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Time series with interdependent level and second moment: statistical testing and applications with Greek external trade and simulated data[1]

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ABSTRACT

This work aims to fill an existing gap in the literature regarding the statistical testing for the existence and the identification of the character of time-varying second moment in its dependence on a non-constant mean level in time series. To this end a new statistical testing procedure is introduced with some considerable advantages over the existing ones. Amongst others it is argued that the existing statistical tests are insufficient and sometimes lead to biased results. Further the effect of the application of this methodology on some crucial elements of time series modelling such as outlier detection and seasonal adjustment is examined, through case studies conducted on a comparative basis using both the new methodology and an established one. The severe consequences of the improper treatment of the type of time-varying second moment dealt with in this work are evidenced and emphasized. The data set comprises time series on monthly external trade statistics for Greece. Overall, the resulting empirical evidence favours the new approach. Further supporting evidence is provided by the application of the new methodology to simulated data.

JEL Classification: C150, C220, C510, F140

Keywords: time series transformations, applied time series analysis, seasonal adjustment, detection of outliers, Greek external trade time series.

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1. Introduction

Over the last five decades a vast volume of research work, at both the theoretical and the applied level, has been devoted to time series with time-varying second moment. This non-constancy in the second moment may be due to various reasons. For the purposes of this work it is methodologically useful to distinguish between type (i): series with conditionally non-constant, but unconditionally constant variance, and type (ii): series with non-constant variance both conditionally and unconditionally. In the present the focus is on the latter.

If the variance is functionally related to the level and the latter is non-stationary (which most often is indeed the case with economic-financial time series), the variance is not constant both conditionally and unconditionally [this is the typical case of type (ii)]. Hence, the process is non-homogeneously non-stationary in the sense of Box and Jenkins (1976) and cannot be made stationary by simply differencing it. One way to tackle variance non-stationarity is to employ power transformations such as the well-known class of the Box and Cox transformations (Box and Cox, 1964). For instance, the transformation given by:

$$f(y_t) = \begin{array}{l} y_t^{\lambda} \;\; if \;\; \lambda > 0 \\ \log y_t \;\; if \;\; \lambda = 0 \\ -y_t^{\lambda} \;\; if \;\; \lambda < 0 \end{array} \tag{1}$$

is very often used.

In spite of its importance for time series modelling, there is not much work at the theoretical level on the detection and correction of non-constancy in the variance owing to its dependence on a non-stationary mean level. Further, at the practical level the treatment of non-stationary variance is not only insufficient (indeed, when a particular transformation is used its selection is often arbitrary) but also, occasionally, biased towards over-rejection of the null hypothesis of unconditionally constant variance, as is argued later on in this paper.

More specifically, the existing statistical approaches for the detection and correction of variancenon-stationarity appear to have several disadvantages as: (i) they detect variance non-stationarity, but the correction they suggest is not formally and rigorously documented (e.g.Hay and McLeay, 1979; Milionis and Davies, 1994);

(ii) usually suffer from subjectivity (see for instance Mills, 1990 chapter 4, for a short review); and (iii) although they may do detect variance non-stationarity and are formally suggestive of a solution, they lack robustness (Milionis, 2004; Milionis, 2003).

The aim of this work is to introduce a formal econometric approach, which not only allows the detection of non-stationary variance and is suggestive of the transformation necessary to correct for it, but is also robust to the particular partition of a time series –a procedure necessary for the test- and the possible existence of outliers. Further, the possible advantages of the application of this methodology on some crucial elements of time series modelling such as outlier detection and seasonal adjustment, as compared to existing methods, are examined.

The paper is structured as follows: Details about the data set are described in section 2; in section 3 the statistical testing procedure is presented, analyzed and the framework is set upon which the possible advantages of the new testing approach on univariate time series modelling are evaluated; in section 4 the results are presented and commented upon; section 5 concludes the paper.

2. Data

The Bank of Greece produces routinely, for internal use, seasonally adjusted data, as well as purely statistical (atheoretical) univariate forecasts for several Balance of Payments series of monthly observations. Such benchmark forecasts are useful, amongst others, for the comparison with actual values, when the latter become available. Seasonal adjustment and forecasts are produced in conjunction with outlier detection and use is made of the algorithms of the specialized statistical software TSW for this purpose. TSW stands for TRAMO-SEATS for Windows, a Windows version of the DOS programmes TRAMO and SEATS (see Gómez and Maravall, 1996)[2]. TSW is freely available by the provider (Bank of Spain) and is currently used by many NCBs, NSIs as well as many other academic and international

[2]TRAMO is the acronym for: Time Series Regression with ARIMA Noise, Missing Observations and Outliers; SEATS is the acronym for Signal Extraction in ARIMA Time Series.

institutions (universities, ECB, EUROSTAT, etc.)[3]. Using TSW in the course of the routine time series analysis within the Bank of Greece it was observed that TSW suggested the logarithmic transformation of the original data in order to stabilize the variance far too often. This observation was the starting point of this work. The time series examined are monthly external trade statistics from the Balance of Payments for Greece. The particular data were selected due to their obvious importance given the continuing economic crisis in the country and the initially large current account deficit of Greece at the beginning of the economic crisis. This current account deficit is attributed primarily to the deficit of the balance of Goods (see press releases on the web site of the Bank of Greece). It is apparent that proper statistical modelling is vital for the short-term monitoring and forecasting of such series.

The data cover the period from January 2003 to June 2015 and consist of one hundred and fifty (150) monthly observations of Total Imports, and Total Exports of Goods excluding fuels and ships (source: Bank of Greece). Those series are of special interest for re-analysis, not least because they have recently undergone adjustments in several ways. More specifically, the International Monetary Fund (IMF henceforth) in its 6th Manual on Balance of Payments (IMF, 2009) redefined the item “Total Goods” so as the new definition be firmly based on the “change of ownership” principle. In that sense, the sub-items “goods for processing” as well as “repairs on goods”, which were included in “goods” before the new definition of IMF, are now classified as services, since no change of ownership takes place. By contrast, transactions under “merchanting”, which used to be classified as services, with the new definition are included in goods, again because according to the change of ownership principle such a change does occur in the merchanting process. A further adjustment in the series of imports and exports of goods occurred owing to the need for harmonization with the external trade statistics produced by the National Statistical Service (ELSTAT). The recording of goods in the latter is based on customs data. Additionally, ELSTAT data include estimates about the volume of illegal trade. The objective of this adjustment is to make BOP statistics on external trade on goods

[3]TSW routines are also incorporated in other econometric software such as E-VIEWS.

fully compatible with the relative notions of the wider framework of the System on National Accounts (SNA, 2008).

The dates of some of the important events that occurred during the crisis are noted in Table 1, while graphical representations of the time series are shown in Figures 1 and 2.

The sharp decline in both series at end 2008, which is conspicuous from the visual inspection of those figures, may be attributed, amongst others, to the Lehman Brothers' bankruptcy and the subsequent sharp reduction in economic activity.

In addition to the real BOP data, simulated time series will also be used in order to provide further supporting evidence for the conclusions drawn from the BOP data.

3. Statistical testing approach

3.1 Description

As in most other similar studies (Mills, 1990; Milionis and Davies, 1994; Milionis, 2004), for the statistical testing approach used in this work, time series are partitioned into segments (subsamples) of equal length. For each subsample the (local) mean (LM) as well as the (local) standard deviation (LSD) are calculated. Local standard deviation is assumed to be functionally dependent on local mean in a non-linear fashion as follows:

$$LSD = \alpha LM^{\beta} e^{u}, \qquad (2)$$

where α, β are model parameters, e is the base of natural logarithms and u the stochastic disturbance. Model parameters α, β are estimated via Ordinary Least Squares (henceforth OLS) using the corresponding log-log model. The estimated value of $\beta\left(\hat{\beta}\right)$ provides the necessary information for the existence (or non-existence) and the type of data transformation needed to ensure variance stationarity (e.g. for the most popular transformations, namely the log-transformation and the square root one, correspond to β = 1, and β = 0.5 respectively). This is formally stated and tested by hypothesis H_a below.

To ensure robustness with respect to a particular partition and the possible existence of outliers the procedure is repeated for different partitions. The number of different partitions is at least equal to the number of divisors of the series' length, giving a quotient (series length over divisor) ≥ 5 and restricting the size of subsamples to be ≥ 5.[4] Robustness is formally stated and tested by hypothesis H_b below.

Finally, the previous steps are repeated with the already transformed data. The purpose of this last step is to test, whether or not, the suggested transformation is sufficient to stabilize the series variance. This is explained further, formally stated, and tested by hypothesis H_c below.

3.2 Notation

- Index (k) indicates the ascending number of a subsample in a partition.
- Index (j) indicates the ascending number of the particular partition, $j=1,2,\ldots,j_{max.}$
- Index i_j represents the maximum value of k (number of subsamples) in partition j.
- N is the total length (size) of the initial time series.
- n_{ij} represents the size of subsamples in partition j.
- $\hat{\beta}_j$ is the estimate of the exponent β using subsamples derived from partition with ascending number j.
- $\hat{u}_{jk}, \hat{\varepsilon}_j, \hat{u}^*_{jk}$ are independent of each other regression residuals.
- An asterisk (*) over a symbol denotes the corresponding transformed data, or the corresponding parameter estimate derived from the transformed data.

3.3 Equations

- $i_j = (N/n_{ij})$, if (N/n_{ij}) is an integer; $n_{ij} \geq 5$,

[4] Five (5) was selected as a reasonable lower limit for both the size of a subsample, as well as the number of subsamples in any partition of the original series.

- i_j = int(N/n_{ij}) + 1, if (N/n_{ij}) is not an integer, n_{ij}≥5 and the residual of the division is ≥5
- i_j = int(N/n_{ij}), if (N/n_{ij}) is not an integer, n_{ij}≥5 and the residual of the division is <5
- $\hat{\beta}_j$ is estimated for each partition j, j=1,2,…, j_{max} via OLS from the model (First stage regression):

$$\ln(LSD_{jk}) = \ln(\alpha_j) + \hat{\beta}_j \ln(LM_{jk}) + \hat{u}_{jk} \qquad (3)$$

- $\hat{\beta}$ is estimated via OLS as the constant term of the model (Second Stage regression):

$$\hat{\beta}_j = \hat{\beta} + \hat{d}j + \hat{\varepsilon}_j \qquad (4)$$

- Model using the transformed data (Third stage regression):

$$\ln(LSD^*_{jk}) = \ln(\alpha^*_j) + \hat{\beta}^*_j \ln(LM^*_{jk}) + \hat{u}^*_{jk} \qquad (5)$$

3.4 Statistical hypotheses and comments

1) **H_a: β_j=0 $\forall$ j** (or at least the majority of β_j s).

   This hypothesis can be tested form the first stage regression (Equation 3) and is utilized to ensure that indeed there exists a dependence of local standard deviation on local mean. Failure to reject **H_a** means that there is no such dependence, hence, no variance instability of type II exists, and therefore, the algorithm stops.

2) **Robustness test. H_b: d =0**[5]

   The dependent variable in Eq. 4 (second stage regression) is the estimate of *β* derived from the partition of ascending number *j* ($\hat{\beta}_j$), while the independent variable is the ascending number of the partition itself (*j*). Therefore, $\hat{d}$ is the estimate of the slope of the regression. This hypothesis states that the slope $\hat{d}$ should not be statistically significant, and non-rejection of it, means that $\hat{\beta}$ is robust to any particular partition of the

[5]Typically, an additional Hypothesis: **H'$_b$:β=0** should also be tested, but practically its rejection is ensured by the previous rejection of **H_a.**

series, or outliers. Additionally, non-rejection of $\mathbf{H_b}$ also ensures a better estimate of β by making more efficient use of information available in all partitions.

3) **Under-transformation test. $\mathbf{H_c}$: β_j^*=0 $\forall$ j,** where β_j^* are the corresponding β_j for the transformed data estimated from the third stage regression (Equation 5). The third hypothesis is a kind of an "under-transformation" test. If $\hat{\beta}_j^*$ are statistically significant it means that there will still be a dependence between local mean and local standard deviation in the already transformed data, consequently the chosen transformation did not succeed in removing type II variance instability. Therefore, $\mathbf{H_c}$ states that there is no remaining dependence of local mean on local standard deviation in the transformed data. Non-rejection of this hypothesis ensures that the chosen transformation is sufficient and has adequately rendered an unconditionally stable variance.

The addition of robustness and under-transformation tests to the above methodology offers advantages over existing methods, as the latter devoid of these features.

3.5 Implementation

At first the possible need for a data transformation will be examined using the new method, as well as the TSW routine. Further, each decision derived from the new methodology and the corresponding one derived from the TSW routine will be compared[6]. This task is of course of interest in its own right. However, in terms of applied time series analysis in general, it is of crucial importance to examine also the extent to which that decision affects some crucial elements of time series modelling such as outlier detection and seasonal adjustment. Once a decision about the proper data transformation is made by the two methods, TSW will be used for both cases for this further analysis.

[6]It is noted that the only alternatives with TSW is either the log-transformation, or no transformation.

As far as outlier detection is concerned, outliers are automatically detected, classified and corrected using the Chen and Liu (1993) approach. It is noted that in TSW framework, outliers are classified into three types, according to their effect on a time series, as follows (for further details as well as the theoretical background good references are Hilmer et al., 1983; Tsay, 1984; Tsay, 1986):

- Additive outliers (AO), which affect only a single observation of the series;
- Transitory Change outliers (TC), the effect of which is not extinguished in the next observation, as is the case with the additive outliers, but damps out gradually over the subsequent few periods; and
- Level shifts (LS), which imply a step change in the level of the series.

Seasonal adjustment with TSW is made after the series are "linearized" [see Appendix1 for a short description on "linearization"]. Seasonal adjustment itself is based on ARIMA model-based signal extraction. This method uses the Burman-Wilson algorithm (Burman, 1980) to decompose a time series into unobserved components [for further details see Maravall, (1995); Gómez and Maravall, (1996)].

4. Results-discussion[7]

4.1 Comparative analysis of the time series of "Imports of goods"

4.1.1 Analysis using of the new statistical testing methodology

The results for the first stage regressions for the time series "Imports of goods" are presented in Table 2. It can be seen that in all subsample pairs the $\hat{\beta}_j$ estimates are statistically significant at the 10% significance level and in almost all subsample pairs at the 5% significance level (exceptions only for the partitions with subsample size 10 and 18, where the estimates are "marginally" significant for the 5% significance level). Hence, $\mathbf{H_a}$ is clearly rejected.

[7] There is little doubt that forecasting is among the main goals of a univariate time series model. However, in this work the topic was deliberately excluded, although results on forecasting of the BOP series based on the new method regarding the possible data transformation were consistently better than those in which this decision was taken by TSW. The reason is that thus far in the literature the empirical evidence on the relation of the forecasting performance and the chosen data-transformation is mixed (Mills, 1990; Makridakis et al.; 1998, Nelson and Granger, 1979). Therefore, more work needs to be done before any of our results can be made available.

