1,026	1,011	1,011	0,998	1,013	1,000	1,007	1,005	0,987	1,013	1,000	1,007	1,005	0,987	0,987	1,000	1,000	1,001	0,967	1,008	1,016
-1,35	0,983	0,997	1,003	0,986	1,016	0,997	1,004	1,004	0,997	0,963	1,004	0,979	1,004	0,997	0,963	1,004	0,979	0,979	1,004	1,004	1,001	0,967	1,008	1,016
-1,30	0,989	1,014	1,037	1,016	1,012	1,016	0,998	1,011	1,018	1,017	1,017	1,017	1,011	1,018	1,017	1,017	1,017	1,017	1,011	1,011	1,001	0,967	1,008	1,016
-1,25	0,988	0,965	0,974	1,026	0,975	0,976	0,994	0,975	0,970	1,002	0,993	0,987	0,993	0,970	1,002	0,993	0,987	0,987	0,993	0,993	1,001	0,967	1,008	1,016
-1,20	0,998	1,044	1,001	1,019	1,043	1,048	0,999	1,014	1,044	1,000	1,008	1,023	1,014	1,044	1,000	1,008	1,023	1,023	1,014	1,014	1,001	0,967	1,008	1,016
-1,15	0,997	0,974	0,988	1,002	1,021	1,005	1,004	0,999	1,000	0,993	0,999	0,983	0,999	1,000	0,993	0,999	0,983	0,983	0,999	0,999	1,001	0,967	1,008	1,016
-1,10	1,021	1,019	1,012	0,995	0,972	1,008	1,022	1,006	1,001	1,014	1,008	1,028	1,006	1,001	1,014	1,008	1,028	1,028	1,006	1,006	1,001	0,967	1,008	1,016
-1,05	1,007	0,976	0,994	0,988	0,945	0,968	1,009	1,002	0,981	1,015	0,986	0,992	1,002	0,981	1,015	0,986	0,992	0,992	1,002	1,002	1,001	0,967	1,008	1,016
-1,00	0,996	0,973	0,970	0,964	0,997	0,972	1,003	1,006	0,968	0,983	0,963	0,975	1,006	0,968	0,983	0,963	0,975	0,975	1,006	1,006	1,001	0,967	1,008	1,016
-0,95	0,990	0,964	0,999	0,971	0,972	0,975	0,971	0,994	0,966	1,004	0,968	0,983	0,994	0,966	1,004	0,968	0,983	0,983	0,994	0,994	1,001	0,967	1,008	1,016
-0,90	0,977	0,957	0,994	0,984	0,975	0,977	0,976	0,998	0,968	1,000	0,978	0,982	0,998	0,968	1,000	0,978	0,982	0,982	0,998	0,998	1,001	0,967	1,008	1,016
-0,85	0,977	1,006	1,001	0,979	1,027	1,034	0,977	1,006	1,008	0,985	0,985	0,977	1,006	1,008	0,985	0,985	0,977	0,977	1,006	1,006	1,001	0,967	1,008	1,016
-0,80	1,006	0,971	1,017	1,009	1,020	0,990	0,991	0,997	0,997	0,977	0,997	0,984	0,997	0,997	0,977	0,997	0,984	0,984	0,997	0,997	1,001	0,967	1,008	1,016
-0,75	0,982	0,984	0,966	0,977	0,988	0,988	0,986	1,013	0,970	0,979	0,976	0,992	1,013	0,970	0,979	0,976	0,992	0,992	1,013	1,013	1,001	0,967	1,008	1,016
-0,70	0,960	0,959	1,013	0,986	0,985	0,981	0,942	0,977	0,976	1,019	1,012	0,971	0,977	0,976	1,019	1,012	0,971	0,971	0,977	0,977	1,001	0,967	1,008	1,016
-0,65	0,977	0,963	0,977	0,991	0,987	0,983	0,977	0,993	0,960	0,998	0,985	0,985	0,993	0,960	0,998	0,985	0,985	0,985	0,993	0,993	1,001	0,967	1,008	1,016
-0,60	0,987	1,011	1,048	1,023	1,018	1,020	1,011	1,001	1,024	1,030	1,018	1,018	1,001	1,024	1,030	1,018	1,018	1,018	1,001	1,001	1,001	0,967	1,008	1,016
-0,55	0,992	0,969	0,990	0,984	1,034	0,995	0,995	1,006	1,000	0,995	0,995	1,007	1,006	1,000	0,995	0,995	1,007	1,007	1,006	1,006	1,001	0,967	1,008	1,016
-0,50	1,002	1,057	1,025	1,027	1,010	1,034	1,025	0,992	1,033	0,995	0,983	1,024	0,992	1,033	0,995	0,983	1,024	1,024	0,992	0,992	1,001	0,967	1,008	1,016
-0,45	0,967	0,943	0,959	0,962	0,950	0,949	0,991	0,993	0,951	0,977	0,981	0,981	0,993	0,951	0,977	0,981	0,981	0,981	0,993	0,993	1,001	0,967	1,008	1,016
-0,40	1,007	1,002	1,004	1,011	0,983	1,003	1,008	1,004	0,982	1,003	0,980	1,036	1,004	0,982	1,003	0,980	1,036	1,036	1,004	1,004	1,001	0,967	1,008	1,016
-0,35	0,998	1,037	0,980	0,989	1,009	1,019	0,981	0,992	1,011	1,025	0,986	1,006	0,992	1,011	1,025	0,986	1,006	1,006	0,992	0,992	1,001	0,967	1,008	1,016
-0,30	1,022	0,977	0,951	0,994	0,989	0,979	1,011	0,979	0,988	1,005	0,998	1,013	0,979	0,988	1,005	0,998	1,013	1,013	0,979	0,979	1,001	0,967	1,008	1,016
-0,25	1,001	0,992	0,987	1,013	0,995	0,989	1,005	0,982	0,989	1,002	0,998	0,992	0,982	0,989	1,002	0,998	0,992	0,992	0,998	0,998	1,001	0,967	1,008	1,016
-0,20	0,985	1,020	0,977	0,999	0,979	0,992	0,990	1,004	1,018	1,009	1,016	0,985	1,004	1,018	1,009	1,016	0,985	0,985	1,004	1,004	1,001	0,967	1,008	1,016
-0,15	1,017	1,039	0,977	0,990	0,999	1,015	1,020	0,995	1,004	1,009	0,995	1,029	0,995	1,004	1,009	0,995	1,029	1,029	0,995	0,995	1,001	0,967	1,008	1,016
-0,10	0,977	0,959	1,002	1,019	0,992	0,992	0,964	0,992	0,974	1,023	0,974	0,990	0,995	0,974	1,023	0,974	0,990	0,990	0,992	0,992	1,001	0,967	1,008	1,016
-0,05	0,997	0,974	0,953	1,016	1,001	0,981	1,012	0,997	0,981	0,987	0,999	1,000	0,997	0,981	0,987	0,999	1,000	1,000	0,997	0,997	1,001	0,967	1,008	1,016
0,00	1,238	1,132	1,378	1,344	3,170	1,816	1,230	1,006	1,702	1,190	1,137	1,261	1,006	1,702	1,190	1,137	1,261	1,261	1,006	1,006	1,001	0,967	1,008	1,016

(2,2) Cokurtosis WITHOUT Hilbert Envelope - Positive Lag												
lag	x(m) = -0,45 Ekte96_Uten	x(m) = 0 Ekte69_Uten	x(m) = 0,30 Ekte68_Uten	x(m) = 0,50 Ekte56_Uten	x(m) = 0,60 Ekte58_Uten	x(m) = 0,70 Ekte77_Uten	x(m) = 0,75 Ekte80_Uten	x(m) = 0,80 Ekte72_Uten	x(m) = 1,35 Ekte62_Uten	x(m) = 1,95 Ekte74_Uten	x(m) = 2,20 Ekte83_Uten	x(m) = 2,40 Ekte79_Uten
0,00	1,238	1,132	1,378	1,344	3,170	1,816	1,230	1,006	1,702	1,190	1,137	1,261
0,05	0,980	0,976	0,994	0,974	0,983	0,981	1,010	0,982	0,979	1,008	0,989	0,981
0,10	0,999	0,983	0,988	1,014	1,000	0,976	1,022	0,992	0,998	0,973	0,999	0,993
0,15	0,990	1,037	1,001	1,007	1,009	1,022	1,003	1,002	1,023	0,996	0,995	0,989
0,20	0,993	1,007	1,019	1,004	0,976	0,991	1,005	0,999	0,995	1,015	1,001	1,028
0,25	0,985	0,980	1,016	0,988	0,997	0,994	1,011	0,978	1,002	1,024	1,006	1,007
0,30	0,983	0,998	1,014	1,004	0,985	0,986	0,981	1,007	0,979	0,988	1,004	0,982
0,35	0,977	1,018	0,973	0,990	1,026	1,025	0,974	0,999	1,005	0,972	1,007	0,978
0,40	0,998	1,005	1,005	1,013	0,986	0,991	1,008	1,012	0,988	1,016	1,026	1,008
0,45	0,979	0,942	0,956	1,000	0,943	0,940	0,984	0,981	0,945	0,993	1,004	0,963
0,50	0,995	1,016	1,030	1,027	1,020	1,021	1,003	0,993	1,005	1,004	1,024	1,010
0,55	0,991	1,000	0,981	0,989	1,048	1,002	1,006	1,011	0,999	1,008	0,999	1,010
0,60	1,022	1,019	1,028	1,016	1,026	1,026	1,029	0,995	1,014	1,012	1,031	1,030
0,65	0,992	0,997	0,995	0,961	0,970	0,982	1,006	1,008	1,002	0,983	0,975	0,977
0,70	0,998	0,954	0,992	0,973	0,981	0,980	1,000	0,987	0,994	0,984	0,966	0,989
0,75	0,983	0,996	0,978	0,978	0,985	0,985	0,972	1,002	1,009	1,010	0,982	0,987
0,80	0,987	0,981	0,988	0,992	1,029	0,997	0,981	1,000	1,002	1,007	0,999	0,978
0,85	0,995	1,025	1,002	1,000	1,035	1,017	0,982	0,972	1,018	0,984	0,988	0,998
0,90	0,979	0,971	0,988	0,956	0,990	0,975	0,970	0,978	0,997	0,969	0,974	0,976
0,95	0,971	0,989	0,981	0,974	0,969	0,981	0,977	0,996	0,982	0,986	0,999	0,995
1,00	0,974	0,978	0,980	0,978	0,999	0,985	0,965	0,995	0,965	1,028	1,006	0,968
1,05	0,978	0,979	0,980	0,981	0,957	0,960	0,979	1,003	0,971	1,004	1,005	0,987
1,10	1,033	1,021	1,039	1,035	1,002	0,996	0,999	0,999	0,984	1,015	1,030	1,005
1,15	0,997	0,990	0,999	0,982	1,017	1,009	1,014	1,004	1,018	0,985	0,991	0,986
1,20	1,026	1,069	1,019	1,007	1,035	1,033	1,032	0,982	1,059	1,000	0,998	1,015
1,25	1,018	0,990	0,990	0,983	0,958	0,972	1,006	1,002	0,994	1,004	0,996	1,019
1,30	1,008	1,033	0,993	0,987	1,001	1,009	1,025	1,000	1,050	0,999	0,988	1,029
1,35	0,995	0,976	0,989	0,984	1,011	1,010	0,996	1,006	0,999	1,032	0,986	0,998
1,40	0,999	1,031	1,000	0,995	0,997	1,007	1,007	0,991	1,016	0,984	1,002	1,020
1,45	1,007	0,981	0,992	1,017	0,991	0,991	0,986	1,006	0,986	0,984	0,991	0,987
1,50	1,009	0,991	0,986	1,022	0,994	0,988	0,995	1,013	0,987	1,006	0,999	0,977
1,55	0,978	1,011	0,984	1,017	0,984	1,014	1,017	1,015	1,004	1,022	0,992	1,026
1,60	0,988	0,981	0,995	1,008	1,019	1,012	0,983	1,017	1,005	1,003	1,031	0,990
1,65	0,993	0,998	0,990	1,007	0,997	0,987	0,981	0,994	1,018	0,983	1,008	0,976
1,70	1,072	1,077	1,277	1,196	1,208	1,153	1,046	1,005	1,159	1,098	1,108	1,094
1,75	1,012	0,995	0,993	0,989	0,989	1,000	1,008	0,989	0,995	0,985	0,980	0,966
1,80	1,023	1,042	1,017	0,997	1,002	1,016	1,039	0,996	1,032	1,004	0,989	1,004
1,85	1,004	1,037	1,005	1,011	1,022	1,031	1,012	1,008	1,002	0,992	1,011	0,974
1,90	0,996	0,998	1,011	0,983	0,999	1,001	1,003	0,996	0,999	1,025	0,997	1,011
1,95	0,993	1,011	0,997	0,992	0,989	1,014	1,007	1,003	1,009	1,021	0,993	1,016
2,00	0,982	0,983	0,973	1,003	0,952	0,970	0,988	0,992	0,973	0,979	1,003	1,000
2,05	0,968	0,946	0,967	0,979	0,986	0,968	0,981	0,988	0,970	0,979	0,968	0,975
2,10	1,002	1,013	0,991	1,020	0,981	0,992	0,987	0,985	0,995	1,019	1,014	0,979
2,15	0,996	0,990	0,963	0,988	0,973	0,968	0,999	1,000	0,979	0,972	0,986	0,969
2,20	1,001	1,030	1,003	1,014	0,998	1,026	1,003	0,993	1,037	1,024	1,012	0,991
2,25	0,996	1,013	0,984	1,004	0,968	0,991	0,979	1,000	1,011	0,977	1,010	1,005
2,30	1,023	1,010	0,992	1,027	1,022	1,016	1,020	0,993	1,019	0,994	1,011	1,010
2,35	0,994	1,038	1,002	0,994	0,994	1,016	1,003	1,011	1,039	0,977	0,976	1,004
2,40	0,988	0,979	0,970	0,999	1,015	0,996	1,005	0,986	1,007	1,002	0,979	0,993
2,45	0,988	0,975	0,999	0,980	0,993	0,987	0,996	1,016	0,982	0,983	0,972	0,982
2,50	0,977	0,972	1,008	1,018	0,998	1,006	0,983	0,998	0,990	1,000	0,999	0,988
2,55	0,984	0,996	0,996	0,960	0,978	1,010	0,994	0,991	0,998	0,989	0,955	0,981
2,60	0,961	0,960	0,974	0,967	0,961	0,967	0,966	0,997	0,945	0,973	0,955	0,969
2,65	0,968	0,975	0,982	0,994	0,965	0,972	0,988	1,002	0,958	0,994	0,980	0,964
2,70	0,990	1,006	1,021	0,985	0,966	0,982	0,976	1,016	1,006	0,998	1,039	0,997
2,75	0,999	0,993	0,989	1,000	0,967	0,984	0,990	1,002	0,995	0,982	1,017	0,961
2,80	1,038	1,017	1,012	0,978	0,990	0,983	1,010	1,007	1,032	0,975	1,017	1,022
2,85	1,005	1,028	1,016	0,992	1,005	1,004	0,998	1,008	1,044	0,998	0,990	1,020
2,90	1,025	1,037	1,010	1,000	1,013	1,024	1,021	1,014	1,019	1,021	0,998	1,019
2,95	1,033	1,008	1,019	0,988	0,996	0,993	1,015	1,014	0,999	1,001	0,999	1,026
3,00	1,010	0,996	0,997	1,012	1,025	1,003	1,030	0,997	0,996	1,009	0,989	1,001
3,05	1,000	0,987	1,017	0,992	0,992	0,983	1,010	1,008	0,977	1,010	0,987	1,001
3,10	0,991	1,028	1,000	1,011	1,028	1,035	1,003	1,001	1,019	0,989	0,982	1,009
3,15	0,995	1,014	0,976	0,979	0,971	0,992	0,981	1,010	0,993	0,985	0,987	0,982
3,20	0,998	0,988	0,981	0,986	0,959	0,968	0,990	1,016	0,990	1,015	1,021	0,988
3,25	0,994	0,969	0,976	1,005	1,002	0,995	1,003	1,004	1,002	1,011	1,020	0,999
3,30	0,976	0,977	1,007	1,003	0,992	0,988	0,977	0,999	0,991	0,992	1,024	0,985
3,35	0,976	0,997	1,007	1,015	0,986	0,992	0,972	0,996	1,008	1,015	0,992	0,969
3,40	1,020	1,030	1,078	1,046	1,070	1,040	1,020	1,005	1,036	1,057	1,058	1,043
3,45	1,026	1,004	0,997	1,000	0,991	0,997	0,996	1,010	0,980	0,968	1,004	0,982
3,50	1,016	1,020	0,993	0,999	1,023	1,022	1,024	0,988	1,018	0,995	0,978	0,997

Time sensitivity of (2,1) coskewness WITH Hilbert Envelope																									
lag		x(m) = -0.45		x(m) = 0		x(m) = 0.30		x(m) = 0.50		x(m) = 0.60		x(m) = 0.70		x(m) = 0.75		x(m) = 0.80		x(m) = 1.35		x(m) = 1.95		x(m) = 2.20		x(m) = 2.40	
Ekte96_Hilbr		Ekte69_Hilbr		Ekte68_Hilbr		Ekte56_Hilbr		Ekte58_Hilbr		Ekte77_Hilbr		Ekte80_Hilbr		Ekte72_Hilbr		Ekte62_Hilbr		Ekte74_Hilbr		Ekte83_Hilbr		Ekte79_Hilbr		Ekte79_Hilbr	
-2.00	-0.0031	-0.0206	0.0053	0.0152	-0.0208	-0.0152	-0.0091	-0.0029	-0.0112	0.0158	-0.0009	-0.0044	-1.95	0.0088	0.0047	-0.0146	-0.0169	0.0107	0.0126	0.0028	0.0049	0.0109	-0.0286	0.0269	-0.0034
-1.90	-0.0153	-0.0090	-0.0079	0.0116	-0.0047	-0.0060	-0.0174	0.0005	-0.0103	0.0312	0.0239	-0.0170	-1.85	-0.0065	0.0532	0.0201	0.0184	0.0351	0.0331	0.0087	0.0103	0.0538	0.0131	-0.0002	0.0074
-1.80	-0.0189	0.0222	0.0146	0.0156	0.0349	0.0254	0.0046	0.0136	0.0273	0.0013	0.0187	-0.0007	-1.75	-0.0037	0.0105	0.0033	-0.0106	-0.0006	0.0024	0.0020	0.0130	0.0219	0.0044	-0.0011	0.0071
-1.70	0.1201	0.2041	0.1241	0.0428	0.0272	0.0565	0.1744	-0.0046	0.2649	0.0705	0.0417	0.1182	-1.65	0.0135	0.0006	0.0028	0.0004	-0.0013	0.0020	0.0146	0.0002	0.0139	-0.0041	0.0071	0.0331
-1.60	0.0146	0.0305	0.0013	0.0210	0.0102	0.0081	0.0324	0.0002	0.0139	0.0073	0.0219	-0.0329	-1.55	-0.0076	0.0559	0.0233	0.0327	0.0383	0.0467	0.0213	0.0152	0.0399	0.0133	0.0129	0.0158
-1.50	0.0150	-0.0128	0.0282	-0.0005	0.0013	0.0006	-0.0011	-0.0082	-0.0003	-0.0030	0.0043	0.0158	-1.45	-0.0049	-0.0092	-0.0126	-0.0194	0.0026	0.0067	-0.0046	0.0219	-0.0062	0.0073	0.0069	0.0080
-1.40	-0.0235	-0.0146	-0.0071	0.0241	-0.0001	0.0067	-0.0186	-0.0070	-0.0153	-0.0063	-0.0207	-0.0329	-1.35	-0.0304	0.0072	-0.0053	-0.0117	-0.0032	-0.0122	-0.0211	-0.0077	0.0046	-0.0103	-0.0067	-0.0216
-1.30	-0.0244	-0.0254	0.0091	0.0035	-0.0156	-0.0112	-0.0208	0.0000	-0.0292	0.0025	0.0365	-0.0400	-1.25	-0.0064	-0.0288	-0.0315	0.0089	-0.0194	-0.0244	-0.0229	0.0073	-0.0389	-0.0120	0.0214	-0.0216
-1.20	0.0103	0.0521	0.0271	0.0158	0.0359	0.0393	0.0046	0.0049	0.0396	0.0160	0.0133	0.0150	-1.10	0.0150	-0.0052	-0.0094	-0.0179	-0.0027	0.0077	0.0331	0.0078	-0.0004	-0.0192	0.0250	0.0287
-1.15	0.0090	0.0244	-0.0052	-0.0027	0.0220	0.0270	0.0005	-0.0078	0.0189	0.0081	-0.0019	0.0029	-1.05	0.0098	-0.0161	-0.0013	0.0028	-0.0221	-0.0257	0.0289	0.0006	-0.0051	0.0115	-0.0099	0.0170
-1.00	-0.0107	-0.0297	-0.0428	-0.0351	-0.0189	-0.0162	-0.0047	0.0096	-0.0361	-0.0321	-0.0512	-0.0490	-0.95	-0.0087	-0.0130	-0.0015	-0.0064	0.0059	-0.0044	-0.0197	-0.0013	0.0004	-0.0428	-0.0190	-0.0490
-0.90	-0.0011	0.0005	-0.0162	-0.0223	-0.0161	-0.0218	-0.0103	-0.0033	-0.0188	-0.0142	-0.0154	-0.0219	-0.85	-0.0139	0.0213	-0.0206	-0.0239	0.0060	0.0174	-0.0033	0.0079	-0.0032	-0.0214	-0.0258	-0.0160
-0.80	-0.0055	-0.0064	-0.0236	-0.0014	-0.0101	-0.0121	-0.0094	-0.0048	-0.0212	-0.0309	-0.0422	-0.0168	-0.75	-0.0380	-0.0102	-0.0371	-0.0267	-0.0068	-0.0083	-0.0210	-0.0040	-0.0202	-0.0315	-0.0196	-0.0316
-0.70	-0.0361	-0.0182	0.0118	-0.0099	-0.0202	-0.0105	-0.0251	0.0012	-0.0324	0.0202	0.0085	-0.0234	-0.65	-0.0140	-0.0227	-0.0140	-0.0163	-0.0046	-0.0104	-0.0240	-0.0089	-0.0315	0.0054	0.0038	-0.0186
-0.60	0.0017	0.0083	0.0204	0.0253	0.0254	0.0375	0.0124	0.0037	0.0226	0.0144	0.0211	0.0112	-0.55	-0.0089	-0.0489	-0.0264	-0.0202	-0.0302	-0.0245	-0.0228	-0.0015	-0.0332	0.0129	-0.0034	-0.0123
-0.50	0.0381	0.0360	0.0180	0.0174	0.0299	0.0275	0.0284	-0.0109	0.0305	-0.0062	-0.0185	0.0378	-0.45	-0.0358	-0.0366	-0.0335	-0.0107	-0.0350	-0.0344	-0.0229	-0.0038	-0.0451	0.0025	-0.0092	-0.0105
-0.40	0.0224	-0.0007	0.0052	0.0155	-0.0071	-0.0082	0.0201	0.0065	0.0052	-0.0083	0.0052	0.0428	-0.35	0.0148	0.0605	0.0143	0.0135	0.0547	0.0365	0.0035	0.0082	0.0274	0.0174	0.0033	-0.0025
-0.30	0.0059	-0.0129	-0.0092	0.0065	0.0116	0.0056	0.0084	0.0003	-0.0082	0.0074	0.0116	0.0120	-0.25	0.0128	0.0008	0.0064	0.0211	0.0071	0.0108	0.0292	-0.0051	-0.0054	0.0147	0.0106	0.0230
-0.20	-0.0005	-0.0067	-0.0289	-0.0141	-0.0326	-0.0307	-0.0171	-0.0026	0.0041	0.0087	0.0297	0.0021	-0.15	-0.0222	0.0074	0.0016	-0.0026	0.0040	0.0018	-0.0022	-0.0027	0.0048	-0.0061	-0.0260	-0.0258