The results of the second stage regression with the aid of which the Hypothesis **H$_b$: d =0** can be formally tested are presented in Table 3. As is evident, the constant $\hat{\beta}$ is statistically significant at the 5% level and equal to 1.082, whereas the slope $\hat{d}$ is not statistically significant[8]. Hence, **H$_b$** cannot be rejected.

The above results clearly suggest that:

(i) the original data series is variance non-stationary;

(ii) the estimated value of $\hat{\beta}$ suggests that the data should be log-transformed.

To examine, whether or not, the chosen logarithmic transformation is indeed sufficient to stabilize the variance the "under-transformation" test is performed. To this end the logarithms of the original data are subjected to the logarithmic transformation once more and the parameters of the third stage regression are estimated.

The results of the "under-transformation" test are presented in Table 4. As is evident from the results of Table 4 none of the $\hat{\beta}_j^*$s is statistically significant, therefore the hypothesis **H$_c$: β_j^* =0 $\forall$ j** is not rejected.

The above results clearly suggest that the log-transformation of the original data makes the series variance stationary.

4.1.2 Analysis using exclusively the TSW testing approach

The same series was reanalyzed following the standard TSW procedure. The way TSW tests whether or not the data need to be transformed in order to stabilize the variance is based on a variant of the so-called range-mean regression (see Gómez and Maravall, 1996). For range-mean regression, the series is divided into subsamples and the range and mean for each subsample are calculated. Then a regression model using the subsamples' ranges and means is estimated. If the regression slope is found to be significant the data are log-transformed.

[8]From the results of Table 3 it is seen that the standard error of $\hat{\beta}$ is 0,099 giving a t-statistic for the difference $\hat{\beta}$ -1 as: t-stat = (1.082 -1)/0,099 = 0,83.Hence, the estimated value of $\hat{\beta}$ is not statistically different from 1.

Using the latest TSW procedure (incorporated in the so-called TSW^+ version), TSW also suggested the logarithmic transformation of the original data, as was the conclusion using the new approach. However, when the TSW procedure was repeated with the log-transformed data ("under-transformation" test), TSW suggested a logarithmic transformation again, as is evident from the TSW extract presented in Table 5. Therefore, for the "under-transformation" test, TSW is biased towards rejection of the null hypothesis of no transformation.

4.1.3. The effect of data transformation on univariate modelling and outlier detection

It is of interest to further investigate how variance non-stationarity could potentially affect the specification of the univariate ARIMA model and the detection of outliers. Table 6 below presents the results of univariate ARIMA modelling with and without the log-transformation, while the estimation details are quoted in Appendix 2. From the results of Table 6 it is apparent that, when variance non-stationarity is taken into account, the univariate model is the so-called "airline" model, often encountered in data with seasonality (see Box and Jenkins, 1976). In contrast without considering variance non-stationarity a much more complicated ARIMA model is selected. Hence, the presence of variance non-stationarity leads to seriously mis-specified univariate ARIMA models, a result that is in accordance with that of other studies (e.g. Milionis, 2004).

The results on the detection of outliers are presented in Table 7. As is evident a TC outlier at period 39 in the original data does not exist in the transformed data. Further, the LS outlier at period 71 (November 2008) in the original data, which could be related to the Lehman bankruptcy, has been shifted forward one period in the transformed data, while the AO outlier in period 97 in the original data has been shifted backward one period in the transformed data. Hence, in properly transformed data the pattern of detected outliers is different, a conclusion that is also in accordance with that of Milionis (2004).

4.2 Comparative analysis of the time series of "Exports of goods excluding fuels and ships"

4.2.1 Testing for variance non-stationarity

Table 8 presents the results of the first stage regressions for the exports of goods excluding fuels and ships. From these results it is evident that $\hat{\beta}_j$ is not statistically significant at the 5% significance level, except for the partition with subsample size 6. Thus, according to the new testing approach, the series variance is (unconditionally) stationary and no transformation of the original data is required. However, the conclusion is different when the approach of TSW is followed. Indeed, TSW log-transforms the data. The outcome of the relevant test is shown in the extract of TSW output presented in Table 9a.

Therefore, once again, TSW is biased towards the logarithmic transformation, whereas no transformation of the original data needs to be performed in this case.

Even worse than that, when the TSW procedure was repeated once again with the already log-transformed data (the "under-transformation" test), which were supposed to be variance stable, TSW suggested the logarithmic transformation again, as is evident from the TSW extract presented in Table 9b. Apparently, that suggestion is seriously biased and misleading.

4.2.2 Univariate ARIMA modelling, outlier detection and seasonal adjustment

Table 10 presents the results of univariate ARIMA modelling with and without the log-transformation for exports of goods excluding fuels and ships, while the estimation details are quoted in Appendix 2. From the results of Table 10 it is apparent that in contrast to the univariate models for imports of goods here the differences in the two univariate models are of minor character, as in both cases the univariate model is of the same type i.e. the so-called "airline model". The differences are confined only to the estimated values of the parameters of the two models. This is not surprising as with exports of goods excluding fuels and ships the original, as well as the log-transformed series, are both variance stationary. Indeed, this result advocates our previous conclusion for imports of goods where the pronounced difference in the character of the univariate ARIMA model for the original and the log-transformed data was attributed to the existence of non-stationary variance in the original data series.

The results for the detection of outliers for both the original and the log-transformed data for exports of goods excluding fuels and ships are quoted in Table 11. As is evident the AO outlier is the same in both cases, while the level shift, which could be related, amongst others things, to the Lehman bankruptcy and its repercussions, has only been moved forward by one time-period in the log-transformed data.

The above results about the consequences of unnecessarily (over) transforming an already variance stationary series in conjunction with the results of section 4.1 (no transformation of a variance non-stationary series which, indeed, needed to be transformed), lead to a conclusion of much practical importance: The consequences for time series modelling (univariate ARIMA model selection, outlier detection etc.) of not properly transforming an originally variance non-stationary series are far more severe than the consequences of (over) transforming a time series which is originally variance stationary and, hence, should not be transformed.

Our next task is to examine if and to what extent the data transformation affects the seasonally adjusted series. A statistic akin to MAPE (mean absolute percentage error), which is used as a means to evaluate the quality of a forecast, will be employed in order to assess the difference in the seasonally adjusted data produced with and without the log-transformation.

To this end, the mean absolute percentage difference (MAPD) statistic was employed to assess the differences in the seasonally adjusted series produced from original data versus transformed data. MAPD is calculated as:

$$MAPD = \frac{1}{J}\sum_{j=1}^{N}\left(\frac{\left|\tilde{X}_j^{\ln} - \tilde{X}_j^{lev}\right|}{\tilde{X}_j^{\ln}}\cdot 100\right) \tag{6}$$

where $\tilde{X}_j^{\ln}$ is the seasonally adjusted value using log-transformed data and $\tilde{X}_j^{lev}$ the corresponding seasonally adjusted data using the original data themselves.

The results are presented in Table 12. It should be noted that in the results of Table 12 quite substantial differences are observed. Indeed, although the value of the MAPD between the two seasonally adjusted series is not so high (approximately 1.3%), the minimum percentage difference is as high as -4.3% and the maximum percentage difference is equal to 5.5%.

4.3 Further analysis using simulated data

It should be recalled that in the normal course of an analysis of a time series, the test for the possible need to transform the original data in order to stabilize the variance precedes all other actions such as the creation of the univariate ARIMA model, the seasonal adjustment etc. Therefore, it is obvious that the outcome of those actions is affected by the decision on data transformation. That lends even more importance to that decision and thus further evidence was sought in favour of our previous finding that TSW suggests the log-transformation far too often due to bias. To this end, use was made of simulated data. After some experimentation, it was observed that with series following ARIMA(p,1,q) processes, the initial conditions influence (although they should not) the decision of TSW regarding the log-transformation. In sequence, 40 time series were artificially created. The first 20 were built simulating a simple Gaussian random walk model:

$X_t = X_{t-1} + e_t$ with $e_t \approx N(0,1)$ and initial condition $X_o = 0$. (7)

The other 20 were created by the same manner, except that X_o was set equal to 1000. All these time series are by construction homogeneously non-stationary so no data transformation is needed.

Applying the testing procedure suggested in this paper, the outcome was indeed no transformation in all 40 cases[9]. Applying TSW, the outcome was no transformation only in the cases with $X_o = 0$. In all the cases with $X_o = 1000$ TSW, falsely, suggested the log transformation.

[9]In the simulated series with initial condition X_0 = 0 the presence of negative values was observed in every single series. Therefore, before log-transforming the series the usual practice of shifting them upwards by adding a constant so that the minimum value of each series becomes slightly positive was adopted.

The values of all the 40 simulated time series are tabulated in Appendix 3. The results of the testing procedure for each case using both methods are presented in Appendices 4.1 and 4.2 respectively. Indeed the results of TSW are, once again, biased in favour of data transformation where no transformation is needed and in the particular case at hand this bias is clearly related to the initial condition of the simulated series. Moreover, even after the log-transformation, when the 20 log-transformed series with X_0 = 1000 were tested again by TSW, the result was biased again (suggestion to log-transform the (already log-transformed) series, as was case with the time series of "exports of goods excluding fuels and ships**".** Those results are presented in Appendix 5.

Hence, using simulated data, the conclusion about the bias of TSW to occasionally suggest the log transformation, when it should not, is strongly conducive to the conclusion derived from the use of BOP data.

5. Summary - conclusions

In this work a new statistical testing procedure for variance non-stationary time series is proposed. This procedure improves on existing ones as it combines detection, correction and robustness. This is of value in its own right as it results in better univariate time series modelling. In addition, it was shown empirically using balance of payments data for Greece, as well as simulated data, that an existing test, namely the widely used algorithm of TSW software, provides, occasionally, biased results. As a matter of fact, with the aid of the simulated data it was possible to identify one of the possible sources responsible for this bias. Further, on the basis of the empirical evidence presented it is argued that the type of data transformation and the entailed correction for variance–non stationarity is also crucial for the detection of outliers and the seasonal adjustment of the original time series. It is also empirically evidenced that the consequences of under-transformation are far more severe than those of over-transformation, an important finding for practical applications. Overall, the proposed statistical testing methodology, placed in a more general framework, seems to be a promising tool in applied time series analysis.

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Tables and Figures

Table 1. *Dates of important events during period*

Event	Date
Lehman Brothers' bankruptcy	15/09/2008
Commencement of the first economic adjustment programme for Greece	06/05/2010
Commencement of the second economic adjustment programme for Greece	13/02/2012

Table 2. *Estimates of $\hat{\beta}_j$ for the various partitions for the first stage regression*

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	1.058	1.203	1.052	0.863	1.090	0.955	1.032	0.791	1.246
t-statistic	2.642	3.230	3.211	2.096	4.204	2.297	3.321	2.278	2.758
p-value	0.013	0.004	0.005	0.056	0.001	0.047	0.010	0.057	0.033

Table 3. *Results for the second stage regression*

	Estimate	t-statistic	standard error
$\hat{\beta}$	1.082	10.956	0.099
$\hat{d}$	0.0005	0.101	0.005

Table 4. *Results for "under-transformation" test*

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j^*$	0.305	1.655	0.222	-1.59	0.558	-0.75	5.882	-1.61	6.470
t-statistic	0.092	0.540	0.085	-0.50	0.258	-0.23	1.325	-0.56	1.350
p-value	0.927	0.594	0.933	0.623	0.801	0.821	0.222	0.592	0.220

Table 5. *Extract from TSW output with log transformed data*

("under-transformation" *test)*

```
LOG-LEVEL PRETEST :
   SSlevels/(SSlog*Gmean(levels)^2)= 1.0078847 LOGS ARE SELECTED
```

Table 6. *Univariate ARIMA modelling*

ARIMA model with linearized original data [Model (1)]
ARIMA(2,1,0) $(1,0,1)_{12}$ MODEL SPECIFICATION
$(1-0.583B-0.401B^2)(1+0.857B^{12})(1-B)Y_t=(1+0.594B^{12})\varepsilon_t$
ARIMA model with linearized transformed data (TSW and new method) [Model (2)]
ARIMA(0,1,1) $(0,1,1)_{12}$ MODEL SPECIFICATION
$(1-B)(1-B^{12})\log Y_t=(1+0.609B)(1+0.592B^{12})\varepsilon_t$

Table 7. *Outlier Detection (series of Imports of goods)*

Outliers with original data	Outliers with log-transformed data (TSW, New Method)
39 TC (3 2006), 71 LS (11 2008), 97 A0 (1 2011)	72 LS (12 2008), 96 A0 (12 2010)

Table 8 . *Estimates of* $\hat{\beta}_j$ *for the various partitions for the first stage regression*

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	0.654	0.723	0.530	0.467	0.455	0.440	0.595	0.466	0.246
t-statistic	1.812	2.110	2.015	1.713	1.233	1.111	1.167	1.279	0.392
p-value	0.081	0.046	0.060	0.110	0.243	0.295	0.277	0.241	0.709

Table 9a. *Extract from TSW output with original data*

```
LOG-LEVEL PRETEST :
   SSlevels/(SSlog*Gmean(levels)^2)= 1.0106056 LOGS ARE SELECTED
```

Table 9b. *Extract from TSW output with log-transformed data*

```
LOG-LEVEL PRETEST :
   SSlevels/(SSlog*Gmean(levels)^2)= 0.98497426 LOGS ARE SELECTED
```

Table 10. *Univariate ARIMA modelling for the series of Exports of goods excluding fuels and ships*

ARIMA model with linearized original data, (new method) [Model (3)]
ARIMA(0,1,1) $(0,1,1)_{12}$ MODEL SPECIFICATION
$(1-B)(1\text{-}B^{12})Y_t = (1+0.584B)(1+0.7.64B^{12})\varepsilon_t$
ARIMA model with linearized transformed data (TSW) [Model (4)]
ARIMA(0,1,1) $(0,1,1)_{12}$ MODEL SPECIFICATION
$(1-B)(1\text{-}B^{12})\log Y_t = (1+0.566B)(1+0.821B^{12})\varepsilon_t$

Table 11. *Outlier Detection (series of Exports of goods excluding fuels and ships)*

Outliers with original data (new method)	Outliers with log-transformed data (TSW)
71 LS (11 2008), 93 AO (9 2010)	72 LS (12 2008), 93 AO (9 2010)

Table 12. *Differences in Seasonally Adjusted Series produced from original data versus transformed data*

MAPD (%)	Minimum Percentage Error (%)	Maximum Percentage Error (%)
1.297	-4.314	5.515

Figure 1. *Imports of Goods (in million euro)*

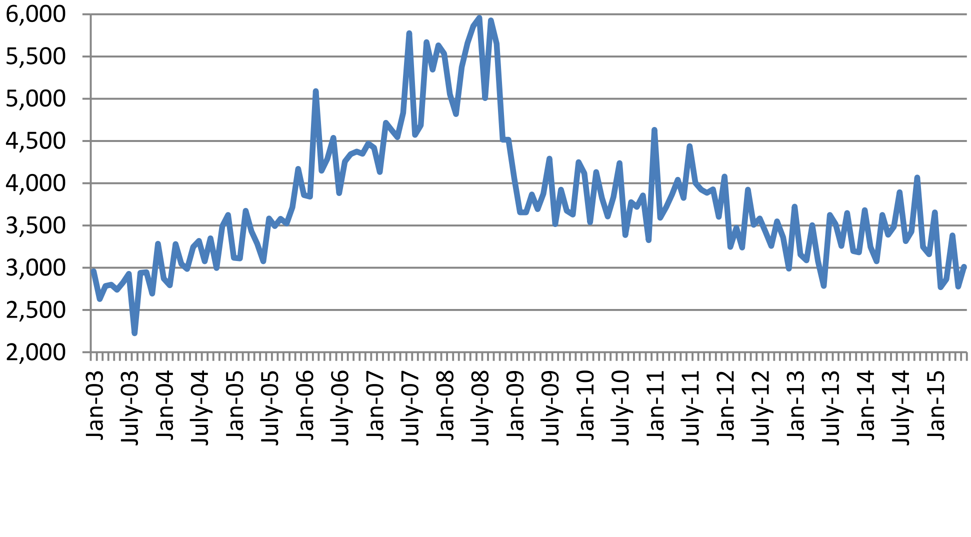
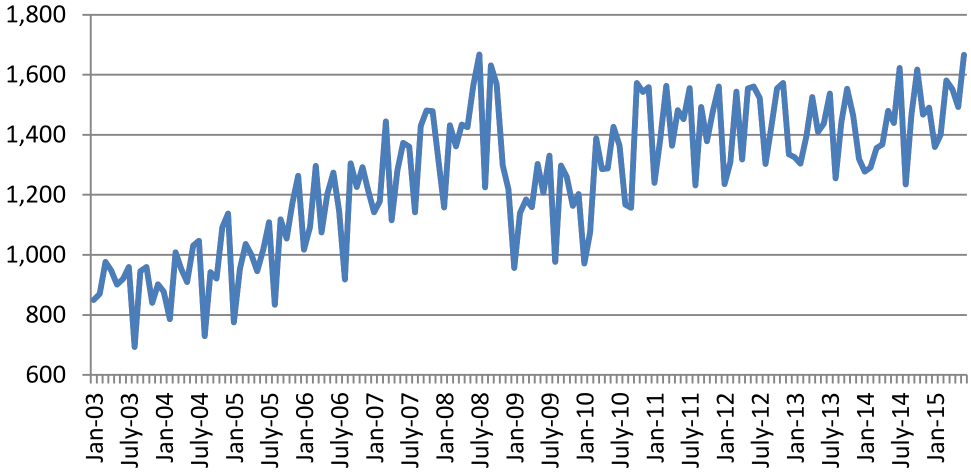


Figure 2. *Exports of Goods without fuels and ship (in million euro)*



Appendix 1

In principle, time series are "linearized" according to the following model:

$$y_t = w_t^{'}\beta + C_t^{'}\eta + \sum_{j=1}^{k}\alpha_j \lambda_j (B) I_t (t_j) + x_t \qquad (8)$$

Where: $\beta = (\beta_1, ..., \beta_n)$ is a vector of regression coefficients;

$w_t' = (w_{1t}, \dots, w_{nt})$ denotes *n* regression or intervention variables;

C_t' denotes the matrix with columns possible calendar effect variables (e.g. trading day) and η the vector of associated coefficients;

$I_t(t_j)$ is an indicator variable for the possible presence of an outlier at period t_j;

$\lambda_j(B)$ captures the transmission of the j-th effect and α_j denotes the coefficient of the outlier in the multiple regression model with k outliers;

x_t follows in general the multiplicative seasonal ARIMA(p,d,q)(P,D,Q)$_s$ model:

$$\phi(B)\Phi(B^s)\nabla^d \nabla_s^D x_t = \theta(B)\Theta(\mathrm{B}^s)\varepsilon_t \qquad (9)$$

where:

- $\phi(B) = 1 - \varphi_1 B - ... - \varphi_p B^p$ is the so–called autoregressive polynomial of order p;
- $\theta(B) = 1 - \theta_1 B - ... - \theta_q B^q$ is the so–called moving average polynomial of order q;
- $\nabla^d \equiv (1-B)^d$ is the arithmetic difference operator of order d;
- $\nabla_s^D \equiv (1-B)_s^D$ is seasonal arithmetic difference operator of order D and seasonality s;
- $\Phi(B^s) = 1 - \Phi_1 B^s - ... - \Phi_P B^{P \cdot s}$ is the so–called seasonal autoregressive polynomial of order P and seasonality s;
- $\Theta(B^s) = 1 - \Theta_1 B^s - ... - \Theta_Q B^{Q \cdot s}$ is the so–called moving average polynomial of order Q and seasonality s;
- ε_t is the stochastic disturbance.

Once the linearized series x_t has been derived from the original series y_t, the signal extraction method is applied to seasonally adjust x_t.

Appendix 2

Parameter estimation of Univariate ARIMA models

Table A.1 *Parameter estimation of Model (1)*

Parameter	Value	t-statistic
ϕ_1	0.583	7.480
φ_2	0.401	5.290
Φ_1	-0.857	-10.890
Θ_1	-0.594	-4.810

Table A.2. *Parameter estimation of Model (2)*

Parameter	Value	t-statistic
θ_1	-0.609	-8.750
Θ_1	-0.592	-8.360

Table A.3. *Parameter estimation of Model (3)*

Parameter	Value	t-statistic
θ_1	-0.584	-8.190
Θ_1	-0.764	-13.490

Table A.4. *Parameter estimation of Model (4)*

Parameter	Value	t-statistic
θ_1	-0.566	-7.850
Θ_1	-0.821	-16.430

Appendix 3

Values of the simulated time series

Simulated series with initial value 1000

1st	2nd	3rd	4th	5th
1000	1000	1000	1000	1000
998.967	998.9873	1000.683	999.8282	999.8419
999.1289	1000.152	1002.233	1000.237	1000.456
1001.496	999.3977	1002.934	1000.838	999.3357
1001.595	1001.152	1002.893	1000.506	999.6686
1002.241	1000.454	1002.998	1000.045	1000.314
1001.601	1000.229	1003.355	998.3997	1000.605
1001.762	998.5864	1005.38	998.9378	1002.032
1000.802	997.4312	1006.443	999.8485	1000.912
1001.773	998.2532	1005.225	998.9525	999.9571
1002.32	999.5079	1004.961	996.6979	999.2366
1003.253	1000.545	1005.522	994.9902	1000.868
1003.195	1001.592	1005.655	996.7925	1001.773
1000.731	1003.843	1005.625	997.5789	1001.264
1000.682	1005.097	1005.123	997.1238	1002.375
1002.381	1004.81	1003.223	995.2867	1001.852
1002.395	1004.37	1003.676	994.4795	1002.654
1001.957	1004.188	1003.258	992.8109	1003.853
1001.095	1003.735	1003.208	993.3717	1004.086
1000.484	1004.997	1002.887	993.9302	1002.152
999.3772	1005.639	1005.046	994.1747	1000.961
998.9691	1004.99	1006.271	995.777	1002.894
998.8665	1005.967	1007.441	995.8164	1001.912
1000.097	1007.484	1008.083	996.2376	1004.559
999.0398	1007.873	1006.501	997.5911	1003.997
998.0328	1006.983	1006.503	997.4355	1004.515
998.294	1007.056	1006.372	996.7464	1003.576
997.9471	1007.047	1008.587	997.2708	1001.396
996.7076	1006.631	1008.734	997.4832	1000.082
996.3938	1006.619	1009.027	997.8798	1000.688
993.3954	1005.578	1008.7	997.3676	1002.076
992.5851	1007.579	1006.292	995.9078	1000.943
992.2707	1008.405	1006.519	995.4633	1001.463
993.1481	1007.343	1006.588	997.0782	999.7946
992.2088	1007.008	1007.842	995.1341	1000.218
993.4063	1006.615	1008.621	995.5395	1001.312
994.6479	1007.663	1008.523	995.4918	1002.878
994.3761	1008.663	1008.589	995.2013	1002.192
992.64	1010.21	1009.05	997.7206	1001.75
992.4832	1009.4	1010.08	998.4322	1000.818

994.5749	1010.762	1008.583	998.9656	1000.37
993.5226	1010.067	1007.045	999.4501	998.1674
993.4732	1010.402	1007.491	999.6007	998.9759
993.5343	1009.936	1005.358	1000.033	996.595
993.6679	1008.871	1003.4	999.0979	996.7777
992.0996	1007.753	1003.891	997.8744	997.816
991.8059	1009.697	1003.725	997.7579	997.037
991.4018	1009.559	1005.198	998.0424	994.9925
991.8456	1007.907	1005.642	996.4752	995.9321
991.7209	1008.864	1005.044	996.804	994.9309
990.7504	1009.178	1004.042	996.0812	994.5378
990.0935	1009.694	1004.711	996.8047	991.7398
989.8622	1008.529	1002.708	998.0274	991.6812
990.68	1009.567	1002.885	998.6846	991.4276
991.5257	1008.508	1003.023	999.3544	991.4746
990.9481	1007.683	1004.092	1000.081	989.3894
990.9703	1007.217	1004.893	999.9682	988.7798
991.1014	1006.529	1004.868	999.7258	990.2692
990.355	1005.811	1005.514	998.0227	988.857
991.9856	1006.697	1005.497	998.9966	989.0954
992.7214	1006.358	1004.335	1000.671	986.6013
991.1667	1006.142	1005.394	1000.073	985.4843
991.1206	1006.382	1005.334	1000.222	984.8858
992.3346	1007.58	1007.264	1000.11	984.3238
992.142	1005.783	1006.067	999.1095	983.7778
992.7196	1006.759	1007.245	1001.153	984.4318
992.2115	1007.217	1007.697	1002.526	984.9818
992.855	1007.328	1007.068	1001.596	984.8216
992.7303	1008.582	1008.432	1001.074	984.9802
992.8783	1009.823	1008.258	1002.526	986.6146
992.0918	1010.865	1007.335	1002.817	986.7638
991.7463	1009.304	1008.101	1003.154	988.2939
991.1096	1008.762	1010.635	1002.796	989.3168
989.1668	1008.395	1009.854	1002.608	989.743
989.2464	1008.908	1009.422	1002.423	989.6556
989.2077	1008.573	1009.328	1002.439	988.7823
988.5955	1008.131	1008.144	1003.46	990.2899
989.4605	1008.148	1008.449	1005.11	988.3917
990.0514	1008.42	1008.244	1006.213	986.7101
990.5036	1007.569	1009.285	1006.434	985.7285
989.8534	1008.537	1009.204	1006.407	984.7521
989.4472	1009.709	1008.937	1005.684	984.3569
988.8391	1009.961	1009.416	1005.448	983.3785
989.9843	1010.183	1011.115	1005.196	984.2952
990.8427	1010.045	1011.748	1004.622	983.272
989.0642	1009.293	1009.71	1005.106	984.0459

987.4945	1011.719	1009.311	1004.606	984.0227
987.4821	1012.011	1009.235	1004.829	983.4359
987.3527	1012.554	1010.788	1005.039	984.0437
988.3558	1014.443	1010.636	1006.624	985.4092
988.853	1013.961	1009.398	1007.702	986.4992
987.0488	1013.577	1010.54	1007.051	986.5294
988.2641	1013.062	1010.443	1005.488	985.5825
987.0507	1014.876	1011.816	1006.616	985.0288
985.7719	1013.442	1011.422	1007.002	984.6075
984.776	1013.518	1010.397	1008.24	985.2071
984.5947	1011.799	1010.434	1007.82	984.3822
986.7543	1010.814	1010.815	1008.987	983.7637
986.5077	1010.813	1011.559	1008.767	983.9021
987.5646	1009.533	1012.552	1007.873	984.3093
988.4282	1011.101	1013.666	1007.965	983.8585
987.5378	1011.259	1014.136	1009.556	983.7538
987.4068	1012.706	1014.273	1009.6	984.1037
987.3097	1010.329	1015.386	1008.714	983.7732
987.2676	1010.534	1015.771	1009.136	982.3922
988.2262	1011.068	1016.661	1008.512	980.7409
989.301	1009.102	1017.247	1006.885	980.4259
987.7547	1009.581	1016.35	1006.668	980.1994
988.0907	1008.915	1017.004	1005.779	978.1823
987.7394	1008.5	1017.226	1006.204	977.8472
988.8648	1010.611	1016.763	1006.248	978.5167
989.4729	1009.456	1016.762	1005.593	978.65
989.7486	1009.935	1016.296	1005.612	980.804
989.0646	1011.203	1018.747	1005.639	981.7595
988.1009	1011.369	1018.749	1005.728	979.7084
988.1095	1011.113	1019.511	1004.303	979.3497
988.6315	1012.103	1020.959	1005.126	976.8648
989.5265	1013.856	1021.423	1004.645	976.3863
989.7331	1014.922	1021.237	1004.033	976.1239
990.813	1016.505	1022.934	1002.99	975.998
990.3195	1015.734	1022.013	1002.047	976.0045
989.6634	1015.968	1021.983	1002.499	977.2952
991.4338	1016.492	1021.27	1001.377	977.5118
990.2363	1015.723	1020.308	1002.924	978.5693
989.8721	1012.97	1019.61	1002.279	977.4354
990.7199	1014.016	1018.613	1002.688	976.5623
991.2949	1014.224	1018.655	1002.889	977.3986
992.9258	1015.408	1017.221	1004.132	976.4558
994.0034	1014.904	1016.733	1003.739	979.0458
993.3262	1014.474	1018.242	1004.206	977.6217
993.2704	1014.308	1018.161	1005.265	976.8898
992.636	1014.217	1017.293	1005.972	976.3309

993.9068	1015.554	1016.973	1006.114	975.8393
993.4496	1016.544	1017.088	1005.124	974.1361
992.8053	1015.885	1017.283	1002.479	974.8136
993.4285	1013.721	1017.906	1003.24	974.014
994.8012	1012.833	1018.103	1003.47	975.5021
993.0982	1013.636	1019.105	1004.474	975.645
990.9646	1013.696	1018.566	1004.136	976.4664
990.8639	1015.6	1018.107	1003.163	975.5432
988.9765	1015.892	1017.807	1003.251	975.0347
989.5767	1016.286	1018.66	1002.966	975.5777
988.9902	1017.9	1018.593	1004.013	975.693
988.3121	1018.438	1018.114	1003.029	973.4308
990.2677	1017.071	1020.37	1002.668	971.9004
989.9241	1017.694	1019.109	1002.748	972.0951
990.5916	1017.921	1018.954	1002.514	971.8408
990.1105	1019.844	1018.174	1000.848	971.2316
988.0585	1020.385	1015.665	1001.503	970.6044
987.9309	1019.732	1014.3	1002.798	970.0574