-0.10	-0.0207	-0.0391	-0.0035	0.0169	-0.0333	-0.0316	-0.0335	-0.0010	-0.0340	0.0193	0.0331	-0.0038	-0.05	0.0007	-0.0116	-0.0144	0.0211	0.0112	0.0046	0.0034	0.0202	-0.0166	-0.0295	-0.0160	-0.0139
0.00	0.1630	0.5655	0.2649	0.2367	0.7944	0.6178	0.1201	0.0259	0.4360	0.1787	0.1158	0.1943													

Time sensitivity of (2,1) coskewness WITH Hilbert Envelope																										
	x(m)=-0,45		x(m)=0		x(m)=0,30		x(m)=0,50		x(m)=0,60		x(m)=0,70		x(m)=0,75		x(m)=0,80		x(m)=1,35		x(m)=1,95		x(m)=2,20		x(m)=2,40			
lag	Ekte96	Hilb Ekte69	Hilb Ekte68	Hilb Ekte56	Hilb Ekte58	Hilb Ekte77	Hilb Ekte80	Hilb Ekte72	Hilb Ekte62	Hilb Ekte74	Hilb Ekte83	Hilb Ekte79	Hilb Ekte96	Hilb Ekte69	Hilb Ekte68	Hilb Ekte56	Hilb Ekte58	Hilb Ekte77	Hilb Ekte80	Hilb Ekte72	Hilb Ekte62	Hilb Ekte74	Hilb Ekte83	Hilb Ekte79	Hilb Ekte96	
0,00	0,00	0,1630	0,5655	0,2649	0,2367	0,7944	0,6178	0,1201	0,0259	0,4360	0,1787	0,1158	0,1943	0,05	0,0165	-0,0011	0,0257	-0,0056	-0,0024	0,0080	0,0257	0,0098	-0,0083	0,0040	-0,0237	0,0039
0,10	0,10	0,0019	-0,0039	0,0144	0,0246	-0,0183	-0,0126	0,0309	0,0011	0,0102	0,0004	0,0145	0,0066	0,15	-0,0060	0,0389	0,0391	0,0259	0,0373	0,0367	-0,0053	0,0140	0,0190	0,0082	0,0286	0,0089
0,20	0,20	0,0068	0,0165	0,0097	-0,0033	0,0049	0,0021	0,0231	0,0077	0,0183	0,0012	-0,0050	0,0161	0,25	-0,0006	-0,0056	0,0013	-0,0014	-0,0106	0,0023	0,0256	0,0121	0,0128	0,0405	0,0007	-0,0033
0,30	0,30	-0,0325	-0,0505	-0,0270	-0,0239	-0,0234	-0,0227	-0,0397	-0,0023	-0,0583	-0,0191	-0,0103	-0,0437	0,35	-0,0426	-0,0042	-0,0310	-0,0101	0,0176	0,0176	-0,0341	-0,0055	-0,0107	-0,0247	0,0013	-0,0201
0,40	0,40	0,0013	-0,0195	-0,0228	0,0085	-0,0116	-0,0247	-0,0059	-0,0053	-0,0205	0,0101	-0,0054	-0,0237	0,45	-0,0044	-0,0354	-0,0327	-0,0143	-0,0353	-0,0294	-0,0134	-0,0163	-0,0484	-0,0289	0,0015	-0,0194
0,50	0,50	-0,0056	0,0011	0,0363	0,0186	0,0188	0,0103	-0,0014	0,0198	-0,0055	-0,0086	0,0100	0,0129	0,55	-0,0106	0,0131	-0,0074	-0,0162	0,0150	0,0169	-0,0236	-0,0071	-0,0056	0,0025	-0,0106	-0,0026
0,60	0,60	0,0268	0,0053	0,0010	0,0047	0,0005	-0,0021	0,0255	-0,0085	0,0248	-0,0067	0,0158	0,0254	0,65	0,0007	-0,0049	0,0006	-0,0164	-0,0072	-0,0097	0,0103	0,0041	-0,0025	-0,0139	-0,0275	-0,0143
0,70	0,70	-0,0118	-0,0594	-0,0372	-0,0233	-0,0525	-0,0491	-0,0211	-0,0141	-0,0390	-0,0319	-0,0528	-0,0209	0,75	-0,0274	-0,0355	-0,0292	-0,0274	-0,0296	-0,0415	-0,0269	-0,0031	-0,0227	-0,0002	-0,0180	-0,0137
0,80	0,80	-0,0018	0,0200	-0,0195	0,0013	0,0160	-0,0052	0,0036	-0,0268	-0,0044	-0,0178	-0,0251	-0,0107	0,85	-0,0215	0,0068	0,0053	-0,0073	-0,0013	-0,0047	-0,0201	-0,0157	0,0127	-0,0247	-0,0334	-0,0064
0,90	0,90	-0,0163	-0,0290	-0,0352	-0,0535	-0,0189	-0,0286	-0,0340	-0,0031	-0,0200	-0,0189	-0,0322	-0,0245	0,95	-0,0234	-0,0508	-0,0060	-0,0157	-0,0356	-0,0272	-0,0105	-0,0100	-0,0607	-0,0211	-0,0052	-0,0153
1,00	1,00	-0,0342	-0,0162	-0,0211	-0,0095	-0,0112	-0,0074	-0,0029	-0,0044	-0,0309	0,0273	0,0219	-0,0293	1,05	-0,0273	-0,0272	-0,0173	-0,0027	-0,0387	-0,0343	-0,0271	-0,0033	-0,0150	-0,0093	-0,0120	-0,0237
1,10	1,10	0,0179	0,0093	0,0257	0,0276	0,0057	-0,0047	-0,0024	0,0070	-0,0086	0,0216	0,0126	0,0038	1,15	-0,0078	-0,0172	-0,0230	-0,0212	-0,0025	0,0046	-0,0057	-0,0043	-0,0241	-0,0238	-0,0066	-0,0152
1,20	1,20	0,0320	0,0898	0,0181	0,0036	0,0483	0,0495	0,0200	-0,0035	0,0716	-0,0022	-0,0083	0,0287	1,25	-0,0052	-0,0297	-0,0176	-0,0076	-0,0240	-0,0256	-0,0024	-0,0068	-0,0062	0,0045	0,0075	0,0044
1,30	1,30	0,0264	0,0328	0,0185	-0,0130	0,0177	0,0125	0,0215	-0,0038	0,0516	-0,0134	0,0099	0,0367	1,35	0,0034	0,0064	0,0293	0,0134	0,0147	0,0141	0,0051	-0,0036	0,0005	0,0340	-0,0140	0,0036
1,40	1,40	-0,0121	0,0411	-0,0007	0,0093	0,0079	0,0133	-0,0122	-0,0111	0,0191	-0,0168	0,0365	0,0286	1,45	-0,0019	-0,0071	0,0079	0,0123	-0,0252	-0,0272	-0,0102	-0,0142	-0,0056	-0,0091	0,0045	-0,0119
1,50	1,50	0,0019	-0,0223	-0,0196	0,0249	-0,0092	-0,0149	-0,0111	0,0129	-0,0313	0,0129	0,0217	0,0037	1,55	-0,0314	-0,0225	-0,0144	0,0149	-0,0054	-0,0051	-0,0121	-0,0063	-0,0180	-0,0007	-0,0070	-0,0183
1,60	1,60	-0,0156	0,0043	-0,0053	0,0192	0,0073	-0,0045	-0,0119	0,0061	0,0062	0,0260	0,0423	0,0043	1,65	-0,0088	0,0008	0,0060	-0,0157	0,0011	0,0166	0,0008	0,0112	0,0032	-0,0030	0,0009	-0,0091
1,70	1,70	0,0104	0,1077	0,1614	0,1105	0,0412	0,1078	0,0074	-0,0092	0,0927	0,0864	0,0803	0,0550	1,75	0,0285	0,0241	0,0098	-0,0067	0,0133	0,0131	0,0220	-0,0002	0,0283	0,0073	-0,0071	0,0126
1,80	1,80	0,0050	0,0192	0,0132	0,0023	0,0215	0,0318	0,0058	0,0025	0,0268	0,0068	0,0077	0,0036	1,85	-0,0113	0,0244	0,0193	0,0355	0,0239	0,0383	0,0036	0,0092	0,0179	-0,0065	0,0239	-0,0157
1,90	1,90	0,0061	0,0029	0,0052	-0,0080	-0,0003	-0,0071	0,0001	-0,0044	0,0037	0,0225	0,0021	0,0099	1,95	0,0003	-0,0068	0,0242	-0,0025	-0,0027	0,0113	-0,0005	0,0060	0,0099	0,0299	-0,0139	-0,0056
2,00	2,00	-0,0311	-0,0349	-0,0276	-0,0169	-0,0375	-0,0346	-0,0181	-0,0126	-0,0412	-0,0260	0,0158	-0,0114	2,05	-0,0332	-0,0655	-0,0290	-0,0375	-0,0574	-0,0464	-0,0265	-0,0116	-0,0493	-0,0162	-0,0043	-0,0131
2,10	2,10	-0,0021	-0,0380	-0,0063	0,0044	-0,0429	-0,0429	-0,0131	0,0020	-0,0365	0,0146	0,0092	-0,0153	2,15	-0,0225	-0,0354	-0,0274	-0,0144	-0,0428	-0,0476	-0,0238	-0,0029	-0,0456	-0,0138	-0,0049	-0,0081
2,20	2,20	0,0054	-0,0022	0,0251	0,0173	-0,0040	-0,0006	0,0095	-0,0122	0,0101	0,0185	0,0235	0,0094	2,25	-0,0031	-0,0222	-0,0059	-0,0103	-0,0152	-0,0161	-0,0229	0,0039	-0,0216	-0,0042	-0,0002	-0,0028
2,30	2,30	0,0321	0,0246	-0,0041	0,0166	0,0263	0,0221	0,0139	-0,0015	0,0220	0,0145	-0,0110	0,0036	2,35	0,0010	0,0287	0,0180	-0,0085	0,0157	0,0287	0,0018	-0,0059	0,0355	-0,0259	-0,0246	-0,0037
2,40	2,40	-0,0114	-0,0376	-0,0419	-0,0103	-0,0404	-0,0309	-0,0194	-0,0077	-0,0435	-0,0115	-0,0261	-0,0256	2,45	-0,0096	-0,0440	-0,0009	-0,0210	-0,0423	-0,0365	0,0000	0,0061	-0,0312	-0,0054	-0,0214	-0,0213
2,50	2,50	-0,0077	-0,0048	-0,0004	0,0165	-0,0025	0,0123	-0,0003	-0,0076	0,0043	-0,0134	0,0034	-0,0034	2,55	-0,0116	0,0003	-0,0148	-0,0120	0,0070	0,0175	-0,0057	-0,0042	-0,0108	-0,0274	-0,0372	-0,0183
2,60	2,60	-0,0293	-0,0802	-0,0374	-0,0249	-0,0544	-0,0477	-0,0258	-0,0051	-0,0427	-0,0205	-0,0538	-0,0374	2,65	-0,0278	-0,0430	-0,0202	0,0026	-0,0294	-0,0266	-0,0110	-0,0070	-0,0429	-0,0068	-0,0014	-0,0239
2,70	2,70	-0,0193	0,0120	0,0159	0,0122	0,0067	-0,0011	-0,0091	0,0039	0,0063	-0,0005	0,0469	0,0011	2,75	0,0057	0,0135	-0,0080	0,0059	0,0065	0,0111	0,0047	-0,0081	-0,0332	-0,0125	-0,0320	-0,0026
2,80	2,80	0,0065	-0,0016	-0,0030	-0,0117	-0,0068	-0,0008	0,0123	0,0184	-0,0070	-0,0153	0,0229	-0,0095	2,85	-0,0035	0,0248	0,0052	-0,0089	0,0062	0,0024	-0,0194	0,0007	0,0373	0,0071	-0,0020	-0,0027
2,90	2,90	0,0092	0,0313	0,0168	0,0067	0,0287	0,0439	0,0116	-0,0015	0,0389	-0,0052	-0,0073	0,0263	2,95	0,0332	0,0003	0,0071	0,0065	0,0041	-0,0009	0,0100	0,0036	0,0022	-0,0024	0,0061	0,0088
3,00	3,00	0,0238	0,0162	-0,0054	0,0177	0,0125	0,0110	0,0245	-0,0101	0,0083	0,0104	0,0049	0,0382	3,05	-0,0108	-0,0148	0,0230	-0,0050	-0,0210	-0,0129	0,0224	0,0154	-0,0233	-0,0106	-0,0071	0,0128
3,10	3,10	-0,0229	0,0128	0,0289	0,0172	0,0121	0,0184	-0,0155	0,0063	0,0082	-0,0162	0,0231	0,0131	3,15	-0,0068	0,0501	-0,0171	-0,0199	0,0272	0,0397	-0,0137	-0,0040	0,0433	-0,0072	-0,0252	-0,0232
3,20	3,20	-0,0109	-0,0193	-0,0007	-0,0074	-0,0327	-0,0232	-0,0185	-0,0064	-0,0190	0,0173	0,0398	-0,0038	3,25	-0,0171	-0,0595	-0,0284	-0,0254	-0,0319	-0,0277	-0,0259	0,0066	-0,0396	-0,0251	-0,0049	-0,0104
3,30	3,30	-0,0173	-0,0002	-0,0002	0,0141	-0,0042	-0,0074	-0,0113	0,0033	0,0022	-0,0163	0,0378	0,0015	3,35	-0,0130	0,0135	0,0218	0,0160	0,0087	0,0020	0,0074	-0,0025	0,0318	0,0117	0,0185	0,0084
3,40	3,40	-0,0048	0,0123	0,0419	0,0333	0,0424	0,0265	-0,0128	0,0004	-0,0099	0,0327	0,0680	0,0148	3,45	0,0149	0,0116	0,0068	0,0204	0,0263	0,0156	0,0143	0,0122	-0,0061	-0,0198		

Time sensitivity of (2,1) coskewness WITHOUT Hilbert Envelope																								
lag	x(m)=-0,45	x(m)=0	x(m)=0,30	x(m)=0,50	x(m)=0,60	x(m)=0,70	x(m)=0,75	x(m)=0,80	x(m)=1,35	x(m)=1,95	x(m)=2,20	x(m)=2,40												
Ekte96	Uter Ekte69	Uter Ekte68	Uter Ekte56	Uter Ekte58	Uter Ekte77	Uter Ekte80	Uter Ekte72	Uter Ekte62	Uter Ekte74	Uter Ekte83	Uter Ekte79	Uter Ekte96												
-2,00	0,0056	0,0037	0,0042	0,0025	-0,0018	0,0131	-0,0019	-0,0010	0,0024	0,0009	-0,0020	-0,0047												
-1,95	0,0003	0,0039	0,0013	-0,0020	-0,0031	0,0026	-0,0058	0,0012	0,0001	-0,0060	-0,0074	-0,0022												
-1,90	-0,0012	0,0020	0,0081	0,0141	-0,0018	0,0011	-0,0177	-0,0008	0,0134	-0,0034	0,0018	0,0056												
-1,85	-0,0073	0,0046	0,0012	0,0144	-0,0017	0,0000	-0,0028	-0,0022	0,0119	-0,0012	-0,0029	-0,0074												
-1,80	-0,0021	0,0094	-0,0075	0,0124	-0,0016	0,0077	0,0071	0,0007	0,0037	-0,0005	0,0028	0,0083												
-1,75	-0,0003	0,0066	-0,0038	0,0132	-0,0067	0,0014	0,0099	0,0045	-0,0059	-0,0038	-0,0095	-0,0085												
-1,70	-0,0043	0,0348	-0,0322	0,0165	-0,0361	-0,0587	0,0203	-0,0100	-0,0343	-0,0007	0,0019	0,0163												
-1,65	-0,0104	-0,0038	-0,0226	0,0092	0,0042	0,0058	-0,0015	-0,0012	0,0085	-0,0020	-0,0043	-0,0035												
-1,60	-0,0023	-0,0103	0,0115	0,0018	0,0006	-0,0116	0,0009	-0,0065	0,0016	-0,0023	0,0089	0,0116												
-1,55	0,0038	0,0031	-0,0177	0,0135	-0,0049	0,0060	-0,0052	-0,0031	0,0034	0,0013	0,0008	-0,0035												
-1,50	-0,0025	-0,0097	0,0039	-0,0083	0,0151	0,0044	-0,0024	-0,0071	-0,0159	0,0055	-0,0110	-0,0047												
-1,45	0,0079	0,0094	0,0000	0,0035	0,0062	0,0069	0,0068	0,0010	0,0098	-0,0111	0,0081	-0,0013												
-1,40	0,0065	0,0055	-0,0053	-0,0038	-0,0073	0,0019	0,0043	-0,0014	-0,0080	-0,0050	-0,0041	-0,0022												
-1,35	0,0000	-0,0011	-0,0012	0,0067	-0,0022	-0,0093	-0,0016	-0,0052	-0,0002	-0,0013	-0,0087	0,0096												
-1,30	0,0006	0,0041	0,0007	0,0050	0,0000	-0,0034	0,0031	0,0087	0,0055	0,0095	0,0008	0,0018												
-1,25	-0,0055	0,0110	-0,0120	0,0092	0,0034	-0,0005	-0,0009	0,0002	0,0046	0,0024	-0,0078	0,0147												
-1,20	-0,0018	-0,0017	-0,0072	0,0039	0,0003	0,0112	0,0049	0,0075	-0,0050	0,0054	-0,0020	-0,0094												
-1,15	-0,0025	0,0032	-0,0100	0,0032	0,0014	-0,0015	0,0012	-0,0005	0,0081	0,0014	-0,0073	-0,0090												
-1,10	0,0029	0,0020	0,0026	0,0015	-0,0155	-0,0016	-0,0011	0,0040	0,0031	0,0191	0,0026	-0,0043												
-1,05	0,0032	0,0046	0,0059	0,0024	-0,0051	0,0040	0,0057	0,0056	0,0186	-0,0015	0,0048	-0,0081												
-1,00	-0,0056	0,0037	-0,0092	-0,0124	0,0102	-0,0040	0,0032	0,0038	0,0084	0,0001	-0,0025	-0,0007												
-0,95	-0,0011	-0,0123	0,0008	-0,0070	0,0046	0,0021	-0,0010	0,0006	-0,0079	-0,0048	0,0101	0,0077												
-0,90	-0,0023	-0,0152	0,0153	-0,0019	-0,0088	-0,0081	-0,0027	0,0050	-0,0020	0,0014	-0,0154	0,0022												
-0,85	-0,0001	0,0024	0,0058	0,0008	0,0031	0,0080	0,0003	0,0030	-0,0079	0,0010	0,0005	0,0001												
-0,80	-0,0030	-0,0009	0,0127	0,0103	0,0178	0,0056	0,0055	-0,0039	0,0103	0,0162	-0,0171	-0,0128												
-0,75	0,0103	0,0055	-0,0098	-0,0022	-0,0041	-0,0087	-0,0027	-0,0030	0,0049	0,0082	-0,0002	-0,0140												
-0,70	0,0023	-0,0031	0,0167	-0,0012	0,0024	-0,0008	0,0093	0,0007	-0,0021	-0,0013	-0,0055	0,0033												
-0,65	0,0021	0,0011	0,0016	-0,0010	0,0030	0,0015	0,0097	0,0031	0,0009	-0,0107	0,0083	0,0051												
-0,60	-0,0028	-0,0006	0,0069	0,0014	-0,0036	-0,0011	-0,0022	-0,0049	0,0078	0,0018	0,0074	0,0017												
-0,55	-0,0037	-0,0034	0,0067	0,0025	0,0151	-0,0023	-0,0088	0,0008	0,0102	-0,0092	-0,0022	0,0042												
-0,50	0,0023	0,0054	0,0013	-0,0010	-0,0127	-0,0002	0,0028	-0,0018	-0,0083	0,0084	0,0006	0,0126												
-0,45	0,0086	-0,0096	-0,0082	-0,0012	0,0084	0,0030	0,0078	0,0008	0,0069	-0,0124	-0,0002	-0,0075												
-0,40	0,0002	0,0129	-0,0046	0,0049	-0,0061	0,0020	-0,0159	0,0038	-0,0051	-0,0016	0,0038	0,0038												
-0,35	-0,0086	0,0062	-0,0076	0,0030	-0,0001	-0,0015	0,0024	-0,0059	-0,0004	-0,0088	-0,0109	0,0008												
-0,30	0,0056	-0,0034	-0,0154	0,0014	0,0041	-0,0072	0,0055	-0,0026	-0,0039	-0,0020	-0,0017	-0,0115												
-0,25	-0,0018	0,0062	-0,0019	-0,0089	0,0047	0,0030	0,0085	-0,0002	-0,0025	0,0021	0,0067	0,0119												
-0,20	0,0105	0,0005	-0,0099	-0,0047	-0,0026	-0,0005	0,0063	0,0028	-0,0108	0,0067	-0,0022	-0,0054												
-0,15	-0,0054	-0,0029	-0,0125	-0,0124	-0,0144	-0,0066	-0,0020	-0,0029	-0,0099	-0,0060	-0,0038	0,0009												
-0,10	-0,0055	-0,0057	0,0166	-0,0080	0,0019	0,0038	-0,0008	0,0007	-0,0009	-0,0010	0,0037	0,0063												
-0,05	0,0086	-0,0037	0,0041	0,0014	0,0061	-0,0064	0,0174	-0,0085	0,0050	0,0101	-0,0053	-0,0091												
0,00	-0,0011	-0,2293	0,0218	0,0134	0,4321	0,0532	-0,0140	-0,0096	0,0331	0,0124	-0,0036	-0,0051												

lag	Time sensitivity of (2,1) coskewness WITHOUT Hilbert Envelope												
	x(m) = -0,45	x(m) = 0	x(m) = 0,30	x(m) = 0,50	x(m) = 0,60	x(m) = 0,70	x(m) = 0,75	x(m) = 0,80	x(m) = 1,35	x(m) = 1,95	x(m) = 2,20	x(m) = 2,40	
	Ekte96	Uter Ekte69	Uter Ekte68	Uter Ekte56	Uter Ekte58	Uter Ekte77	Uter Ekte80	Uter Ekte72	Uter Ekte62	Uter Ekte74	Uter Ekte83	Uter Ekte79	Uter
0,00	-0,0011	-0,2293	0,0218	0,0134	0,4321	0,0532	-0,0140	-0,0096	0,0331	0,0124	-0,0036	-0,0051	
0,05	0,0011	-0,0055	0,0040	0,0056	0,0044	-0,0049	0,0075	0,0021	-0,0075	0,0010	-0,0110	0,0037	
0,10	-0,0010	0,0020	-0,0204	0,0038	0,0145	0,0009	0,0026	0,0035	-0,0004	-0,0003	-0,0107	0,0001	
0,15	-0,0016	-0,0134	0,0114	-0,0100	-0,0102	-0,0059	0,0042	-0,0035	-0,0068	0,0107	0,0018	-0,0080	
0,20	-0,0058	0,0176	-0,0027	0,0072	-0,0148	-0,0112	0,0078	0,0071	0,0080	-0,0063	0,0034	-0,0091	
0,25	-0,0031	0,0004	0,0053	-0,0071	0,0062	0,0005	0,0034	-0,0046	0,0044	0,0033	-0,0027	0,0001	
0,30	-0,0006	-0,0014	0,0166	0,0070	0,0018	-0,0052	-0,0124	0,0002	-0,0001	0,0044	0,0043	0,0066	
0,35	-0,0016	0,0029	0,0006	-0,0071	0,0122	0,0104	-0,0063	-0,0003	0,0018	-0,0009	0,0025	-0,0089	
0,40	-0,0034	-0,0077	0,0072	-0,0001	0,0064	0,0014	0,0046	-0,0097	0,0000	0,0005	-0,0013	-0,0148	
0,45	0,0009	-0,0072	0,0075	0,0006	0,0046	0,0012	-0,0005	0,0012	-0,0058	-0,0025	0,0045	-0,0041	
0,50	0,0042	0,0055	0,0025	0,0016	-0,0135	0,0006	0,0035	0,0000	-0,0016	-0,0049	0,0080	-0,0019	
0,55	-0,0013	-0,0085	0,0048	0,0004	0,0085	0,0034	0,0015	-0,0035	-0,0132	0,0039	0,0047	0,0019	
0,60	0,0034	0,0014	0,0141	-0,0022	0,0069	0,0116	0,0013	-0,0031	-0,0041	-0,0092	0,0009	-0,0033	
0,65	-0,0009	-0,0029	0,0012	0,0003	0,0043	0,0049	-0,0032	-0,0005	0,0037	0,0037	-0,0055	-0,0016	