6th	**7th**	**8th**	**9th**	**10th**
1000	1000	1000	1000	1000
999.9977	998.5651	999.6352	1000.234	997.4495
1000.038	1000.488	1000.305	1000.732	996.0022
1002.233	999.8072	999.5097	1002.021	994.9594
1002.511	1001.485	1000.567	1001.891	994.7454
1003.403	1000.881	999.5769	1002.337	995.1555
1002.925	1001.005	1001.979	1001.015	994.2582
1002.676	1002.665	1003.05	1000.835	994.5287
1003.121	1003.474	1004.56	1000.874	995.4226
1003.741	1002.508	1002.915	1000.99	993.9908
1002.835	1003.073	1001.976	1000.953	993.8183
1002.979	1001.783	1000.925	1000.946	994.4889
1001.918	1003.214	1000.545	1000.51	995.3666
1002.134	1004.621	1001.221	1000.764	996.0249
1004.09	1003.744	1000.802	1001.757	996.509
1002.619	1002.537	1001.16	1002.074	997.0419
1001.093	1003.004	1002.366	1000.717	998.0721
1000.911	1004.113	1001.437	1001.144	997.5975
1000.187	1002.592	999.8846	1002.389	999.2825
1000.608	1000.901	999.1981	1003.258	999.572
998.39	999.71	1000.149	1004.056	998.6613
997.6321	1000.895	1001.472	1003.186	999.9947
997.499	1000.572	1000.825	1002.472	999.5925
998.7469	999.6761	1002.347	1004.206	999.0502

998.1273	997.9655	1002.406	1004.125	999.0869
998.61	996.7833	1002.694	1005.208	999.5604
997.2065	996.22	1003.286	1004.377	998.8456
998.8833	997.5061	1002.098	1005.118	998.9439
999.4416	998.3574	1003.247	1004.313	996.1813
998.0259	997.9884	1001.995	1005.504	996.5989
997.7254	998.5292	1003.108	1004.342	996.9851
998.1099	997.5534	1001.933	1003.32	996.5211
998.2323	997.5186	1001.193	1002.826	997.1239
997.0252	997.9648	1001.373	1003.208	996.4144
997.7464	998.1229	1001.81	1001.192	996.8101
995.4229	996.0762	1001.093	999.6878	996.6514
994.6563	995.5724	1001.464	999.6408	997.2191
994.2987	994.8549	999.0636	999.1482	996.9591
996.4466	993.6928	999.0344	1000.168	996.6085
997.3829	993.2233	999.2704	999.4479	996.8101
998.4112	993.7383	999.6865	999.3839	996.9414
997.861	995.8268	999.3529	1000.263	995.0617
997.8346	996.2381	999.5988	999.7542	994.7931
997.4436	997.0497	1000.844	998.0657	994.0928
997.0306	996.7536	1000.751	999.6979	995.0644
997.8225	997.6466	1001.367	999.1566	994.2308
996.9879	998.1319	1001.61	999.1518	994.3434
997.0614	998.759	1000.807	998.6361	993.5902
996.4518	999.7598	999.7847	997.3206	994.0781
997.4302	999.9515	998.8793	996.9762	993.3375
997.6718	999.587	999.0188	994.9627	993.4942
997.204	999.4147	998.4772	993.6626	992.982
996.5577	998.8062	998.0465	994.4601	992.856
995.4692	999.1355	996.9186	995.4215	993.5848
994.3613	1000.796	996.9198	994.3748	993.4938
995.8111	1001.753	995.8893	993.5729	992.328
994.2751	1002.235	996.4555	992.9909	992.3599
992.9467	1002.068	996.8685	992.0039	991.9704
992.4925	1000.848	996.5394	991.0994	993.2959
991.3521	1000.609	997.477	990.2797	992.5763
991.792	999.6601	997.8526	989.2861	992.602
991.4724	1000.682	995.7138	988.1913	995.1174
992.3698	1001.288	996.1902	989.7116	995.9013
992.1041	1001.106	997.1399	991.1247	997.0367
991.1669	1001.143	997.7347	990.2219	994.3495
989.5532	999.3574	997.7195	990.6004	992.9843
989.6668	1000.792	997.3649	990.4494	994.5999
988.7728	1000.099	998.4298	990.316	994.5348
986.8013	999.1298	999.356	990.7545	995.2891
987.3356	1000.656	999.0608	990.9814	994.9842

987.57	1000.469	999.6544	989.6461	993.7867
988.842	1000.377	1002.391	989.3054	993.1058
987.9027	998.7744	1003.363	988.1052	992.0814
989.238	999.5643	1004.921	988.259	992.8128
990.0902	998.7566	1003.693	990.0737	991.8695
992.588	999.2137	1002.922	990.1457	992.2182
992.9783	998.238	1003.671	990.0683	991.8743
992.7159	997.3701	1003.03	989.9805	991.6909
994.1054	997.4457	1003.835	989.4983	993.0307
995.4827	997.5326	1004.238	989.2593	992.6041
996.2397	998.7633	1004.1	989.9047	992.3615
996.1179	1000.642	1003.577	989.4843	991.6947
996.2082	1000.011	1003.346	989.7114	991.6733
995.4416	999.8256	1004.58	989.4168	991.0196
996.0372	999.0895	1004.835	990.2175	990.0727
996.0551	998.4623	1004.555	990.6413	988.0787
997.2996	998.9235	1003.676	989.4215	986.4397
997.9618	999.6491	1002.811	988.8985	986.1787
998.4936	999.8731	1003.01	987.6451	985.013
997.5277	999.8839	1003.105	987.327	984.8211
996.8092	1000.162	1003.354	986.7715	985.0262
996.4036	999.6102	1004.277	986.9679	985.3222
995.6691	1000.032	1003.813	986.1307	986.1721
996.2802	998.8608	1004.464	985.5065	987.3331
997.8647	998.7354	1003.773	985.4864	987.7178
997.4511	997.4682	1002.071	984.5086	989.1639
997.086	998.2024	1000.878	985.7997	989.7552
995.8514	998.8537	1000.341	987.438	988.7303
995.4576	999.3245	1000.837	987.6908	988.4802
994.5794	1001.574	999.8646	987.6162	987.8425
994.771	1004.708	999.3133	987.3482	987.9569
995.679	1005.453	999.4284	987.0085	987.8291
995.8808	1005.244	998.3856	986.0208	988.6804
995.5968	1005.982	996.5643	987.4444	988.8271
996.4844	1006.406	996.3309	987.216	989.6024
996.6473	1007.186	997.3482	988.2946	989.8856
996.8841	1008.23	997.2129	987.2442	988.8068
996.4128	1007.479	997.9361	988.0162	990.2696
996.4474	1006.113	998.4333	987.6192	991.7529
996.1236	1006.773	996.8319	988.7092	990.7693
994.6784	1007.593	995.2672	989.1279	990.6095
995.0218	1006.72	994.4865	989.0992	989.9886
995.0595	1006.646	996.2255	991.2819	990.4201
994.0472	1005.888	997.4591	990.6313	989.6229
993.9019	1005.584	998.4499	990.7573	990.4252
993.2524	1004.478	998.421	989.9142	989.9466

993.439	1005.355	998.9436	989.4561	990.1974
993.1518	1004.478	997.8147	992.0614	988.4641
993.5662	1003.96	996.4064	990.3771	988.7264
993.5919	1002.728	997.5613	991.019	988.8171
993.8179	1003.143	996.7626	990.6754	988.6165
993.155	1003.444	995.5807	989.8313	990.7372
992.5855	1004.431	996.8311	991.0066	990.2321
991.7577	1003.567	997.9137	990.8107	991.4773
991.2282	1002.576	998.5059	992.5537	991.9834
990.7257	1003.515	999.7165	991.8409	991.0251
991.7641	1003.017	1000.764	990.7002	989.2697
992.931	1003.588	1000.446	991.3896	988.8909
991.142	1003.491	1000.047	991.8975	989.111
990.7636	1002.236	999.6354	992.5994	988.5461
989.9629	1002.207	1000.861	992.5382	989.5008
991.0572	1003.098	999.2426	992.2313	988.6232
990.3572	1002.767	1000.7	991.4036	990.4239
991.2869	1001.804	999.7175	992.625	989.9632
991.7911	1003.773	1000.091	991.071	989.7237
992.8225	1004.879	999.6873	989.7761	990.4887
992.3255	1005.665	999.2959	987.702	989.8415
989.4837	1006.336	999.7269	987.018	990.5042
988.4276	1005.967	1001.113	986.8969	989.8478
989.2431	1005.167	1001.473	986.1875	988.699
987.7113	1005.211	1002.11	984.9548	988.252
987.9239	1004.697	1001.035	984.2439	988.9104
987.5831	1004.987	1003.133	984.15	988.8958
987.5549	1004.987	1003.931	987.4157	990.4905
988.8299	1002.285	1005.48	987.1475	990.4
989.7551	1000.568	1006.638	988.4359	990.3925
989.281	999.9129	1007.18	987.2161	991.6182
988.2224	1000.595	1007.925	987.6921	991.7848
989.6093	1000.52	1008.897	987.9841	990.5921
990.5189	999.6239	1009.966	987.934	990.275

11th	**12th**	**13th**	**14th**	**15th**
1000	1000	1000	1000	1000
999.6392	1000.671	1000.335	999.5879	1000.394
999.2639	1001.759	998.9867	1000.114	1000.871
999.4469	1000.731	997.863	1000.586	1000.753
998.5279	1001.651	998.7019	999.3694	1001.118
998.2739	1001.157	999.2763	1000.569	1001.682
998.6037	1000.968	999.3164	998.4011	1001.382
1000.41	1002.353	999.7165	998.8049	1001.673
1000.672	1003.621	999.0304	999.512	1002.749
1001.378	1005.967	998.3341	1000.428	1001.542

1002.31	1007.243	996.8066	999.4832	1002.191
1003.362	1008.801	996.7345	1000.649	1002.756
1000.926	1009.16	996.8708	999.749	1003.196
999.5114	1009.297	996.7676	999.5962	1002.7
999.8901	1009.069	995.6474	1000.965	1000.705
1000.95	1009.414	996.9429	1000.246	1000.081
1003.022	1008.565	997.0594	1001.077	1000.284
1003.191	1009.562	996.0187	1000.977	999.6196
1002.779	1009.604	996.9311	1001.857	999.8642
1003.328	1008.367	996.2038	1001.189	999.1675
1003.556	1009.296	995.8798	1001.313	999.9749
1003.06	1007.571	997.4581	998.9207	999.2176
1002.622	1007.425	1000.201	999.9738	998.7448
1002.702	1006.621	1001.232	1000.521	997.9905
1004.008	1007.777	1001.526	1002.805	997.6582
1003.921	1008.39	1002.255	1002.958	997.7208
1004.144	1008.72	1001.727	1003.441	997.4309
1002.641	1007.455	1003.147	1003.95	998.2019
1002.693	1007.788	1002.265	1005.195	998.6172
1003.102	1008.099	1001.914	1004.822	999.8787
1004.95	1008.578	1002.16	1005.143	999.5783
1006.096	1008.145	1002.274	1005.506	1001.093
1005.099	1008.291	1001.753	1007.031	1001.839
1003.788	1007.442	1001.859	1008.276	1002.567
1003.473	1006.513	1001.422	1006.703	1004.07
1003.062	1005.014	1001.651	1006.368	1005.937
1004.162	1005.287	1000.265	1005.655	1003.778
1004.798	1006.691	1001.014	1006.27	1003.789
1004.822	1008.393	1002.498	1007.036	1004.259
1005.201	1008.054	1001.587	1008.906	1002.776
1006.836	1009.938	1000.66	1009.699	1002.747
1007.235	1011.79	998.5051	1008.281	1004.585
1008.421	1011.263	998.1616	1007.895	1005.02
1008.536	1011.119	998.7869	1008.298	1005.992
1008.645	1009.821	997.9993	1009.902	1007.22
1008.813	1011.167	998.3742	1010.152	1007.692
1009.243	1011.13	998.1963	1009.408	1008.721
1008.231	1011.494	999.8951	1007.887	1010.487
1006.508	1013.495	1000.233	1005.802	1009.876
1007.004	1015.791	999.098	1004.884	1009.513
1008.063	1016.052	999.0605	1004.144	1009.194
1011.469	1015.116	998.8349	1003.287	1009.088
1012.481	1014.735	999.0753	1004.66	1009.512
1013.219	1014.538	998.1611	1004.911	1009.983
1012.444	1013.334	999.0728	1005.125	1013.2
1012.1	1014.521	1000.085	1005.979	1013.36

1011.453	1014.86	1000.904	1005.415	1013.188
1011.997	1014.646	997.5749	1006.153	1014.133
1012.139	1014.609	999.6154	1004.855	1014.368
1012.469	1014.346	999.688	1004.834	1012.988
1011.632	1013.523	999.6802	1005.595	1012.778
1013.364	1012.862	1000.523	1006.029	1012.633
1014.226	1015.447	1000.333	1004.918	1012.892
1014.221	1015.566	1000.677	1005.333	1011.891
1013.23	1016.317	1000.213	1004.609	1011.814
1013.065	1015.628	1001.231	1005.546	1012.552
1012.191	1016.68	1001.347	1005.162	1010.794
1012.034	1017.36	1000.802	1004.707	1009.697
1010.579	1017.974	1000.925	1002.678	1009.29
1008.484	1017.945	999.8658	1001.577	1008.527
1008.462	1018.145	999.468	1000.287	1006.654
1007.768	1017.414	1001.044	999.9219	1006.296
1008.659	1019.482	1000.802	998.9171	1005.143
1007.87	1019.496	1000.448	999.9923	1004.446
1009.815	1019.987	999.0801	997.7371	1002.527
1009.659	1020.117	999.5557	997.314	1003.758
1010.734	1018.548	1001.653	997.9297	1002.847
1011.716	1017.154	998.8797	996.145	1003.535
1010.947	1017.483	998.5088	997.9646	1005.129
1013.164	1017.437	998.858	1000.139	1004.8
1013.4	1018.027	998.0427	1001.098	1003.762
1014.218	1018.794	998.156	1001.315	1002.482
1013.367	1016.878	998.838	1000.955	1002.151
1014.044	1017.846	998.7677	1000.212	1004.174
1012.899	1017.418	998.4567	1000.664	1005.147
1012.445	1017.623	998.8443	1000.999	1006.688
1011.538	1018.052	999.4594	999.8198	1005.853
1011.03	1017.893	1000.417	998.7424	1005.693
1011.242	1018.362	999.0316	998.4363	1003.63
1010.003	1019.395	1000.074	999.3669	1004.39
1010.176	1019.521	1000.544	999.9597	1003.122
1011.215	1019.313	1001.957	997.5112	1002.648
1010.91	1019.088	1002.188	997.7871	1003.273
1010.456	1019.826	1001.705	997.9227	1003.589
1011.699	1019.936	999.6937	999.0389	1002.84
1011.482	1020.714	997.4386	999.5822	1003.387
1011.377	1021.19	998.4037	1000.271	1003.435
1009.577	1021.503	999.2096	1000.899	1006.729
1007.739	1020.846	999.8474	1000.225	1008.78
1007.936	1019.86	999.6231	1001.185	1009.435
1007.58	1018.837	1000.399	1001.612	1008.94
1007.34	1018.324	1000.865	1000.674	1008.814