0,70	0,0009	-0,0077	0,0114	-0,0016	0,0029	0,0062	0,0021	0,0024	0,0049	-0,0082	0,0090	0,0053	
0,75	0,0060	0,0079	-0,0044	0,0053	0,0009	0,0008	-0,0109	-0,0005	0,0111	0,0059	-0,0020	-0,0038	
0,80	-0,0013	0,0000	-0,0169	0,0052	0,0198	0,0119	-0,0058	0,0004	-0,0003	-0,0037	0,0018	0,0013	
0,85	0,0062	0,0095	-0,0058	0,0035	0,0065	-0,0090	-0,0092	0,0026	0,0079	0,0057	0,0002	-0,0046	
0,90	0,0025	-0,0082	-0,0096	-0,0224	0,0006	-0,0029	-0,0029	0,0006	-0,0064	-0,0076	0,0009	0,0151	
0,95	-0,0012	-0,0013	0,0014	-0,0106	-0,0017	0,0128	0,0008	0,0000	-0,0008	-0,0119	-0,0147	-0,0095	
1,00	0,0033	0,0045	-0,0120	-0,0063	0,0099	-0,0005	-0,0039	-0,0151	-0,0071	-0,0006	0,0017	-0,0044	
1,05	0,0031	0,0064	-0,0074	-0,0074	-0,0046	0,0003	-0,0174	0,0039	0,0100	0,0089	-0,0042	-0,0004	
1,10	0,0040	-0,0065	0,0045	0,0073	0,0029	-0,0034	-0,0054	-0,0100	-0,0023	0,0038	0,0009	-0,0004	
1,15	-0,0112	-0,0122	-0,0053	0,0008	0,0112	0,0143	0,0128	0,0012	0,0077	-0,0114	-0,0007	-0,0025	
1,20	0,0025	-0,0021	0,0071	-0,0091	-0,0005	-0,0046	0,0049	-0,0072	-0,0057	0,0032	-0,0032	-0,0033	
1,25	0,0032	0,0050	0,0037	0,0002	-0,0047	-0,0052	0,0052	0,0012	0,0075	0,0013	0,0089	0,0064	
1,30	0,0001	-0,0086	-0,0025	0,0000	0,0037	0,0028	0,0028	0,0013	0,0109	0,0006	-0,0109	-0,0017	
1,35	-0,0033	-0,0109	0,0082	-0,0019	0,0023	-0,0063	-0,0041	-0,0013	0,0139	-0,0024	-0,0045	0,0028	
1,40	0,0020	0,0006	-0,0001	-0,0026	-0,0151	-0,0077	-0,0127	-0,0027	0,0020	0,0066	-0,0055	-0,0053	
1,45	0,0021	0,0026	0,0055	0,0139	-0,0005	-0,0077	-0,0058	-0,0017	-0,0001	-0,0110	0,0005	-0,0004	
1,50	0,0000	-0,0011	0,0088	0,0014	-0,0019	-0,0029	0,0030	0,0010	0,0082	-0,0022	-0,0058	-0,0025	
1,55	0,0032	-0,0042	-0,0109	-0,0003	-0,0157	-0,0059	0,0024	0,0039	-0,0021	-0,0013	-0,0033	-0,0118	
1,60	-0,0037	-0,0029	-0,0039	0,0008	-0,0008	-0,0024	-0,0049	0,0006	0,0021	0,0008	-0,0014	-0,0006	
1,65	-0,0024	0,0171	-0,0026	0,0063	0,0059	0,0087	-0,0083	0,0035	-0,0014	-0,0107	-0,0040	0,0028	
1,70	-0,0005	0,0338	-0,0185	-0,0020	-0,0568	-0,0771	0,0132	0,0022	0,0058	0,0114	-0,0035	-0,0119	
1,75	-0,0017	-0,0025	-0,0048	0,0003	-0,0081	-0,0049	-0,0015	0,0009	0,0050	0,0040	0,0106	0,0071	
1,80	0,0012	-0,0031	0,0188	-0,0086	-0,0118	0,0020	0,0077	-0,0074	-0,0012	0,0019	0,0081	-0,0020	
1,85	0,0062	0,0153	-0,0071	-0,0062	0,0033	0,0003	0,0124	0,0019	-0,0051	0,0015	0,0005	0,0077	
1,90	0,0063	-0,0082	0,0154	-0,0037	0,0010	0,0081	-0,0075	-0,0009	-0,0086	0,0144	0,0055	0,0080	
1,95	0,0022	-0,0036	-0,0075	-0,0017	-0,0073	0,0094	-0,0021	-0,0014	-0,0088	0,0003	0,0027	-0,0004	
2,00	-0,0011	0,0045	-0,0101	-0,0063	-0,0074	0,0030	0,0112	-0,0048	0,0046	-0,0127	0,0023	0,0078	
2,05	-0,0018	-0,0089	-0,0061	0,0022	0,0137	-0,0021	0,0152	0,0008	-0,0024	-0,0054	-0,0127	0,0005	
2,10	0,0007	0,0139	-0,0113	0,0096	-0,0020	0,0028	-0,0114	-0,0034	-0,0018	0,0031	-0,0038	-0,0030	
2,15	0,0009	0,0058	0,0021	-0,0080	0,0026	-0,0015	0,0034	-0,0019	-0,0042	0,0099	-0,0029	-0,0014	
2,20	0,0031	0,0058	-0,0066	-0,0011	0,0024	0,0016	0,0110	-0,0042	0,0157	-0,0050	-0,0053	0,0033	
2,25	0,0000	0,0028	-0,0027	-0,0064	-0,0044	-0,0098	-0,0181	0,0024	0,0066	0,0037	-0,0070	-0,0046	
2,30	0,0040	-0,0046	-0,0056	-0,0010	-0,0098	-0,0087	-0,0040	-0,0144	0,0035	0,0015	-0,0027	-0,0057	
2,35	-0,0058	0,0045	0,0097	-0,0036	-0,0117	0,0093	-0,0115	0,0056	-0,0161	-0,0026	-0,0084	0,0016	
2,40	-0,0012	-0,0059	-0,0049	0,0052	0,0074	-0,0024	0,0055	-0,0003	-0,0058	0,0066	-0,0057	-0,0016	
2,45	-0,0031	-0,0042	0,0036	-0,0014	0,0077	0,0013	0,0074	0,0058	0,0023	-0,0002	-0,0042	0,0014	
2,50	0,0007	0,0024	-0,0031	-0,0016	-0,0051	-0,0033	0,0001	-0,0011	0,0007	0,0008	-0,0031	0,0007	
2,55	0,0007	0,0025	-0,0032	-0,0016	-0,0052	-0,0034	0,0001	-0,0011	0,0007	0,0008	-0,0032	0,0007	
2,60	0,0007	0,0026	-0,0033	-0,0016	-0,0054	-0,0035	0,0001	-0,0011	0,0007	0,0008	-0,0032	0,0008	
2,65	0,0007	0,0027	-0,0034	-0,0017	-0,0056	-0,0036	0,0001	-0,0011	0,0007	0,0009	-0,0033	0,0009	
2,70	0,0007	0,0027	-0,0035	-0,0017	-0,0058	-0,0036	0,0001	-0,0011	0,0007	0,0009	-0,0034	0,0009	
2,75	0,0007	0,0028	-0,0036	-0,0017	-0,0060	-0,0037	0,0001	-0,0011	0,0007	0,0009	-0,0035	0,0010	
2,80	0,0007	0,0029	-0,0037	-0,0017	-0,0061	-0,0038	0,0001	-0,0011	0,0007	0,0010	-0,0035	0,0011	
2,85	0,0007	0,0030	-0,0039	-0,0018	-0,0063	-0,0039	0,0002	-0,0011	0,0007	0,0010	-0,0036	0,0011	
2,90	0,0008	0,0031	-0,0040	-0,0018	-0,0065	-0,0040	0,0002	-0,0012	0,0007	0,0010	-0,0037	0,0012	
2,95	0,0008	0,0031	-0,0041	-0,0018	-0,0067	-0,0040	0,0002	-0,0012	0,0007	0,0010	-0,0037	0,0013	
3,00	0,0008	0,0032	-0,0042	-0,0018	-0,0069	-0,0041	0,0002	-0,0012	0,0007	0,0011	-0,0038	0,0013	
3,05	0,0008	0,0033	-0,0043	-0,0018	-0,0070	-0,0042	0,0002	-0,0012	0,0007	0,0011	-0,0039	0,0014	
3,10	0,0008	0,0034	-0,0044	-0,0019	-0,0072	-0,0043	0,0002	-0,0012	0,0007	0,0011	-0,0040	0,0015	
3,15	0,0008	0,0035	-0,0045	-0,0019	-0,0074	-0,0044	0,0002	-0,0012	0,0007	0,0012	-0,0040	0,0015	
3,20	0,0008	0,0036	-0,0046	-0,0019	-0,0076	-0,0045	0,0002	-0,0012	0,0007	0,0012	-0,0041	0,0016	
3,25	0,0009	0,0036	-0,0048	-0,0019	-0,0077	-0,0045	0,0003	-0,0012	0,0007	0,0012	-0,0042	0,0017	
3,30	0,0009	0,0037	-0,0049	-0,0020	-0,0079	-0,0046	0,0003	-0,0012	0,0008	0,0013	-0,0042	0,0017	
3,35	0,0009	0,0038	-0,0050	-0,0020	-0,0081	-0,0047	0,0003	-0,0012	0,0008	0,0013	-0,0043	0,0018	
3,40	0,0009	0,0039	-0,0051	-0,0020	-0,0083	-0,0048	0,0003	-0,0012	0,0008	0,0013	-0,0044	0,0019	
3,45	0,0009	0,0040	-0,0052	-0,0020	-0,0085	-0,0049	0,0003	-0,0012	0,0008	0,0013	-0,0045	0,0019	
3,50	0,0009	0,0041	-0,0053	-0,0021	-0,0086	-0,0049	0,0003	-0,0012	0,0008	0,0014	-0,0045	0,0020	

lag	Time sensitivity of Correlation WITH Hilbert Envelope												
	x(m) = -0,45	x(m) = 0	x(m) = 0,30	x(m) = 0,50	x(m) = 0,60	x(m) = 0,70	x(m) = 0,75	x(m) = 0,80	x(m) = 1,35	x(m) = 1,95	x(m) = 2,20	x(m) = 2,40	
	Ekte96_Hilbr	Ekte69_Hilbr	Ekte68_Hilbr	Ekte56_Hilbr	Ekte58_Hilbr	Ekte77_Hilbr	Ekte80_Hilbr	Ekte72_Hilbr	Ekte62_Hilbr	Ekte74_Hilbr	Ekte83_Hilbr	Ekte79_Hilbr	
-2,00	-0,0096	-0,0190	-0,0268	-0,0113	-0,0176	-0,0124	-0,0055	-0,0016	-0,0286	-0,0093	-0,0080	-0,0051	
-1,95	-0,0001	-0,0016	0,0031	0,0034	-0,0003	0,0000	-0,0017	0,0046	-0,0077	-0,0110	0,0101	0,0085	
-1,90	-0,0062	-0,0016	-0,0074	0,0123	0,0011	-0,0013	-0,0036	0,0032	-0,0040	0,0085	0,0070	0,0005	
-1,85	0,0051	0,0219	0,0109	-0,0050	0,0154	0,0126	0,0098	0,0074	0,0238	-0,0040	-0,0147	-0,0011	
-1,80	-0,0164	0,0118	0,0049	0,0047	0,0097	0,0034	-0,0080	0,0021	0,0140	0,0034	0,0163	0,0017	
-1,75	-0,0156	-0,0081	-0,0137	-0,0169	-0,0100	-0,0118	-0,0110	0,0013	-0,0091	-0,0105	0,0072	-0,0050	
-1,70	0,1634	0,2231	0,1334	0,0594	0,0962	0,1039	0,1770	0,0171	0,2430	0,0590	0,0344	0,1080	
-1,65	-0,0109	-0,0225	-0,0026	-0,0037	-0,0122	-0,0144	-0,0016	0,0041	-0,0167	-0,0159	-0,0050	0,0070	
-1,60	0,0189	0,0162	-0,0092	0,0065	0,0042	0,0015	0,0315	-0,0035	0,0097	0,0074	-0,0124	0,0216	
-1,55	-0,0007	0,0014	0,0091	0,0185	-0,0049	-0,0037	0,0011	-0,0063	0,0032	0,0087	-0,0027	0,0008	
-1,50	0,0060	0,0036	0,0113	-0,0069	0,0047	0,0020	0,0010	-0,0174	0,0021	0,0212	0,0097	0,0139	
-1,45	-0,0041	-0,0076	-0,0127	0,0016	-0,0077	-0,0074	0,0027	0,0069	-0,0091	0,0160	0,0138	0,0015	
-1,40	-0,0047	0,0109	0,0099	0,0251	0,0103	0,0064	0,0028	0,0119	-0,0035	0,0071	-0,0030	-0,0054	
-1,35	-0,0141	0,0053	-0,0191	-0,0201	0,0038	-0,0013	-0,0130	-0,0069	-0,0042	-0,0316	-0,0166	-0,0239	
-1,30	-0,0062	0,0152	0,0215	0,0103	0,0251	0,0163	0,0026	0,0120	0,0180	0,0095	0,0441	0,0054	
-1,25	-0,0116	-0,0314	-0,0108	0,0246	-0,0223	-0,0266	-0,0116	-0,0072	-0,0374	0,0004	0,0088	-0,0145	
-1,20	0,0064	0,0262	0,0060	-0,0031	0,0275	0,0321	0,0017	0,0041	0,0161	-0,0060	0,0075	0,0094	
-1,15	-0,0033	-0,0045	-0,0028	0,0029	0,0042	-0,0010	0,0124	0,0056	-0,0033	-0,0072	0,0020	0,0034	
-1,10	0,0253	0,0177	0,0078	0,0134	0,0047	0,0058	0,0301	0,0103	0,0137	0,0171	0,0153	0,0235	
-1,05	-0,0048	-0,0319	-0,0098	-0,0149	-0,0375	-0,0326	0,0073	-0,0008	-0,0263	-0,0023	-0,0133	0,0030	
-1,00	0,0056	-0,0057	-0,0201	-0,0063	-0,0063	-0,0071	0,0078	0,0004	-0,0077	-0,0116	-0,0252	-0,0124	
-0,95	-0,0113	-0,0317	-0,0079	-0,0179	-0,0216	-0,0238	-0,0146	-0,0063	-0,0230	0,0044	-0,0207	-0,0130	
-0,90	-0,0129	-0,0166	-0,0058	-0,0100	-0,0099	-0,0084	-0,0128	-0,0047	-0,0138	-0,0017	-0,0139	-0,0146	
-0,85	-0,0138	0,0250	0,0029	-0,0202	0,0202	0,0231	-0,0012	-0,0032	0,0243	-0,0267	-0,0019	-0,0090	
-0,80	-0,0043	-0,0073	0,0037	0,0100	-0,0028	-0,0049	-0,0009	-0,0017	0,0007	-0,0229	-0,0125	-0,0123	
-0,75	-0,0107	-0,0161	-0,0186	-0,0090	-0,0082	-0,0064	-0,0129	0,0077	-0,0151	-0,0127	-0,0137	-0,0160	
-0,70	-0,0329	-0,0056	-0,0068	-0,0040	-0,0023	-0,0015	-0,0304	-0,0182	-0,0077	0,0158	0,0037	-0,0249	
-0,65	-0,0137	-0,0278	-0,0169	-0,0020	-0,0101	-0,0175	-0,0165	-0,0088	-0,0328	-0,0065	0,0071	-0,0143	
-0,60	0,0112	0,0232	0,0289	0,0258	0,0275	0,0255	0,0049	0,0045	0,0178	0,0105	0,0192	0,0242	
-0,55	-0,0026	0,0044	0,0062	0,0035	0,0109	0,0102	0,0023	0,0131	0,0087	0,0141	0,0001	-0,0040	
-0,50	0,0204	0,0302	0,0225	0,0201	0,0178	0,0218	0,0187	-0,0126	0,0282	-0,0067	-0,0125	0,0197	
-0,45	-0,0202	-0,0606	-0,0320	-0,0235	-0,0496	-0,0447	-0,0134	-0,0032	-0,0536	-0,0310	-0,0146	-0,0149	
-0,40	0,0211	0,0072	0,0079	0,0052	0,0026	0,0086	0,0125	0,0047	0,0007	0,0022	-0,0044	0,0208	
-0,35	-0,0162	0,0039	-0,0187	-0,0177	0,0008	0,0018	-0,0268	-0,0092	-0,0019	0,0038	-0,0070	-0,0120	
-0,30	0,0057	-0,0046	-0,0193	-0,0047	-0,0015	-0,0057	0,0131	-0,0213	-0,0048	0,0007	-0,0138	0,0061	
-0,25	0,0070	-0,0099	-0,0052	0,0087	-0,0069	-0,0109	-0,0008	-0,0089	-0,0216	0,0037	-0,0044	-0,0018	
-0,20	-0,0024	0,0095	-0,0059	0,0007	-0,0041	-0,0057	0,0026	0,0001	0,0103	0,0074	0,0049	0,0041	
-0,15	0,0115	0,0019	0,0008	-0,0057	0,0014	0,0053	0,0093	-0,0006	-0,0061	0,0023	-0,0064	0,0013	
-0,10	-0,0239	-0,0153	-0,0060	0,0171	-0,0043	-0,0056	-0,0374	-0,0145	-0,0192	-0,0062	0,0073	-0,0085	
-0,05	-0,0096	-0,0213	-0,0240	-0,0191	-0,0233	-0,0306	-0,0028	-0,0032	-0,0226	-0,0074	0,0014	-0,0011	
0,00	0,2391	0,7275	0,3224	0,2961	0,9252	0,7789	0,2070	0,0248	0,5663	0,1539	0,1278	0,2289	

Time sensitivity of Correlation WITH Hilbert Envelope													
lag	x(m)=-0,45 Ekte96	x(m)=0 Hilb Ekte69	x(m)=0,30 Hilb Ekte68	x(m)=0,50 Hilb Ekte56	x(m)=0,60 Hilb Ekte58	x(m)=0,70 Hilb Ekte77	x(m)=0,75 Hilb Ekte80	x(m)=0,80 Hilb Ekte72	x(m)=1,35 Hilb Ekte62	x(m)=1,95 Hilb Ekte74	x(m)=2,20 Hilb Ekte83	x(m)=2,40 Hilb Ekte79	Hilb Ekte96
0,00	0,2391	0,7275	0,3224	0,2961	0,9252	0,7789	0,2070	0,0248	0,5663	0,1539	0,1278	0,2289	
0,05	-0,0139	-0,0352	-0,0066	-0,0228	-0,0359	-0,0279	-0,0048	-0,0082	-0,0222	-0,0014	-0,0197	-0,0123	
0,10	0,0052	-0,0047	0,0050	-0,0072	-0,0145	-0,0057	0,0127	-0,0073	-0,0016	-0,0181	-0,0187	-0,0008	
0,15	-0,0160	0,0093	0,0115	0,0055	0,0019	0,0025	-0,0089	-0,0014	0,0123	-0,0049	-0,0065	-0,0225	
0,20	0,0042	-0,0084	0,0103	0,0031	0,0012	0,0049	0,0099	-0,0019	-0,0092	0,0156	0,0076	0,0156	
0,25	-0,0021	-0,0163	0,0032	-0,0060	-0,0202	-0,0153	0,0051	-0,0107	-0,0078	0,0202	0,0068	-0,0004	
0,30	-0,0178	-0,0004	-0,0043	0,0103	0,0010	-0,0036	-0,0156	0,0030	-0,0074	-0,0138	-0,0004	-0,0117	
0,35	-0,0201	0,0071	-0,0150	-0,0171	0,0032	0,0020	-0,0214	0,0019	-0,0040	-0,0128	-0,0135	-0,0161	
0,40	0,0006	-0,0040	0,0075	0,0156	0,0022	-0,0010	0,0002	0,0094	-0,0087	0,0227	0,0243	0,0052	
0,45	-0,0101	-0,0470	-0,0356	-0,0125	-0,0475	-0,0538	-0,0220	-0,0077	-0,0444	-0,0010	0,0074	-0,0260	
0,50	-0,0018	0,0093	0,0318	0,0156	0,0153	0,0156	0,0033	-0,0121	0,0122	-0,0009	0,0161	0,0035	
0,55	0,0010	0,0282	0,0039	-0,0053	0,0263	0,0160	0,0122	0,0206	0,0149	0,0109	-0,0001	0,0116	
0,60	0,0166	0,0254	0,0212	0,0103	0,0212	0,0183	0,0270	-0,0016	0,0325	0,0039	0,0186	0,0257	
0,65	-0,0003	-0,0139	-0,0153	-0,0308	-0,0247	-0,0264	0,0000	-0,0006	-0,0068	-0,0115	-0,0267	-0,0060	
0,70	-0,0056	-0,0022	-0,0037	-0,0094	0,0006	-0,0017	0,0051	-0,0080	-0,0041	-0,0018	-0,0255	-0,0070	
0,75	-0,0047	-0,0065	-0,0169	-0,0107	-0,0071	-0,0106	-0,0121	0,0045	-0,0083	0,0048	-0,0152	-0,0122	
0,80	-0,0154	-0,0038	-0,0045	0,0040	-0,0014	-0,0030	-0,0031	0,0020	-0,0086	0,0067	-0,0092	-0,0164	
0,85	-0,0150	0,0133	0,0091	0,0046	0,0203	0,0200	-0,0171	-0,0281	0,0122	-0,0154	-0,0159	-0,0036	
0,90	-0,0286	-0,0107	-0,0112	-0,0188	-0,0122	-0,0093	-0,0215	-0,0160	-0,0063	-0,0178	-0,0163	-0,0225	
0,95	-0,0071	-0,0133	-0,0121	-0,0125	-0,0152	-0,0194	-0,0081	0,0013	-0,0134	-0,0049	-0,0060	-0,0151	
1,00	-0,0285	-0,0182	-0,0179	-0,0027	-0,0057	-0,0068	-0,0116	0,0061	-0,0259	0,0049	0,0069	-0,0216	
1,05	-0,0185	-0,0361	-0,0160	-0,0001	-0,0288	-0,0301	-0,0111	-0,0020	-0,0235	0,0080	0,0083	-0,0097	
1,10	0,0225	0,0117	0,0245	0,0195	0,0138	0,0070	0,0069	0,0039	0,0048	0,0159	0,0256	0,0111	
1,15	-0,0002	0,0049	0,0045	-0,0066	0,0023	0,0022	0,0041	0,0073	-0,0008	-0,0010	0,0045	-0,0149	
1,20	0,0142	0,0381	0,0141	0,0077	0,0263	0,0264	0,0102	-0,0118	0,0384	-0,0037	-0,0132	0,0100	
1,25	0,0078	-0,0160	-0,0165	-0,0122	-0,0261	-0,0222	0,0089	0,0055	-0,0064	-0,0027	-0,0152	0,0061	
1,30	0,0182	0,0287	0,0094	0,0026	0,0147	0,0159	0,0229	0,0029	0,0293	0,0055	0,0000	0,0175	
1,35	-0,0109	-0,0036	-0,0071	-0,0120	0,0043	0,0053	-0,0168	-0,0004	-0,0157	0,0114	-0,0131	-0,0082	
1,40	0,0029	0,0136	0,0073	0,0046	0,0093	0,0039	0,0044	-0,0037	0,0222	-0,0089	-0,0077	0,0132	
1,45	0,0059	-0,0147	-0,0101	0,0010	-0,0121	-0,0101	-0,0061	0,0011	-0,0110	-0,0076	0,0045	-0,0034	
1,50	0,0013	-0,0020	-0,0173	0,0185	0,0092	-0,0026	-0,0030	0,0037	-0,0101	0,0063	0,0029	0,0043	
1,55	0,0014	0,0026	0,0156	0,0113	-0,0028	-0,0027	0,0081	0,0111	0,0072	0,0111	-0,0034	0,0137	
1,60	-0,0218	-0,0087	-0,0006	-0,0028	0,0029	0,0014	-0,0218	0,0081	-0,0032	0,0024	0,0169	-0,0020	
1,65	-0,0084	0,0024	-0,0202	-0,0069	-0,0148	-0,0094	-0,0088	-0,0041	-0,0006	-0,0126	0,0009	-0,0128	
1,70	0,0485	0,1432	0,2480	0,1593	0,1134	0,1452	0,0405	0,0004	0,1162	0,0699	0,0758	0,0637	
1,75	-0,0084	-0,0211	-0,0257	-0,0189	-0,0202	-0,0116	-0,0116	-0,0074	-0,0140	0,0001	-0,0111	-0,0099	
1,80	0,0127	0,0170	0,0016	-0,0066	0,0100	0,0107	0,0127	0,0132	0,0190	-0,0064	-0,0173	0,0044	
1,85	-0,0057	0,0149	0,0102	0,0116	0,0179	0,0198	-0,0018	-0,0024	0,0041	-0,0036	0,0125	-0,0161	
1,90	0,0033	0,0009	0,0040	0,0003	0,0092	0,0053	0,0056	-0,0080	0,0076	0,0234	0,0027	0,0174	
1,95	0,0009	-0,0013	0,0037	0,0005	-0,0096	-0,0032	0,0022	0,0044	0,0128	0,0150	0,0009	-0,0006	
2,00	-0,0173	-0,0215	-0,0099	0,0010	-0,0249	-0,0188	-0,0101	-0,0064	-0,0183	-0,0095	0,0084	-0,0072	
2,05	-0,0175	-0,0322	-0,0128	-0,0266	-0,0215	-0,0190	-0,0176	-0,0028	-0,0277	-0,0205	-0,0228	-0,0149	