1009.005	1019.044	1000.514	1000.634	1010.53
1012.043	1019.886	1000.887	1000.178	1011.095
1012.924	1019.768	1000.206	1000.058	1013.63
1013.085	1019.575	1001.814	998.7296	1013.217
1014.944	1019.268	1001.528	998.4428	1014.487
1016.482	1018.189	1000.716	997.7466	1014.326
1017.813	1018.042	1001.008	995.9722	1014.243
1017.943	1017.593	1000.45	995.3375	1016.445
1016.679	1017.497	1000.739	995.5647	1014.517
1015.592	1016.868	999.6085	994.2543	1015.376
1014.38	1015.607	999.3915	994.091	1013.727
1014.553	1015.019	998.6992	993.8712	1014.84
1014.417	1015.095	999.5728	994.5375	1014.732
1014.355	1015.705	999.6618	994.2101	1015.874
1012.483	1014.793	1000.027	994.264	1014.767
1012.508	1014.904	1001.045	995.8992	1015.267
1013.039	1014.238	1000.461	996.981	1014.709
1013.462	1014.478	1000.59	996.796	1014.494
1015.234	1015.903	1001.048	996.4696	1015.018
1015.714	1015.429	1000.411	996.9739	1013.606
1015.798	1016.649	1000.243	997.9639	1013.966
1016.12	1016.739	1000.554	997.7017	1013.879
1016.841	1016.369	1000.224	998.1649	1013.432
1015.7	1013.903	999.6414	997.426	1014.96
1016.813	1014.037	1001.053	998.6557	1015.452
1016.452	1014.763	999.95	997.8052	1014.393
1017.426	1015.515	998.3961	997.9867	1015.623
1017.456	1014.417	996.3338	999.4357	1015.356
1017.793	1013.169	995.244	999.443	1014.938
1017.826	1013.74	995.6451	1000.489	1014.946
1018.61	1013.23	996.7394	1001.683	1014.739
1018.558	1013.938	996.7092	1002.303	1014.63
1019.656	1013.811	997.4777	1002.895	1015.316
1019.088	1014.363	998.2599	1002.789	1015.511
1019.76	1013.039	995.8004	1001.452	1015.556
1019.225	1014.121	995.2963	1002.064	1016.275
1019.357	1013.663	994.517	1002.434	1016.768
1019.483	1013.08	995.1571	1004.118	1017.921
1019.131	1013.821	996.4468	1003.512	1016.377
1018.779	1013.51	995.6965	1004.692	1017.134
1019.089	1013.89	996.6262	1005.913	1016.118
1018.817	1014.577	996.9589	1005.613	1017.214
1018.7	1014.668	995.302	1004.921	1017.995
1018.556	1014.136	995.3505	1006.301	1017.244
1020.07	1013.657	993.9291	1007.097	1015.513
1022.347	1014.412	994.6262	1006.656	1015.893

1022.952	1014.507	995.8506	1005.765	1013.4
1024.595	1014.827	996.5925	1005.878	1012.88

16th	**17th**	**18th**	**19th**	**20th**
1000	1000	1000	1000	1000
999.9303	999.4339	998.9048	998.2922	998.7999
1000.504	999.8934	999.2367	998.1549	998.9599
999.6117	999.3897	999.6236	999.2488	998.1201
998.378	998.868	997.8922	998.3833	999.3806
996.7231	999.428	997.4072	998.3766	999.1896
996.0355	999.1819	997.6288	997.873	998.3073
995.5847	998.6875	997.5438	999.0268	998.5788
996.9134	999.3742	997.5548	997.7091	997.4063
995.8098	999.135	996.0052	996.2914	996.9875
996.9553	1000.146	996.2069	995.9835	997.2764
995.3745	999.1883	996.5645	994.3227	995.4365
996.0926	999.278	996.9553	994.3875	995.7799
998.4349	1000.56	997.4591	994.6839	994.691
999.627	1000.034	996.7432	995.3785	996.1409
999.6149	999.9125	998.3469	993.9176	996.9929
1000.538	998.7676	998.5905	993.73	996.0304
1000.614	999.7653	999.505	995.3965	996.0533
1000.17	997.9884	1000.128	995.6411	996.5731
1001.23	997.8363	999.8011	996.7261	996.4389
1000.93	997.3494	1001.462	997.3887	996.2039
1001.822	998.061	999.8061	995.7002	996.8012
1001.903	997.3744	998.419	996.8682	997.3439
1001.608	996.6751	998.6416	995.9424	998.7942
1000.501	995.4537	999.3886	998.7878	997.5211
1000.762	996.711	998.8018	1001.104	996.5386
1001.474	997.4932	998.968	1001.765	995.5917
1003.559	995.9205	998.8321	1002.382	995.2301
1002.848	994.8405	998.7661	1003.193	996.3024
1001.339	994.1209	999.0778	1004.709	996.7739
1000.201	994.6507	999.5485	1005.466	996.285
999.3724	994.8987	1001.086	1005.531	996.9712
1000.761	994.9227	1001.883	1006.418	997.3799
1002.607	994.31	1002.139	1007.92	997.3104
1001.368	993.893	1000.458	1006.329	995.5543
1000.84	991.6853	999.7664	1006.84	993.987
1002.151	989.5327	1001.27	1007.096	994.8994
1002.257	989.1074	1001.957	1006.927	994.6002
1001.171	988.9992	1002.598	1007.885	996.853
1003.225	987.2433	1003.98	1007.428	996.6534
1003.955	988.001	1003.172	1006.471	998.1705
1003.605	986.2427	1004.049	1005.415	997.6126

1001.172	984.2099	1004.057	1006.65	995.9426
999.6721	984.2168	1003.635	1006.586	995.56
999.0561	984.19	1003.748	1006.218	996.4861
999.5799	983.6291	1003.72	1004.972	998.395
999.1579	982.8526	1003.824	1005.611	999.0211
998.3703	983.5997	1003.383	1004.504	998.5952
996.9555	982.7848	1003.106	1004.868	998.6257
997.2256	982.4759	1002.212	1004.605	999.1261
997.8143	981.9311	1001.559	1003.326	999.981
999.3496	981.8946	1000.9	1002.882	999.439
999.6939	981.2515	1001.479	1002.723	999.6777
999.8944	979.7291	1002.557	1004.73	1000.602
999.059	979.5773	1001.881	1005.568	1001.261
998.3941	979.2132	1002.749	1004.85	1001.183
999.3273	979.7861	1003.351	1004.304	1000.59
998.882	980.4723	1003.248	1005.182	1000.377
997.6565	981.967	1004.094	1003.092	1001.753
1000.144	980.9014	1003.383	1000.094	1000.144
1000.16	979.3695	1005.108	998.688	1000.866
1000.28	979.357	1004.772	997.6179	1000.385
1000.404	980.0021	1004.086	996.5522	1002.715
1000.588	980.2277	1004.627	996.2829	1001.98
1001.183	979.667	1004.52	995.7255	1001.869
1001.248	980.1922	1005.219	994.5384	1001.493
1000.267	980.8916	1003.974	995.3716	1003.388
1003.922	981.5894	1004.23	994.9594	1002.814
1005.225	983.6591	1004.305	994.8247	1003.176
1005.472	983.4369	1003.128	994.382	1002.502
1006.293	981.1629	1004.195	995.0639	1001.761
1006.406	980.1023	1003.116	994.9354	1000.046
1006.186	978.3038	1002.355	994.4726	998.8421
1006.532	977.6973	1003.769	995.1911	999.3962
1006.275	976.8316	1003.636	993.9504	999.7268
1008.024	975.8722	1003.207	994.0353	1000.374
1006.877	974.5246	1001.593	993.8635	999.3164
1006.114	975.81	1003.282	993.7925	999.6788
1006.669	975.0131	1004.149	994.7586	999.5138
1004.952	973.6222	1003.327	994.4538	1000.607
1005.68	972.2682	1004.191	994.3005	1000.62
1005.598	971.7622	1006.745	993.5424	999.6934
1006.455	971.2954	1007.851	994.0213	998.7597
1006.426	972.5026	1007.565	994.2654	998.4117
1007.947	972.2265	1008.247	993.5785	999.3308
1009.138	974.7439	1007.233	993.827	998.2467
1010.973	974.3665	1005.634	992.7239	997.5122
1010.603	976.4021	1005.743	993.3053	997.1693

1010.778	974.9341	1005.099	993.5736	996.3247
1009.259	974.8095	1005.907	992.9532	995.3409
1010.223	976.4938	1006.895	992.4249	994.445
1010.713	977.0706	1005.14	992.7477	993.7956
1012.071	979.157	1005.199	992.5686	994.6339
1011.158	978.3911	1006.148	990.6706	992.329
1012.042	978.266	1007.339	990.5697	992.5769
1012.068	978.4428	1007.992	991.9673	993.8661
1010.483	980.166	1006.69	992.0405	994.0235
1011.834	979.2112	1007.435	993.214	996.1891
1011.902	980.0465	1009.305	992.7519	996.8869
1013.387	980.7405	1010.148	991.5281	997.0114
1012.678	981.6003	1008.037	992.4369	996.6742
1012.999	982.8287	1007.051	992.7233	997.5446
1012.904	983.0485	1008.142	993.5444	997.3429
1013.693	984.0334	1007.19	993.9063	998.6364
1013.376	984.8913	1006.883	994.1953	998.4745
1012.632	984.3908	1005.368	994.4813	997.6348
1012.004	983.6615	1004.841	994.5304	996.9188
1011.887	984.6056	1005.325	994.8239	998.0542
1012.83	982.2424	1005.008	993.2065	996.9587
1012.912	981.9096	1005.149	995.5092	997.5672
1011.496	981.4921	1004.912	993.5968	997.4254
1011.449	980.9441	1005.528	995.0409	996.3423
1010.571	981.2483	1007.681	995.0696	998.2724
1011.508	981.5554	1007.081	995.756	998.2652
1011.038	982.0129	1007.22	996.3888	997.8357
1009.967	982.3204	1006.76	995.5461	997.6954
1011.137	982.7613	1007.322	995.1159	995.5575
1011.926	985.3871	1009.601	995.2737	995.1157
1010.919	983.6786	1009.99	994.8939	994.6233
1012.039	981.4833	1010.419	993.6075	994.4933
1009.157	981.6828	1010.694	994.0541	995.7892
1009.526	984.0768	1009.322	993.2582	994.6563
1010.906	981.2002	1007.484	993.2253	993.969
1011.51	981.9055	1009.071	994.0918	993.5068
1010.861	979.7237	1010.05	994.6126	993.609
1011.116	980.7702	1008.643	993.7508	994.1388
1011.998	980.2295	1008.41	992.2964	993.275
1012.18	980.9541	1008.809	991.8296	992.1729
1012.985	979.6654	1009.011	992.9638	991.2986
1012.302	978.7064	1009.412	991.1739	990.9065
1012.493	978.3202	1009.61	991.2028	992.1372
1012.381	977.0248	1007.8	991.9125	992.4982
1012.888	975.4756	1006.518	992.7052	992.8237
1012.94	974.1427	1006.665	992.3105	993.4496

1011.647	972.616	1006.144	992.4012	993.9743
1011.061	972.1311	1005.997	991.7103	993.7912
1012.059	971.1042	1006.58	991.2567	994.5717
1011.615	969.8355	1005.724	993.3221	995.5493
1012.261	969.8559	1006.191	995.3384	993.951
1013.933	970.3103	1006.724	995.5588	993.1831
1013.192	971.365	1007.063	996.2142	992.8577
1014.709	971.5977	1006.324	996.2859	992.9708
1014.087	970.7053	1007.312	995.2295	992.6136
1014.411	969.1935	1006.991	996.9649	992.0127
1012.802	968.4307	1005.695	996.8672	992.4051
1014.209	967.6295	1005.225	997.067	993.52
1013.732	968.5323	1006.371	995.9035	994.6047
1016.485	969.899	1006.163	994.0534	995.3644
1017.184	970.4533	1007.277	994.2744	994.5627
1017.249	969.8895	1007.891	994.2984	994.6229

Simulated series with initial value 0

21st	22nd	23rd	24th	25th
0	0	0	0	0
-1.033	-1.01271	0.683126	-0.1718	-0.15815
-0.87105	0.152343	2.232955	0.237445	0.455616
1.495926	-0.60234	2.933988	0.838133	-0.66427
1.595041	1.151697	2.892991	0.505791	-0.33137
2.241327	0.454	2.998455	0.045068	0.313645
1.600575	0.228664	3.354662	-1.60031	0.604642
1.761642	-1.41356	5.379844	-1.06221	2.032012
0.802116	-2.56877	6.44279	-0.15154	0.911975
1.772903	-1.74678	5.224711	-1.04755	-0.04294
2.319615	-0.49214	4.960771	-3.30208	-0.76336
3.253465	0.544799	5.522498	-5.00982	0.867613
3.195165	1.59153	5.655426	-3.20754	1.772588
0.731497	3.84326	5.625303	-2.42115	1.264318
0.681558	5.097071	5.122917	-2.87615	2.375068
2.380558	4.81002	3.222669	-4.71327	1.852152
2.394743	4.370335	3.67611	-5.52052	2.6542
1.956708	4.188391	3.257999	-7.18909	3.85322
1.095084	3.735278	3.207518	-6.62825	4.086339
0.48391	4.996608	2.886594	-6.06979	2.151961
-0.62283	5.639406	5.046423	-5.82528	0.961212
-1.03095	4.989507	6.270585	-4.223	2.893973
-1.13353	5.966601	7.441215	-4.18362	1.911671
0.097234	7.483858	8.083117	-3.76242	4.558501
-0.96024	7.87308	6.501452	-2.40892	3.996684
-1.96721	6.982505	6.502702	-2.56448	4.51516
-1.706	7.055573	6.371711	-3.25364	3.575797

-2.0529	7.046538	8.586871	-2.72915	1.3964
-3.29241	6.63115	8.73399	-2.51682	0.082435
-3.60624	6.618879	9.026694	-2.12016	0.688332
-6.6046	5.578302	8.699744	-2.63239	2.075866
-7.41487	7.579025	6.292033	-4.0922	0.942833
-7.72928	8.404896	6.519304	-4.53672	1.462987
-6.85193	7.34316	6.587908	-2.92184	-0.20539
-7.79116	7.008295	7.841987	-4.86592	0.217741
-6.59366	6.614824	8.620938	-4.4605	1.311552
-5.35212	7.663199	8.523314	-4.50816	2.877825
-5.6239	8.663393	8.58889	-4.79874	2.191792
-7.35995	10.20987	9.049997	-2.27938	1.750484
-7.51684	9.399543	10.08015	-1.56777	0.817971
-5.42512	10.76227	8.582728	-1.03443	0.369635
-6.47745	10.06681	7.044574	-0.54985	-1.83259
-6.52684	10.40154	7.490759	-0.39932	-1.02414
-6.46571	9.936226	5.358427	0.032936	-3.40504
-6.33209	8.870748	3.399512	-0.90212	-3.22229
-7.90038	7.753236	3.891278	-2.12556	-2.18401
-8.19415	9.697439	3.724683	-2.24209	-2.96304
-8.59825	9.559228	5.198095	-1.95759	-5.00746
-8.15439	7.907242	5.642331	-3.52475	-4.06786
-8.27909	8.86375	5.043961	-3.19597	-5.06912
-9.24956	9.178045	4.041614	-3.91884	-5.46219
-9.90654	9.694311	4.710667	-3.1953	-8.26019
-10.1378	8.529293	2.707521	-1.97263	-8.31882
-9.31997	9.567386	2.884758	-1.31544	-8.5724
-8.47432	8.507784	3.022744	-0.6456	-8.52544
-9.05186	7.682737	4.092167	0.080516	-10.6106
-9.02969	7.217015	4.892702	-0.03177	-11.2202
-8.89858	6.529095	4.867762	-0.27422	-9.73082
-9.64497	5.811378	5.513756	-1.97732	-11.143
-8.01443	6.696712	5.497161	-1.00342	-10.9046
-7.27863	6.358466	4.334537	0.671008	-13.3987
-8.83327	6.142463	5.394363	0.072777	-14.5157
-8.87939	6.382372	5.334499	0.222338	-15.1142
-7.6654	7.580008	7.263984	0.110033	-15.6762
-7.85802	5.783307	6.066599	-0.89049	-16.2222
-7.28041	6.759313	7.245262	1.153295	-15.5682
-7.78849	7.216668	7.697155	2.526194	-15.0182
-7.145	7.328059	7.067921	1.596166	-15.1784
-7.26969	8.582078	8.432347	1.073695	-15.0198
-7.12175	9.823257	8.258147	2.525885	-13.3854
-7.90816	10.86546	7.334929	2.817155	-13.2362
-8.25372	9.303887	8.100665	3.154282	-11.7061
-8.89035	8.761536	10.63524	2.795774	-10.6832

-10.8332	8.394724	9.854484	2.608066	-10.257
-10.7536	8.907815	9.421835	2.423131	-10.3444
-10.7923	8.573006	9.328423	2.438794	-11.2177
-11.4045	8.131317	8.144186	3.459509	-9.71013
-10.5395	8.147812	8.44855	5.10958	-11.6083
-9.94864	8.419878	8.243934	6.213496	-13.2899
-9.49637	7.568737	9.28516	6.434056	-14.2715
-10.1466	8.536767	9.203575	6.40658	-15.2479
-10.5528	9.709063	8.937422	5.683587	-15.6431
-11.1609	9.961332	9.416476	5.447595	-16.6215
-10.0157	10.18339	11.11499	5.196128	-15.7048
-9.15732	10.04522	11.74836	4.622116	-16.728
-10.9358	9.293466	9.709685	5.106486	-15.9541
-12.5055	11.71915	9.310926	4.605635	-15.9773
-12.5179	12.01079	9.234596	4.829037	-16.5641
-12.6473	12.55357	10.78831	5.039323	-15.9563
-11.6442	14.44305	10.63617	6.62397	-14.5908
-11.147	13.96061	9.398122	7.702133	-13.5008
-12.9512	13.57719	10.54028	7.050791	-13.4706
-11.7359	13.06237	10.44284	5.488074	-14.4175
-12.9493	14.87601	11.8157	6.616084	-14.9712
-14.2281	13.44236	11.42193	7.001839	-15.3925
-15.224	13.51788	10.39725	8.239805	-14.7929
-15.4053	11.79878	10.43444	7.82032	-15.6178
-13.2457	10.81431	10.81496	8.986514	-16.2363
-13.4923	10.81306	11.55896	8.7666	-16.0979
-12.4354	9.533185	12.55169	7.873445	-15.6907
-11.5718	11.10127	13.66563	7.965278	-16.1415
-12.4622	11.25855	14.13581	9.555855	-16.2462
-12.5932	12.70645	14.27318	9.599978	-15.8963
-12.6903	10.32924	15.38551	8.714239	-16.2268
-12.7324	10.5338	15.77143	9.135792	-17.6078
-11.7738	11.06806	16.66112	8.512135	-19.2591
-10.699	9.101861	17.24676	6.885161	-19.5741
-12.2453	9.580716	16.34985	6.668245	-19.8006
-11.9093	8.914806	17.00441	5.779238	-21.8177
-12.2606	8.499905	17.22647	6.20418	-22.1528
-11.1352	10.61112	16.763	6.248266	-21.4833
-10.5271	9.455624	16.76225	5.592585	-21.35
-10.2514	9.935031	16.29553	5.611711	-19.196
-10.9354	11.20267	18.74704	5.638756	-18.2405
-11.8991	11.36936	18.74855	5.728456	-20.2916
-11.8905	11.1133	19.51076	4.30268	-20.6503
-11.3685	12.10346	20.95883	5.126161	-23.1352
-10.4735	13.85577	21.4232	4.645174	-23.6137
-10.2669	14.92244	21.23741	4.033391	-23.8761

-9.18701	16.50479	22.934	2.989773	-24.002
-9.68049	15.73403	22.01328	2.046882	-23.9955
-10.3366	15.96771	21.98257	2.49873	-22.7048
-8.56619	16.49248	21.26959	1.376574	-22.4882
-9.76372	15.72334	20.30842	2.924475	-21.4307
-10.1279	12.96971	19.61023	2.279441	-22.5646
-9.28009	14.01572	18.61322	2.688064	-23.4377
-8.70515	14.22428	18.65452	2.888644	-22.6014
-7.07416	15.40762	17.22053	4.132372	-23.5442
-5.99657	14.90445	16.73301	3.739452	-20.9542
-6.67379	14.47439	18.24184	4.20595	-22.3783
-6.72962	14.30831	18.16092	5.264895	-23.1102
-7.36399	14.21737	17.29254	5.972078	-23.6691
-6.09321	15.55392	16.97314	6.113853	-24.1607
-6.55043	16.54426	17.08806	5.123793	-25.8639
-7.19471	15.88529	17.28332	2.479235	-25.1864
-6.57155	13.72052	17.90634	3.240479	-25.986
-5.19876	12.83264	18.10323	3.469943	-24.4979
-6.90181	13.63575	19.10476	4.474476	-24.355
-9.03543	13.6957	18.5657	4.135803	-23.5336
-9.13613	15.60002	18.10734	3.163124	-24.4568
-11.0235	15.89242	17.80703	3.251273	-24.9653
-10.4233	16.28575	18.65984	2.965591	-24.4223
-11.0098	17.90032	18.59286	4.012637	-24.307
-11.6879	18.43839	18.11437	3.028585	-26.5692
-9.73228	17.07113	20.37005	2.668228	-28.0996
-10.0759	17.69398	19.109	2.747772	-27.9049
-9.40845	17.92086	18.95425	2.513684	-28.1592
-9.88948	19.84394	18.17389	0.847895	-28.7684
-11.9415	20.3845	15.66546	1.502502	-29.3956
-12.0691	19.73245	14.30026	2.797852	-29.9426

26th	27th	28th	29th	30th
0	0	0	0	0
-0.00231	-1.43491	-0.36477	0.233938	-2.55055
0.03768	0.487594	0.304502	0.731803	-3.99776
2.233223	-0.19275	-0.49033	2.020801	-5.04057
2.511128	1.485445	0.567322	1.890956	-5.25455
3.403045	0.880575	-0.42307	2.337344	-4.84452
2.924948	1.005096	1.978705	1.015258	-5.74178
2.676043	2.664786	3.049622	0.835347	-5.47132
3.120642	3.473877	4.559976	0.874421	-4.57741
3.740744	2.508062	2.915189	0.990493	-6.00924
2.835231	3.073119	1.97553	0.952548	-6.18173
2.978987	1.782891	0.925295	0.946304	-5.51112
1.917695	3.213686	0.545479	0.509765	-4.63345

2.134021	4.621415	1.220679	0.764268	-3.9751
4.090027	3.743744	0.802381	1.757083	-3.491
2.61864	2.537147	1.159555	2.07364	-2.95806
1.093233	3.004374	2.366438	0.716591	-1.92791
0.911433	4.112649	1.437222	1.144185	-2.4025
0.18746	2.591936	-0.11535	2.388978	-0.71746
0.607583	0.900604	-0.80193	3.258165	-0.42803
-1.61005	-0.29002	0.148505	4.056012	-1.33871
-2.36785	0.894863	1.471824	3.186388	-0.00525
-2.50103	0.571869	0.825368	2.472352	-0.40754
-1.25307	-0.32391	2.347191	4.205936	-0.94981
-1.87269	-2.03451	2.405686	4.124925	-0.91314
-1.39	-3.21671	2.694045	5.208053	-0.43964
-2.79349	-3.78003	3.286129	4.377196	-1.1544
-1.11672	-2.49393	2.098161	5.11822	-1.05613
-0.55839	-1.64258	3.246882	4.313312	-3.81871
-1.9741	-2.01163	1.995382	5.504123	-3.40114
-2.27461	-1.4708	3.108427	4.342268	-3.01489
-1.89009	-2.44655	1.933153	3.32002	-3.47894
-1.76768	-2.48144	1.193353	2.826276	-2.87613
-2.97484	-2.03522	1.37322	3.207657	-3.5856
-2.25357	-1.87705	1.809888	1.191569	-3.18989
-4.57711	-3.92376	1.092585	-0.31223	-3.34857
-5.34372	-4.42755	1.463547	-0.35917	-2.78085
-5.70133	-5.14513	-0.93644	-0.85184	-3.04088
-3.55341	-6.30723	-0.96558	0.16776	-3.39152
-2.61709	-6.77674	-0.72964	-0.55208	-3.18992
-1.5888	-6.26172	-0.31353	-0.61609	-3.05862
-2.13903	-4.17324	-0.64713	0.263133	-4.93829
-2.16545	-3.76187	-0.40118	-0.24575	-5.20694
-2.55638	-2.95026	0.843882	-1.93429	-5.90716
-2.9694	-3.24643	0.750578	-0.30215	-4.93563
-2.17752	-2.3534	1.366825	-0.84338	-5.76923
-3.01215	-1.86807	1.610445	-0.84819	-5.65656
-2.93865	-1.241	0.806529	-1.36393	-6.40981
-3.54822	-0.24018	-0.21534	-2.67935	-5.92188
-2.56981	-0.04851	-1.12066	-3.0238	-6.66254
-2.32817	-0.41302	-0.98123	-5.03727	-6.50578
-2.79601	-0.58531	-1.5228	-6.33744	-7.01802
-3.44226	-1.19382	-1.95354	-5.5399	-7.14398
-4.53084	-0.8645	-3.08135	-4.57848	-6.41515
-5.63866	0.796293	-3.0802	-5.62517	-6.50616
-4.1889	1.7534	-4.11068	-6.42706	-7.67205
-5.72489	2.234699	-3.54453	-7.00907	-7.64005
-7.05328	2.067895	-3.13146	-7.99605	-8.02964
-7.5075	0.848249	-3.46055	-8.90062	-6.70411

-8.64785	0.608564	-2.52299	-9.72028	-7.42369
-8.20798	-0.33989	-2.14739	-10.7139	-7.39799
-8.52762	0.682265	-4.28616	-11.8087	-4.88264
-7.63021	1.288419	-3.80982	-10.2884	-4.09875
-7.89594	1.105928	-2.86011	-8.87527	-2.96329
-8.83313	1.14309	-2.26531	-9.77809	-5.65047
-10.4468	-0.64261	-2.28045	-9.39955	-7.01573
-10.3332	0.792168	-2.6351	-9.55056	-5.40009
-11.2272	0.098731	-1.57019	-9.68403	-5.46524
-13.1987	-0.87022	-0.64398	-9.24549	-4.71093
-12.6644	0.656062	-0.93924	-9.01857	-5.01577
-12.43	0.469389	-0.3456	-10.3539	-6.21333
-11.158	0.37687	2.391197	-10.6946	-6.89422
-12.0973	-1.22564	3.363303	-11.8948	-7.91857
-10.762	-0.43573	4.921346	-11.741	-7.18721
-9.90979	-1.2434	3.693036	-9.92627	-8.13046
-7.41198	-0.78628	2.921628	-9.85432	-7.78176
-7.02166	-1.76195	3.670878	-9.93172	-8.12572
-7.28415	-2.6299	3.029977	-10.0195	-8.30908
-5.89461	-2.55435	3.835016	-10.5017	-6.9693
-4.51726	-2.4674	4.238469	-10.7407	-7.39586
-3.76026	-1.23668	4.099543	-10.0953	-7.63848
-3.88212	0.642169	3.577221	-10.5157	-8.30529
-3.79181	0.011147	3.345651	-10.2886	-8.32673
-4.55844	-0.1744	4.580432	-10.5832	-8.98036
-3.9628	-0.91049	4.834597	-9.78252	-9.92727
-3.94491	-1.53771	4.555293	-9.35865	-11.9213
-2.70037	-1.07646	3.675843	-10.5785	-13.5603
-2.03816	-0.35088	2.811328	-11.1015	-13.8213
-1.50636	-0.12695	3.010156	-12.3549	-14.987
-2.4723	-0.11609	3.105436	-12.673	-15.1789
-3.19083	0.162045	3.353553	-13.2285	-14.9738
-3.59641	-0.38978	4.276949	-13.0321	-14.6778
-4.33087	0.031982	3.812755	-13.8693	-13.8279
-3.7198	-1.13917	4.463686	-14.4935	-12.6669
-2.13528	-1.26465	3.772625	-14.5136	-12.2822
-2.54891	-2.53185	2.071493	-15.4914	-10.8361
-2.91401	-1.79759	0.877883	-14.2003	-10.2448
-4.14858	-1.14627	0.340876	-12.562	-11.2697
-4.54236	-0.67551	0.837168	-12.3092	-11.5198
-5.42063	1.574281	-0.13539	-12.3838	-12.1575
-5.22902	4.707896	-0.6867	-12.6518	-12.0431
-4.32096	5.453025	-0.57159	-12.9915	-12.1709
-4.11919	5.244325	-1.6144	-13.9792	-11.3196
-4.40323	5.982078	-3.43572	-12.5556	-11.1729
-3.51561	6.405721	-3.66911	-12.784	-10.3976