2,10	0,0042	-0,0044	0,0073	0,0137	-0,0041	-0,0075	-0,0083	-0,0113	0,0024	0,0140	0,0254	-0,0006	
2,15	-0,0054	-0,0147	-0,0414	-0,0147	-0,0181	-0,0234	-0,0085	0,0020	-0,0215	-0,0108	0,0001	-0,0195	
2,20	-0,0091	0,0156	0,0115	0,0047	0,0254	0,0203	-0,0028	0,0011	0,0140	0,0157	0,0125	-0,0092	
2,25	-0,0009	0,0059	-0,0047	0,0092	0,0082	0,0080	0,0001	0,0016	0,0076	-0,0136	0,0049	0,0083	
2,30	0,0123	0,0182	0,0053	0,0201	0,0217	0,0245	0,0165	0,0067	0,0161	0,0144	0,0124	0,0105	
2,35	0,0076	0,0135	0,0084	-0,0094	0,0025	0,0044	0,0110	0,0143	0,0207	-0,0122	-0,0133	0,0223	
2,40	-0,0104	-0,0032	-0,0027	0,0108	0,0007	-0,0064	-0,0012	-0,0126	-0,0062	-0,0061	-0,0176	-0,0071	
2,45	0,0038	-0,0037	-0,0039	-0,0111	-0,0043	0,0010	-0,0014	0,0048	-0,0080	-0,0059	-0,0116	-0,0045	
2,50	-0,0266	-0,0091	0,0017	0,0094	-0,0020	0,0051	-0,0162	-0,0022	0,0023	-0,0008	0,0043	-0,0108	
2,55	-0,0112	-0,0029	-0,0132	-0,0128	-0,0036	0,0036	-0,0088	-0,0074	0,0012	-0,0224	-0,0281	-0,0262	
2,60	-0,0429	-0,0413	-0,0292	-0,0259	-0,0314	-0,0233	-0,0235	-0,0079	-0,0339	-0,0118	-0,0390	-0,0366	
2,65	-0,0192	-0,0213	-0,0198	-0,0031	-0,0203	-0,0169	-0,0070	-0,0110	-0,0137	-0,0077	-0,0067	-0,0198	
2,70	-0,0165	-0,0134	0,0122	0,0041	-0,0113	-0,0119	-0,0098	0,0061	0,0013	-0,0051	0,0295	-0,0025	
2,75	-0,0052	-0,0148	-0,0070	0,0023	-0,0116	-0,0111	-0,0017	-0,0054	-0,0205	-0,0183	0,0147	-0,0241	
2,80	0,0196	0,0062	0,0130	-0,0003	-0,0058	-0,0050	0,0146	0,0068	0,0081	-0,0042	0,0198	0,0104	
2,85	0,0034	0,0138	0,0108	0,0030	-0,0028	-0,0020	-0,0038	0,0054	0,0188	0,0003	-0,0023	0,0109	
2,90	0,0046	0,0117	0,0066	-0,0011	0,0203	0,0216	0,0043	0,0124	0,0073	0,0111	0,0003	0,0092	
2,95	0,0165	0,0068	0,0037	-0,0007	-0,0016	-0,0005	0,0132	0,0046	-0,0023	0,0015	-0,0078	0,0182	
3,00	0,0178	0,0025	0,0048	0,0021	0,0098	0,0106	0,0245	-0,0012	0,0153	0,0164	-0,0050	0,0097	
3,05	-0,0105	-0,0139	0,0044	-0,0141	-0,0218	-0,0291	0,0045	-0,0009	-0,0200	-0,0016	-0,0048	0,0007	
3,10	-0,0063	0,0237	0,0044	0,0099	0,0259	0,0282	-0,0030	0,0000	0,0155	-0,0100	-0,0077	0,0084	
3,15	0,0048	-0,0090	-0,0204	-0,0131	-0,0247	-0,0195	-0,0072	0,0011	-0,0096	-0,0128	-0,0170	-0,0046	
3,20	-0,0073	-0,0213	-0,0197	-0,0118	-0,0262	-0,0205	-0,0213	0,0061	-0,0175	-0,0086	0,0014	-0,0069	
3,25	0,0044	-0,0030	0,0004	0,0161	0,0036	0,0073	0,0033	0,0012	-0,0006	0,0055	-0,0007	-0,0006	
3,30	-0,0246	-0,0241	0,0068	0,0110	-0,0193	-0,0208	-0,0150	0,0101	-0,0184	-0,0030	0,0249	-0,0024	
3,35	-0,0124	-0,0150	-0,0159	-0,0105	-0,0164	-0,0158	-0,0143	-0,0116	-0,0022	-0,0076	-0,0136	-0,0267	
3,40	0,0313	0,0370	0,0647	0,0505	0,0684	0,0522	0,0239	0,0086	0,0261	0,0485	0,0545	0,0224	
3,45	-0,0061	-0,0198	-0,0158	-0,0161	-0,0216	-0,0248	-0,0128	-0,0025	-0,0105	-0,0119	-0,0127	-0,0053	
3,50	0,0037	0,0057	0,0048	-0,0055	0,0054	0,0134	0,0147	-0,0009	0,0119	-0,0016	-0,0166	0,0006	

lag	Time sensitivity of Correlation WITHOUT Hilbert Envelope											
	x(m) = -0,45 Ekte96_UTEI	x(m) = 0 Ekte69_UTEI	x(m) = 0,30 Ekte68_UTEI	x(m) = 0,50 Ekte56_UTEI	x(m) = 0,60 Ekte58_UTEI	x(m) = 0,70 Ekte77_UTEI	x(m) = 0,75 Ekte80_UTEI	x(m) = 0,80 Ekte72_UTEI	x(m) = 1,35 Ekte62_UTEI	x(m) = 1,95 Ekte74_UTEI	x(m) = 2,20 Ekte83_UTEI	x(m) = 2,40 Ekte79_UTEI
-2,00	-0,0019	-0,0002	0,0043	0,0086	0,0026	0,0094	-0,0078	0,0018	0,0057	-0,0102	0,0094	0,0061
-1,95	0,0045	0,0016	0,0018	-0,0024	-0,0020	-0,0033	-0,0135	0,0123	-0,0001	-0,0025	0,0178	0,0119
-1,90	-0,0050	0,0011	0,0018	0,0184	-0,0027	-0,0001	-0,0001	0,0078	0,0072	-0,0016	0,0039	-0,0038
-1,85	0,0064	-0,0058	0,0263	0,0076	0,0040	0,0028	0,0134	0,0010	-0,0001	-0,0149	0,0009	-0,0181
-1,80	0,0037	0,0011	0,0098	0,0056	-0,0020	-0,0055	0,0016	0,0109	-0,0027	-0,0035	0,0025	-0,0014
-1,75	0,0067	-0,0012	-0,0081	0,0098	0,0003	0,0064	0,0025	-0,0075	0,0022	0,0057	0,0010	0,0092
-1,70	0,0221	-0,1028	0,0055	-0,0195	-0,2610	-0,1994	0,0374	0,0207	0,0855	0,0138	-0,0095	-0,0339
-1,65	0,0092	-0,0017	-0,0239	0,0295	-0,0041	-0,0027	0,0118	0,0029	-0,0077	0,0117	-0,0138	0,0062
-1,60	0,0030	-0,0006	-0,0316	-0,0168	-0,0022	0,0005	0,0034	-0,0069	-0,0019	0,0116	-0,0073	-0,0107
-1,55	0,0021	0,0036	-0,0121	0,0160	0,0011	-0,0019	0,0002	0,0140	-0,0002	-0,0222	0,0055	0,0030
-1,50	-0,0040	0,0009	0,0212	-0,0064	0,0045	0,0055	0,0068	0,0045	-0,0031	-0,0103	0,0062	-0,0032
-1,45	0,0040	-0,0015	0,0138	0,0015	0,0045	0,0070	-0,0043	0,0085	0,0024	0,0112	0,0057	0,0039
-1,40	0,0047	-0,0024	-0,0083	0,0254	-0,0023	-0,0006	0,0112	-0,0018	0,0022	-0,0076	0,0187	0,0028
-1,35	-0,0099	0,0041	-0,0044	0,0214	-0,0003	-0,0021	-0,0012	0,0053	-0,0048	-0,0092	0,0053	0,0057
-1,30	0,0020	-0,0018	0,0182	0,0028	-0,0005	0,0017	0,0018	0,0000	0,0042	0,0040	-0,0087	-0,0044
-1,25	-0,0090	-0,0072	-0,0109	0,0236	0,0032	0,0044	-0,0071	-0,0017	-0,0030	-0,0014	0,0156	0,0025
-1,20	-0,0039	-0,0031	-0,0029	-0,0022	0,0006	0,0022	-0,0028	0,0096	-0,0034	-0,0086	-0,0015	0,0069
-1,15	0,0015	-0,0028	-0,0265	0,0327	-0,0006	-0,0004	-0,0094	-0,0086	-0,0046	-0,0080	0,0153	0,0134
-1,10	-0,0118	0,0000	-0,0077	0,0040	-0,0027	0,0027	0,0011	0,0084	-0,0036	0,0229	-0,0160	0,0123
-1,05	0,0079	-0,0049	0,0091	0,0098	-0,0025	0,0086	0,0102	-0,0051	0,0044	0,0207	-0,0098	0,0019
-1,00	-0,0040	-0,0072	0,0128	0,0066	-0,0006	0,0046	0,0077	0,0042	0,0006	0,0071	-0,0059	0,0012
-0,95	0,0023	-0,0048	0,0144	0,0016	0,0029	-0,0021	0,0023	-0,0044	0,0046	0,0244	-0,0004	-0,0066
-0,90	0,0007	-0,0019	0,0069	-0,0126	-0,0035	-0,0022	0,0042	-0,0008	0,0024	0,0136	0,0008	-0,0132
-0,85	-0,0059	0,0009	0,0092	0,0167	0,0097	0,0062	-0,0041	-0,0086	-0,0011	-0,0073	0,0080	0,0017
-0,80	-0,0022	0,0056	0,0241	0,0190	0,0072	-0,0035	0,0066	-0,0069	-0,0020	-0,0117	0,0100	0,0203
-0,75	0,0014	0,0043	-0,0109	-0,0142	-0,0020	-0,0009	0,0049	0,0045	0,0021	-0,0007	-0,0059	0,0083
-0,70	-0,0075	0,0043	0,0231	-0,0042	0,0041	-0,0044	0,0126	0,0005	0,0050	-0,0061	0,0280	0,0018
-0,65	0,0011	-0,0006	0,0019	-0,0078	0,0033	0,0002	0,0001	0,0051	-0,0030	0,0147	-0,0034	-0,0016
-0,60	-0,0061	-0,0021	-0,0146	0,0118	-0,0010	0,0020	0,0134	-0,0023	0,0021	0,0056	0,0060	-0,0039
-0,55	-0,0006	0,0134	-0,0065	0,0154	-0,0036	-0,0010	-0,0211	0,0040	0,0025	-0,0001	0,0040	-0,0082
-0,50	-0,0056	-0,0003	0,0070	-0,0235	-0,0060	0,0057	-0,0065	-0,0019	0,0021	0,0067	0,0017	-0,0028
-0,45	0,0139	0,0000	-0,0040	0,0072	-0,0069	-0,0007	0,0090	0,0005	-0,0035	-0,0037	-0,0083	0,0001
-0,40	0,0005	-0,0005	-0,0053	-0,0117	0,0055	0,0008	-0,0216	0,0183	-0,0003	0,0080	-0,0262	-0,0126
-0,35	0,0115	-0,0038	-0,0044	0,0161	-0,0010	-0,0028	-0,0003	-0,0042	0,0005	0,0061	0,0322	0,0108
-0,30	0,0063	0,0008	-0,0057	-0,0258	-0,0043	-0,0093	0,0095	-0,0044	-0,0049	0,0061	-0,0138	-0,0040
-0,25	-0,0097	-0,0014	0,0155	-0,0027	0,0036	-0,0011	0,0153	-0,0137	0,0053	0,0028	-0,0016	-0,0102
-0,20	-0,0039	-0,0027	-0,0134	-0,0118	0,0005	0,0011	-0,0087	-0,0106	-0,0052	-0,0061	-0,0021	-0,0032
-0,15	0,0025	0,0058	-0,0377	-0,0122	-0,0089	-0,0094	-0,0068	-0,0025	0,0003	0,0084	0,0068	0,0083
-0,10	0,0024	-0,0031	-0,0025	0,0044	0,0007	-0,0004	-0,0017	0,0059	0,0070	-0,0004	-0,0077	-0,0035
-0,05	-0,0005	0,0014	0,0009	0,0083	0,0126	0,0012	0,0187	-0,0034	-0,0107	-0,0048	0,0018	0,0103
0,00	0,0061	-0,1784	0,0339	0,0465	0,9388	0,3280	-0,0520	-0,0041	-0,4931	-0,0187	0,0301	-0,0098