-3.35267	7.185931	-2.65178	-11.7054	-10.1144
-3.11588	8.230437	-2.78709	-12.7558	-11.1932
-3.58721	7.479024	-2.06389	-11.9838	-9.73042
-3.55258	6.113313	-1.5667	-12.3808	-8.24706
-3.87644	6.773063	-3.16807	-11.2908	-9.23067
-5.32157	7.592627	-4.73283	-10.8721	-9.39047
-4.97823	6.72024	-5.51352	-10.9008	-10.0114
-4.94048	6.645957	-3.77445	-8.71807	-9.57992
-5.95283	5.887863	-2.54086	-9.36865	-10.3771
-6.09813	5.584293	-1.55006	-9.24268	-9.5748
-6.74756	4.477828	-1.57896	-10.0858	-10.0534
-6.561	5.354881	-1.05643	-10.5439	-9.80262
-6.84816	4.477768	-2.18534	-7.93856	-11.5359
-6.4338	3.959787	-3.59361	-9.62293	-11.2736
-6.40814	2.728468	-2.43866	-8.98101	-11.1829
-6.18214	3.142543	-3.23743	-9.32462	-11.3835
-6.84505	3.443567	-4.41931	-10.1687	-9.26277
-7.41448	4.431418	-3.1689	-8.99336	-9.76792
-8.24232	3.567219	-2.08631	-9.18932	-8.52274
-8.77179	2.57592	-1.49409	-7.44628	-8.01663
-9.27427	3.515189	-0.2835	-8.15912	-8.97495
-8.23588	3.01743	0.763712	-9.29984	-10.7303
-7.06902	3.587853	0.445527	-8.61039	-11.1091
-8.85801	3.491401	0.047368	-8.10247	-10.889
-9.23645	2.235993	-0.36464	-7.40062	-11.4539
-10.0371	2.206634	0.861499	-7.4618	-10.4992
-8.94284	3.097819	-0.75739	-7.76869	-11.3768
-9.64283	2.767271	0.699568	-8.59641	-9.57615
-8.71306	1.804245	-0.28254	-7.37505	-10.0368
-8.20894	3.772564	0.09103	-8.92903	-10.2763
-7.17753	4.879337	-0.31272	-10.2239	-9.51127
-7.67451	5.665216	-0.70414	-12.298	-10.1585
-10.5163	6.336454	-0.27309	-12.982	-9.4958
-11.5724	5.967474	1.11327	-13.1031	-10.1522
-10.7569	5.166659	1.472772	-13.8125	-11.301
-12.2887	5.211371	2.110161	-15.0452	-11.748
-12.0761	4.697239	1.034948	-15.7561	-11.0896
-12.4169	4.987036	3.132732	-15.85	-11.1042
-12.4451	4.986634	3.93067	-12.5843	-9.5095
-11.1701	2.2849	5.480053	-12.8525	-9.60004
-10.2449	0.568239	6.637657	-11.5641	-9.60745
-10.719	-0.08714	7.180498	-12.7839	-8.38178
-11.7776	0.59548	7.92498	-12.3079	-8.2152
-10.3907	0.520322	8.897223	-12.0159	-9.40789
-9.48112	-0.37612	9.966323	-12.066	-9.72502

31st	32nd	33rd	34th	35th
0	0	0	0	0
-0.36083	0.671381	0.335041	-0.41209	0.3936
-0.73608	1.758585	-1.01327	0.113906	0.870875
-0.55313	0.731106	-2.13704	0.5857	0.753404
-1.47205	1.651321	-1.2981	-0.63059	1.117766
-1.72612	1.156578	-0.72373	0.569494	1.681536
-1.39629	0.968213	-0.68358	-1.59885	1.382455
0.409528	2.352595	-0.28349	-1.19513	1.67252
0.672447	3.620511	-0.96955	-0.48802	2.749031
1.377869	5.966557	-1.66589	0.427808	1.541642
2.310429	7.24256	-3.1934	-0.51683	2.190562
3.361684	8.800896	-3.26546	0.648603	2.755761
0.925956	9.160402	-3.12924	-0.25104	3.195647
-0.48856	9.297293	-3.23236	-0.40383	2.699526
-0.10992	9.069177	-4.35264	0.965423	0.705087
0.949733	9.414063	-3.05709	0.246028	0.080999
3.022172	8.565011	-2.94061	1.076981	0.283546
3.190508	9.562361	-3.98134	0.976848	-0.38038
2.778528	9.603833	-3.0689	1.856667	-0.13575
3.327567	8.366605	-3.79623	1.188557	-0.83251
3.556155	9.296034	-4.12022	1.312777	-0.02514
3.060081	7.570649	-2.54191	-1.07933	-0.78241
2.622481	7.425329	0.200758	-0.02617	-1.25516
2.702222	6.621249	1.232307	0.520742	-2.00948
4.007943	7.776986	1.52615	2.805001	-2.34179
3.920711	8.389819	2.254575	2.9577	-2.27923
4.144321	8.720426	1.727218	3.441292	-2.56912
2.641284	7.454809	3.147408	3.949655	-1.79808
2.692588	7.788021	2.264614	5.195004	-1.38279
3.101693	8.099212	1.9136	4.822413	-0.12133
4.95002	8.578203	2.160405	5.142675	-0.4217
6.09564	8.145128	2.274186	5.506324	1.093325
5.099067	8.291448	1.752759	7.031401	1.83862
3.78776	7.441547	1.859203	8.275819	2.567081
3.472542	6.512914	1.422144	6.70346	4.069772
3.062046	5.013743	1.650998	6.36814	5.937357
4.161514	5.28676	0.264936	5.655064	3.77793
4.798122	6.690806	1.014082	6.269552	3.788958
4.821963	8.393037	2.49755	7.035907	4.259036
5.200564	8.053637	1.587365	8.90618	2.775877
6.835536	9.938089	0.660358	9.698929	2.747061
7.235369	11.79043	-1.49485	8.281172	4.584717
8.421147	11.26251	-1.83841	7.895121	5.019597
8.53607	11.11927	-1.21312	8.297607	5.991974
8.644657	9.820617	-2.00074	9.90219	7.220454

8.812838	11.16675	-1.62584	10.15198	7.692393
9.243329	11.12962	-1.80371	9.407949	8.721366
8.230752	11.49377	-0.10491	7.887219	10.48651
6.508051	13.49453	0.23289	5.801982	9.875565
7.003684	15.79134	-0.90202	4.883518	9.513262
8.06297	16.05184	-0.93949	4.143607	9.194049
11.46925	15.11599	-1.16508	3.287268	9.088286
12.4811	14.73465	-0.92473	4.660267	9.512346
13.21911	14.53795	-1.83892	4.910884	9.982887
12.44384	13.33449	-0.9272	5.125047	13.19959
12.09953	14.52075	0.084538	5.97908	13.36018
11.45275	14.86026	0.904189	5.414749	13.18788
11.99651	14.64581	-2.42508	6.152693	14.13262
12.13913	14.6086	-0.38457	4.85537	14.36804
12.4692	14.34603	-0.31203	4.834094	12.98779
11.63206	13.52306	-0.31978	5.595262	12.7779
13.3636	12.86229	0.522554	6.029024	12.63336
14.22599	15.44689	0.332809	4.917776	12.89188
14.22051	15.56633	0.677444	5.332689	11.89083
13.2302	16.31715	0.213471	4.608679	11.81417
13.06502	15.62843	1.231371	5.546127	12.55164
12.1909	16.68036	1.347259	5.161745	10.79416
12.03385	17.36044	0.801904	4.706667	9.696509
10.57905	17.97392	0.925268	2.678283	9.290284
8.483973	17.94495	-0.13422	1.577144	8.527001
8.461608	18.14466	-0.53205	0.287496	6.653978
7.768302	17.41421	1.04363	-0.0781	6.296277
8.658715	19.48207	0.802236	-1.08286	5.142526
7.870003	19.49564	0.447922	-0.00768	4.446156
9.814766	19.98721	-0.91994	-2.26295	2.526503
9.659126	20.11668	-0.44427	-2.68596	3.757808
10.73399	18.54792	1.652987	-2.07026	2.846967
11.71599	17.15393	-1.12029	-3.85501	3.534927
10.94708	17.48294	-1.49118	-2.03541	5.128978
13.16438	17.43719	-1.142	0.138889	4.800356
13.40007	18.02684	-1.95731	1.098103	3.762491
14.21768	18.79412	-1.84396	1.315084	2.481517
13.36698	16.87812	-1.16201	0.954608	2.151421
14.04402	17.84572	-1.23227	0.21172	4.173853
12.89853	17.41812	-1.54331	0.664079	5.14666
12.44456	17.62272	-1.15575	0.99879	6.687548
11.53835	18.05173	-0.54057	-0.1802	5.853221
11.02994	17.89314	0.417488	-1.2576	5.692823
11.24168	18.36241	-0.96837	-1.56375	3.630109
10.00325	19.39454	0.074318	-0.63309	4.3902
10.17586	19.52127	0.543647	-0.04033	3.121635

11.21485	19.31277	1.956656	-2.48885	2.648339
10.91022	19.08826	2.187639	-2.21289	3.273114
10.45576	19.82603	1.704686	-2.07732	3.588575
11.69932	19.93619	-0.30625	-0.96106	2.840159
11.48198	20.71405	-2.56136	-0.41775	3.386766
11.37724	21.18994	-1.59631	0.270832	3.434514
9.577124	21.50344	-0.7904	0.899465	6.728875
7.739034	20.84554	-0.15257	0.225094	8.779644
7.936022	19.86	-0.37691	1.18495	9.435332
7.579612	18.83664	0.398756	1.612142	8.940204
7.340444	18.3241	0.865409	0.673733	8.813869
9.004852	19.04432	0.51449	0.634266	10.52951
12.04285	19.88561	0.887017	0.177853	11.09481
12.92435	19.76826	0.206382	0.058388	13.63024
13.08524	19.57531	1.814184	-1.27041	13.2168
14.94445	19.26827	1.527804	-1.55724	14.48701
16.48215	18.18904	0.715598	-2.25339	14.32602
17.81258	18.04182	1.0082	-4.02784	14.24333
17.94307	17.59308	0.450403	-4.66254	16.4445
16.67882	17.49654	0.73878	-4.43534	14.51664
15.5917	16.86807	-0.39155	-5.7457	15.37597
14.37968	15.60685	-0.6085	-5.90897	13.72693
14.55303	15.01901	-1.30079	-6.12878	14.84018
14.41659	15.09493	-0.42722	-5.46254	14.73207
14.35532	15.70501	-0.33817	-5.7899	15.8736
12.4834	14.79298	0.027176	-5.73602	14.76733
12.50824	14.90395	1.044916	-4.10076	15.26714
13.03888	14.23839	0.460886	-3.01903	14.70925
13.46217	14.47764	0.590473	-3.20404	14.49354
15.23369	15.90302	1.047896	-3.53038	15.01774
15.71409	15.42899	0.411234	-3.02611	13.60638
15.79762	16.64943	0.243376	-2.03608	13.96607
16.11969	16.7393	0.554322	-2.29833	13.8789
16.84132	16.36895	0.22427	-1.83507	13.43177
15.69988	13.90293	-0.35856	-2.574	14.96025
16.81303	14.03697	1.052508	-1.34429	15.45246
16.45223	14.76336	-0.05003	-2.19477	14.39318
17.42604	15.5148	-1.60391	-2.01333	15.6228
17.45634	14.41729	-3.66621	-0.56431	15.35638
17.79329	13.16947	-4.75595	-0.55701	14.93762
17.82573	13.73976	-4.35492	0.488699	14.94594
18.61022	13.22974	-3.26062	1.682943	14.73915
18.55786	13.93752	-3.29078	2.303314	14.63034
19.65634	13.81094	-2.52231	2.895209	15.31614
19.08826	14.36345	-1.74011	2.789265	15.51072
19.75965	13.03879	-4.19965	1.451516	15.55573

19.2253	14.12095	-4.70367	2.063648	16.27466
19.35692	13.6629	-5.48298	2.433729	16.76763
19.48345	13.0803	-4.84289	4.117535	17.92115
19.13061	13.82135	-3.55316	3.512142	16.37735
18.77886	13.5102	-4.30349	4.691555	17.13424
19.0886	13.89023	-3.37375	5.913091	16.11809
18.81664	14.57668	-3.04111	5.612657	17.21428
18.69984	14.66794	-4.69804	4.921445	17.99496
18.55578	14.13613	-4.64946	6.300555	17.24404
20.07006	13.65711	-6.07095	7.09679	15.51287
22.34715	14.41157	-5.37376	6.656035	15.89332
22.95185	14.50688	-4.14936	5.765404	13.40043
24.59523	14.82739	-3.40749	5.877658	12.87953

36th	37th	38th	39th	40th
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-0.06968	-0.56612	-1.09525	-1.70784	-1.20009
0.503826	-0.1066	-0.76326	-1.84506	-1.04009
-0.38827	-0.61027	-0.37638	-0.75116	-1.87986
-1.62204	-1.13198	-2.10776	-1.61674	-0.61941
-3.27686	-0.57196	-2.59283	-1.62336	-0.81036
-3.96453	-0.81811	-2.37124	-2.12696	-1.69273
-4.41531	-1.31247	-2.45617	-0.97323	-1.42119
-3.08664	-0.62585	-2.4452	-2.29094	-2.59369
-4.19022	-0.86497	-3.99475	-3.70863	-3.01254
-3.04466	0.145582	-3.79308	-4.01651	-2.72364
-4.62549	-0.81166	-3.43554	-5.67731	-4.56353
-3.90744	-0.72204	-3.04465	-5.61251	-4.22011
-1.56512	0.559962	-2.54089	-5.31608	-5.30903
-0.37303	0.03396	-3.25683	-4.62148	-3.85912
-0.38512	-0.08749	-1.65313	-6.08242	-3.00715
0.538212	-1.23236	-1.40947	-6.27001	-3.96958
0.613529	-0.23471	-0.49496	-4.60348	-3.94669
0.169583	-2.01164	0.128257	-4.3589	-3.42692
1.229908	-2.16368	-0.19889	-3.27389	-3.56107
0.929689	-2.65061	1.462236	-2.61126	-3.79611
1.821953	-1.93896	-0.19394	-4.29979	-3.19883
1.902635	-2.62556	-1.58097	-3.13176	-2.65611
1.608179	-3.3249	-1.35843	-4.05758	-1.20584
0.501038	-4.54634	-0.6114	-1.21215	-2.47889
0.762309	-3.28902	-1.19822	1.103633	-3.46139
1.473984	-2.50683	-1.03202	1.764609	-4.40829
3.558782	-4.07948	-1.16793	2.382258	-4.76991
2.848273	-5.1595	-1.23391	3.192707	-3.69759
1.338935	-5.87905	-0.92223	4.709372	-3.22611
0.201061	-5.34925	-0.45154	5.465596	-3.71497