lag	Time sensitivity of Correlation WITHOUT Hilbert Envelope											
	x(m) = -0,45 Ekte96	x(m) = 0 UTEI Ekte69	x(m) = 0,30 UTEI Ekte68	x(m) = 0,50 UTEI Ekte56	x(m) = 0,60 UTEI Ekte58	x(m) = 0,70 UTEI Ekte77	x(m) = 0,75 UTEI Ekte80	x(m) = 0,80 UTEI Ekte72	x(m) = 1,35 UTEI Ekte62	x(m) = 1,95 UTEI Ekte74	x(m) = 2,20 UTEI Ekte83	x(m) = 2,40 UTEI Ekte79
0,00	0,0061	-0,1784	0,0339	0,0465	0,9388	0,3280	-0,0520	-0,0041	-0,4931	-0,0187	0,0301	-0,0098
0,05	0,0079	-0,0070	0,0169	0,0184	0,0123	0,0028	-0,0019	-0,0018	-0,0013	0,0019	0,0105	-0,0060
0,10	0,0035	0,0025	-0,0180	0,0008	-0,0036	-0,0064	-0,0002	0,0113	0,0007	-0,0134	0,0127	0,0170
0,15	0,0127	-0,0019	0,0052	-0,0241	-0,0068	-0,0020	-0,0044	-0,0101	0,0075	0,0170	-0,0080	-0,0020
0,20	0,0124	-0,0021	-0,0242	0,0228	0,0006	0,0000	0,0092	-0,0033	0,0030	0,0161	0,0092	0,0197
0,25	0,0055	0,0005	-0,0019	-0,0077	0,0015	-0,0025	0,0035	-0,0081	-0,0016	-0,0073	-0,0063	-0,0058
0,30	-0,0010	0,0028	-0,0003	-0,0143	-0,0018	-0,0040	-0,0180	0,0133	0,0056	0,0029	-0,0177	-0,0107
0,35	-0,0020	0,0036	0,0166	-0,0104	-0,0021	-0,0008	-0,0058	-0,0022	0,0061	0,0025	-0,0096	0,0031
0,40	0,0032	-0,0021	-0,0213	0,0055	0,0028	-0,0039	0,0027	-0,0041	-0,0048	-0,0069	0,0166	0,0122
0,45	-0,0011	-0,0022	0,0178	-0,0070	-0,0060	0,0028	-0,0081	0,0033	0,0043	0,0015	-0,0043	-0,0199
0,50	0,0007	0,0008	-0,0011	-0,0045	-0,0067	0,0008	0,0162	-0,0073	-0,0030	0,0016	0,0089	0,0076
0,55	0,0059	-0,0101	0,0327	-0,0346	-0,0010	-0,0056	0,0097	0,0079	-0,0008	0,0176	-0,0099	0,0018
0,60	-0,0021	0,0027	0,0087	-0,0132	-0,0019	0,0035	0,0080	-0,0068	-0,0058	-0,0082	0,0241	0,0034
0,65	0,0033	0,0035	-0,0205	-0,0197	0,0015	0,0053	0,0093	0,0158	0,0059	-0,0172	0,0210	0,0077
0,70	-0,0025	-0,0051	-0,0098	0,0029	0,0018	-0,0022	-0,0197	-0,0058	0,0014	0,0028	-0,0142	0,0014
0,75	0,0063	-0,0069	-0,0109	0,0017	-0,0047	-0,0065	0,0076	-0,0063	-0,0060	-0,0196	-0,0019	0,0126
0,80	0,0072	-0,0075	-0,0043	0,0108	0,0064	-0,0058	0,0033	-0,0102	-0,0087	-0,0078	0,0195	0,0126
0,85	-0,0036	-0,0006	-0,0066	-0,0112	0,0086	0,0031	-0,0019	-0,0002	-0,0026	0,0134	0,0006	0,0006
0,90	-0,0116	0,0010	-0,0162	-0,0327	-0,0002	0,0061	-0,0061	-0,0001	0,0042	0,0092	-0,0011	-0,0017
0,95	-0,0001	0,0010	0,0011	-0,0133	0,0008	0,0027	0,0021	-0,0044	0,0034	-0,0045	0,0131	0,0083
1,00	0,0091	0,0049	-0,0179	0,0042	0,0001	0,0040	0,0141	0,0007	0,0102	0,0130	-0,0043	0,0182
1,05	0,0045	0,0033	-0,0090	0,0060	-0,0057	-0,0024	0,0007	-0,0053	-0,0003	-0,0040	0,0215	0,0097
1,10	0,0082	-0,0007	0,0116	0,0112	-0,0029	-0,0019	-0,0065	-0,0079	0,0067	0,0003	-0,0010	0,0083
1,15	0,0074	0,0046	0,0133	-0,0259	0,0021	0,0073	0,0343	0,0066	0,0003	-0,0004	0,0191	0,0020
1,20	0,0073	0,0043	-0,0003	0,0228	0,0027	0,0040	0,0010	-0,0037	0,0061	0,0044	-0,0198	-0,0049
1,25	-0,0050	0,0060	-0,0142	-0,0002	0,0021	-0,0011	-0,0005	0,0042	0,0000	0,0140	-0,0072	0,0119
1,30	0,0042	0,0038	0,0092	0,0158	-0,0012	0,0047	0,0194	-0,0037	0,0074	-0,0092	0,0247	-0,0057
1,35	0,0020	-0,0006	0,0204	-0,0039	-0,0010	0,0003	0,0038	-0,0074	-0,0073	-0,0141	-0,0075	-0,0118
1,40	0,0112	-0,0006	-0,0048	0,0083	-0,0015	0,0035	-0,0028	0,0046	0,0001	-0,0062	0,0171	0,0017
1,45	0,0016	0,0015	-0,0194	0,0357	0,0015	0,0000	-0,0242	0,0040	-0,0023	0,0123	-0,0102	0,0020
1,50	0,0034	0,0017	0,0039	0,0129	0,0021	-0,0023	0,0098	0,0084	-0,0004	0,0107	0,0056	-0,0041
1,55	-0,0005	0,0001	0,0255	0,0201	0,0047	0,0035	0,0051	0,0144	-0,0023	-0,0020	-0,0186	0,0011
1,60	-0,0005	-0,0010	-0,0125	-0,0105	-0,0022	-0,0046	-0,0095	-0,0120	-0,0040	0,0214	0,0101	0,0072
1,65	-0,0164	-0,0016	-0,0341	-0,0204	-0,0028	-0,0021	-0,0174	0,0045	0,0040	0,0022	0,0024	-0,0061
1,70	0,0115	0,0222	-0,0634	-0,0302	-0,2928	-0,1963	0,0228	0,0080	0,2011	0,0076	-0,0211	0,0518
1,75	-0,0030	0,0007	-0,0013	-0,0201	-0,0041	-0,0068	0,0201	0,0038	0,0012	-0,0105	0,0036	0,0066
1,80	-0,0070	-0,0052	0,0130	0,0015	0,0016	0,0052	0,0040	-0,0098	-0,0068	0,0293	-0,0209	-0,0156
1,85	-0,0039	0,0003	0,0005	0,0169	0,0067	0,0026	0,0075	0,0088	-0,0066	0,0042	-0,0101	-0,0141
1,90	-0,0208	0,0005	0,0087	-0,0074	-0,0017	0,0023	-0,0051	-0,0129	-0,0050	0,0224	-0,0173	0,0021
1,95	-0,0005	0,0002	-0,0089	0,0000	-0,0027	0,0038	-0,0018	-0,0041	-0,0042	0,0013	0,0039	0,0015
2,00	0,0055	-0,0027	-0,0011	0,0132	0,0007	0,0002	0,0201	0,0029	-0,0040	-0,0009	0,0087	0,0061
2,05	-0,0086	0,0011	-0,0094	-0,0195	0,0042	0,0054	0,0146	-0,0036	-0,0022	-0,0111	0,0238	0,0183
2,10	-0,0086	0,0018	0,0055	-0,0148	-0,0050	0,0044	-0,0103	0,0010	-0,0012	-0,0029	0,0054	0,0025
2,15	0,0034	-0,0013	-0,0210	0,0160	0,0096	0,0040	0,0106	-0,0043	-0,0043	0,0133	0,0037	0,0014
2,20	0,0019	0,0021	0,0088	0,0095	0,0009	0,0015	-0,0085	-0,0074	0,0004	0,0151	-0,0169	-0,0007
2,25	0,0024	0,0078	-0,0165	0,0156	-0,0027	0,0015	0,0041	0,0014	0,0013	-0,0171	0,0000	-0,0010
2,30	0,0001	-0,0031	-0,0062	0,0017	0,0006	-0,0016	-0,0094	-0,0048	0,0036	-0,0071	-0,0137	0,0033
2,35	-0,0020	-0,0083	0,0054	0,0050	-0,0032	-0,0027	-0,0159	-0,0063	-0,0021	0,0049	0,0071	0,0052
2,40	-0,0005	0,0018	-0,0037	0,0038	0,0045	0,0028	0,0168	0,0036	0,0034	0,0030	0,0215	0,0131
2,45	-0,0026	0,0037	-0,0017	-0,0147	0,0053	0,0015	0,0070	0,0010	0,0075	0,0321	0,0089	-0,0022
2,50	0,0023	0,0041	-0,0064	-0,0021	0,0036	0,0048	0,0044	0,0046	0,0076	0,0106	-0,0202	0,0057
2,55	0,0028	-0,0014	0,0033	0,0041	-0,0092	-0,0071	0,0100	-0,0067	-0,0015	-0,0062	-0,0016	0,0206
2,60	0,0043	0,0043	0,0151	0,0168	-0,0032	-0,0016	-0,0041	-0,0074	0,0024	-0,0071	-0,0067	0,0117
2,65	0,0011	-0,0011	0,0139	0,0162	0,0009	0,0021	0,0061	0,0010	-0,0075	-0,0094	-0,0090	-0,0034
2,70	-0,0099	-0,0090	0,0195	0,0018	0,0025	0,0012	-0,0199	0,0077	-0,0065	-0,0043	-0,0184	0,0024
2,75	0,0033	0,0013	0,0040	0,0120	-0,0021	-0,0019	0,0063	-0,0033	-0,0042	0,0109	-0,0113	-0,0025
2,80	0,0069	0,0016	0,0071	-0,0098	0,0027	0,0028	-0,0125	0,0059	0,0015	-0,0021	-0,0075	-0,0212
2,85	-0,0178	0,0067	-0,0081	0,0171	0,0025	0,0020	-0,0235	-0,0083	0,0035	0,0057	-0,0310	0,0079
2,90	0,0005	0,0038	-0,0112	-0,0086	-0,0070	-0,0034	-0,0006	0,0049	-0,0083	-0,0158	0,0111	0,0009
2,95	-0,0089	-0,0017	0,0308	0,0111	-0,0048	-0,0042	-0,0070	-0,0027	0,0052	-0,0081	-0,0113	-0,0025
3,00	-0,0026	-0,0022	0,0059	-0,0087	-0,0049	-0,0100	-0,0124	0,0004	-0,0047	0,0204	0,0033	-0,0028
3,05	-0,0052	0,0029	-0,0251	0,0092	0,0027	0,0047	0,0111	0,0155	0,0037	0,0010	-0,0131	0,0045
3,10	0,0020	-0,0006	0,0006	0,0053	0,0016	0,0045	0,0071	0,0106	-0,0045	-0,0044	-0,0214	-0,0125
3,15	0,0096	-0,0008	0,0201	-0,0163	-0,0026	-0,0028	0,0125	-0,0022	0,0070	-0,0066	0,0271	0,0057
3,20	-0,0023	-0,0021	-0,0022	-0,0059	0,0001	0,0041	-0,0036	-0,0073	0,0031	-0,0116	0,0092	0,0028
3,25	-0,0079	-0,0003	-0,0143	-0,0205	-0,0089	-0,0018	0,0028	-0,0013	0,0079	0,0118	0,0116	0,0031
3,30	0,0009	0,0034	0,0049	0,0164	0,0006	0,0014	0,0070	0,0109	0,0010	-0,0204	-0,0099	-0,0126
3,35	-0,0022	-0,0037	0,0479	0,0026	0,0050	0,0001	0,0153	-0,0092	-0,0019	-0,0012	0,0119	0,0051
3,40	-0,0146	0,0032	0,0647	0,0007	0,1055	0,0381	-0,0030	-0,0072	-0,0556	0,0003	-0,0089	-0,0231
3,45	-0,0172	0,0061	-0,0146	-0,0051	-0,0035	0,0033	-0,0088	-0,0136	-0,0070	0,0150	-0,0178	0,0066
3,50	0,0119	0,0035	-0,0158	0,0069	-0,0027	-0,0041	0,0207	0,0059	0,0057	-0,0122	0,0096	0,0122