-0.6276	-5.10128	1.086351	5.531175	-3.02885
0.761209	-5.07726	1.882955	6.418187	-2.62009
2.606553	-5.69002	2.13887	7.920022	-2.68962
1.367633	-6.10703	0.457569	6.329336	-4.44571
0.839504	-8.31474	-0.23359	6.839865	-6.01304
2.151195	-10.4673	1.269621	7.095509	-5.10056
2.256675	-10.8926	1.957088	6.927008	-5.39984
1.170586	-11.0008	2.597597	7.885122	-3.14704
3.224699	-12.7567	3.979554	7.427829	-3.3466
3.955137	-11.999	3.172174	6.471395	-1.82951
3.605374	-13.7573	4.049343	5.415388	-2.38739
1.171831	-15.7901	4.056782	6.649632	-4.0574
-0.32789	-15.7832	3.635442	6.586434	-4.44003
-0.94394	-15.81	3.748154	6.217769	-3.51386
-0.42008	-16.3709	3.719774	4.972472	-1.60496
-0.84205	-17.1474	3.824462	5.611207	-0.97886
-1.62974	-16.4003	3.382666	4.504001	-1.40477
-3.04448	-17.2152	3.106408	4.867805	-1.3743
-2.77439	-17.5241	2.212072	4.605009	-0.87394
-2.1857	-18.0689	1.558635	3.325505	-0.01902
-0.65043	-18.1054	0.899924	2.881702	-0.56099
-0.30613	-18.7485	1.478528	2.722525	-0.32231
-0.10563	-20.2709	2.55656	4.730185	0.601677
-0.94099	-20.4227	1.881131	5.568147	1.2613
-1.60589	-20.7868	2.748538	4.850466	1.18269
-0.67268	-20.2139	3.350978	4.304028	0.589725
-1.11803	-19.5277	3.247509	5.181731	0.37723
-2.34345	-18.033	4.093874	3.092166	1.753156
0.144434	-19.0986	3.383468	0.093946	0.144271
0.159805	-20.6305	5.107606	-1.31198	0.865644
0.280256	-20.643	4.772245	-2.38214	0.384969
0.403589	-19.9979	4.086074	-3.44782	2.71507
0.588492	-19.7723	4.626805	-3.71707	1.979698
1.183256	-20.333	4.519666	-4.27447	1.868524
1.24834	-19.8078	5.218732	-5.46163	1.492945
0.266551	-19.1084	3.974147	-4.62841	3.388389
3.922181	-18.4106	4.230116	-5.04062	2.813856
5.224927	-16.3409	4.304644	-5.17533	3.176345
5.47226	-16.5631	3.12759	-5.61804	2.502414
6.293498	-18.8371	4.195179	-4.93608	1.76075
6.405539	-19.8977	3.116136	-5.0646	0.046192
6.186065	-21.6962	2.354536	-5.52743	-1.15791
6.532023	-22.3027	3.768875	-4.80891	-0.60379
6.274544	-23.1684	3.636253	-6.04963	-0.27317
8.023605	-24.1278	3.206909	-5.96474	0.373631
6.876544	-25.4754	1.592664	-6.1365	-0.68358

6.114381	-24.19	3.28237	-6.2075	-0.32121
6.669477	-24.9869	4.148781	-5.24142	-0.4862
4.951813	-26.3778	3.32669	-5.54618	0.607131
5.680343	-27.7318	4.191437	-5.6995	0.619513
5.597546	-28.2378	6.744763	-6.45764	-0.3066
6.455434	-28.7046	7.851026	-5.97872	-1.24026
6.42578	-27.4974	7.565038	-5.73464	-1.58828
7.946993	-27.7735	8.24688	-6.42146	-0.66924
9.137734	-25.2561	7.232826	-6.17302	-1.7533
10.97297	-25.6335	5.633501	-7.27613	-2.4878
10.60337	-23.5979	5.742725	-6.6947	-2.8307
10.77797	-25.0659	5.098934	-6.42644	-3.67533
9.25918	-25.1905	5.906579	-7.04678	-4.65912
10.22252	-23.5062	6.894527	-7.57513	-5.55498
10.71335	-22.9294	5.140451	-7.25233	-6.20438
12.07054	-20.843	5.199478	-7.43144	-5.36608
11.15799	-21.6089	6.147513	-9.32942	-7.67104
12.04214	-21.734	7.33866	-9.43035	-7.42309
12.06839	-21.5572	7.992	-8.03266	-6.13394
10.48278	-19.834	6.689685	-7.95955	-5.97649
11.83402	-20.7888	7.434542	-6.786	-3.81088
11.90224	-19.9535	9.304694	-7.24812	-3.11314
13.38707	-19.2595	10.14803	-8.47195	-2.98863
12.67805	-18.3997	8.036886	-7.56308	-3.32578
12.99936	-17.1713	7.050911	-7.27669	-2.45543
12.90394	-16.9515	8.142409	-6.45565	-2.6571
13.69296	-15.9666	7.189656	-6.09369	-1.36356
13.3763	-15.1087	6.882571	-5.80472	-1.52554
12.63181	-15.6092	5.36797	-5.51871	-2.36522
12.00422	-16.3385	4.840991	-5.46962	-3.08117
11.88717	-15.3944	5.325413	-5.17614	-1.9458
12.82982	-17.7576	5.00763	-6.7935	-3.04127
12.91164	-18.0904	5.148799	-4.49083	-2.4328
11.49586	-18.5079	4.912228	-6.40317	-2.57457
11.44875	-19.0559	5.528354	-4.95908	-3.65767
10.57115	-18.7517	7.681394	-4.93045	-1.72756
11.50846	-18.4446	7.080928	-4.24397	-1.73475
11.03778	-17.9871	7.219867	-3.61118	-2.16434
9.967241	-17.6796	6.759569	-4.45389	-2.30461
11.13684	-17.2387	7.322447	-4.88412	-4.44252
11.92622	-14.6129	9.600509	-4.72633	-4.88434
10.91916	-16.3214	9.989907	-5.10612	-5.37674
12.0388	-18.5167	10.4194	-6.3925	-5.50666
9.156815	-18.3172	10.69407	-5.94594	-4.21076
9.526046	-15.9232	9.322192	-6.74182	-5.34367
10.90623	-18.7998	7.484329	-6.77467	-6.03104

11.51044	-18.0945	9.071197	-5.90823	-6.49317
10.86091	-20.2763	10.05017	-5.38743	-6.39104
11.11619	-19.2298	8.643302	-6.24923	-5.86117
11.99815	-19.7705	8.40975	-7.70358	-6.72496
12.18021	-19.0459	8.808701	-8.17043	-7.82707
12.98526	-20.3346	9.010769	-7.0362	-8.70141
12.3018	-21.2936	9.412291	-8.82605	-9.09348
12.49349	-21.6798	9.610354	-8.79717	-7.86278
12.38082	-22.9752	7.799901	-8.08747	-7.50177
12.88787	-24.5244	6.51757	-7.2948	-7.17626
12.94006	-25.8573	6.664598	-7.68954	-6.55042
11.64705	-27.384	6.143757	-7.59877	-6.0257
11.06129	-27.8689	5.996957	-8.28973	-6.20879
12.05922	-28.8958	6.579765	-8.74334	-5.42831
11.61522	-30.1645	5.723523	-6.6779	-4.45068
12.26071	-30.1441	6.190798	-4.66162	-6.04897
13.9329	-29.6897	6.724011	-4.44124	-6.81687
13.19215	-28.635	7.062635	-3.78579	-7.14231
14.70888	-28.4023	6.324382	-3.71413	-7.02917
14.08713	-29.2947	7.311761	-4.77046	-7.38636
14.41086	-30.8065	6.991377	-3.03508	-7.98725
12.80202	-31.5693	5.695444	-3.13278	-7.59494
14.20887	-32.3705	5.225209	-2.93303	-6.47996
13.73232	-31.4677	6.370704	-4.09648	-5.39532
16.48492	-30.101	6.162895	-5.94658	-4.63557
17.18432	-29.5467	7.277028	-5.72561	-5.43734
17.24925	-30.1105	7.891074	-5.70156	-5.37706

Appendix 4.1

Test results for data transformation using the new method

1st simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.71	-1.32	14.89	9.52	24.75	22.21	24.39	32.43	17.97
t-statistic	-0.03	-0.09	0.65	0.56	0.86	1.41	0.89	1.01	0.57
p-value	0.97	0.92	0.51	0.57	0.40	0.19	0.39	0.34	0.58

2nd simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	11.97	22.60	9.78	8.61	20.02	6.66	-4.37	-9.72	-23.36
t-statistic	0.59	1.11	0.39	0.51	0.98	0.33	-0.24	-0.38	-1.16
p-value	0.55	0.27	0.69	0.61	0.34	0.74	0.81	0.70	0.28

3rd simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	4.45	-11.25	-11.16	7.97	8.13	-5.24	-3.30	-9.63	17.36
t-statistic	0.27	-0.80	-0.52	0.50	0.36	-0.26	-0.12	-0.35	1.07
p-value	0.78	0.42	0.60	0.62	0.72	0.79	0.90	0.73	0.32

4th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-22.72	-33.26	-18.57	-15.88	-22.55	-9.96	-33.87	-30.36	-0.35
t-statistic	-1.07	-1.40	-0.91	-0.96	-1.31	-0.64	-1.58	-1.14	-0.009
p-value	0.28	0.17	0.37	0.35	0.21	0.53	0.15	0.29	0.99

5th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	0.58	4.57	6.81	-3.99	11.98	-15.94	8.21	15.81	-2.12
t-statistic	0.08	0.49	0.53	-0.37	1.03	-1.39	0.55	1.18	-0.13
p-value	0.93	0.62	0.59	0.71	0.32	0.19	0.59	0.27	0.90

6th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-22.53	-15.81	-22.73	-33.29	-6.25	-13.74	-21.95	-22.26	-8.58
t-statistic	-0.92	-0.64	-1.00	-1.10	-0.20	-0.40	-0.65	-0.54	-0.30
p-value	0.36	0.52	0.33	0.28	0.84	0.69	0.53	0.60	0.77

7th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-17.22	-12.61	-43.31	-23.40	43.92	35.00	40.68	12.04	-22.31
t-statistic	-0.91	-0.43	-1.23	-0.64	0.89	0.74	0.73	0.16	-0.47
p-value	0.36	0.66	0.23	0.53	0.38	0.47	0.48	0.87	0.65

8th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-2.65	-1.67	-21.08	42.38	-42.29	57.81	-12.22	-24.50	60.98
t-statistic	-0.08	-0.05	-0.63	1.07	-1.23	1.37	-0.29	-0.56	1.21
p-value	0.92	0.95	0.53	0.30	0.24	0.20	0.77	0.59	0.27

9th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-8.53	-29.62	3.71	-3.80	0.36	8.46	-1.38	7.47	-0.85
t-statistic	-0.59	-1.28	0.25	-0.22	0.01	0.31	-0.03	0.21	-0.02
p-value	0.55	0.21	0.80	0.82	0.98	0.75	0.96	0.83	0.97

10th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-17.10	-15.37	-15.38	-32.80	33.70	-30.40	5.43	27.83	6.10
t-statistic	-0.63	-0.48	-0.41	-0.71	1.07	-0.87	0.14	0.59	0.16
p-value	0.53	0.63	0.68	0.48	0.30	0.40	0.89	0.57	0.87

11th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-15.46	-9.00	11.98	20.18	-12.44	12.96	9.06	9.12	21.45
t-statistic	-0.80	-0.38	0.49	0.94	-0.45	0.56	0.34	0.43	1.15
p-value	0.42	0.70	0.62	0.36	0.65	0.58	0.74	0.67	0.29

12th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-26.30	-21.22	-4.80	-25.29	-40.71	-52.76	-60.70	-79.50	-34.93
t-statistic	-1.37	-0.96	-0.23	-1.09	-1.34	-1.58	-1.49	-1.65	-0.68
p-value	0.17	0.34	0.81	0.29	0.20	0.14	0.17	0.14	0.52

13th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-73.94	-88.74	-84.44	8.99	-89.78	-93.00	25.37	3.15	-16.50
t-statistic	-1.40	-1.56	-2.03	0.13	-1.39	-1.09	0.32	0.04	-0.18
p-value	0.17	0.13	0.057	0.89	0.18	0.30	0.75	0.96	0.85

14th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	8.33	-0.42	-16.62	13.17	13.12	0.53	-52.46	23.32	-6.05
t-statistic	0.39	-0.02	-0.58	0.52	0.47	0.01	-1.07	0.48	-0.09
p-value	0.69	0.98	0.56	0.60	0.64	0.98	0.31	0.64	0.92

15th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-9.92	-13.98	-9.14	-3.35	-15.04	1.43	4.03	-19.98	-12.70
t-statistic	-0.54	-0.69	-0.40	-0.15	-0.58	0.06	0.12	-0.57	-0.41
p-value	0.59	0.49	0.68	0.88	0.57	0.95	0.90	0.58	0.69

16th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-15.62	-8.36	-19.69	-38.08	-20.36	-30.33	-10.20	-29.77	-17.24
t-statistic	-0.87	-0.57	-1.17	-1.89	-1.20	-1.57	-0.48	-1.38	-0.72
p-value	0.38	0.57	0.25	0.08	0.25	0.14	0.64	0.20	0.49

17th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-17.14	-24.85	-21.56	-26.78	-22.66	-28.43	-25.36	-27.07	-23.42
t-statistic	-1.68	-2.71	-1.97	-2.17	-1.86	-1.64	-1.21	-1.29	-0.98
p-value	0.10	0.012	0.064	0.049	0.08	0.13	0.25	0.23	0.36

18th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	46.47	31.18	26.08	4.86	-18.33	3.40	19.84	28.95	3.26
t-statistic	1.51	0.96	1.00	0.17	-0.52	0.11	1.07	0.99	0.09
p-value	0.14	0.34	0.32	0.86	0.61	0.91	0.31	0.35	0.92

19th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	5.73	45.58	23.74	17.78	33.09	26.71	34.63	72.11	72.71
t-statistic	0.30	2.43	0.87	0.68	1.30	0.70	0.76	1.43	2.46
p-value	0.76	0.023	0.39	0.50	0.21	0.49	0.46	0.19	0.049

20th simulated series with initial value 1000

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-22.80	-17.29	-38.19	-48.90	-37.54	-28.21	2.14	3.23	31.87
t-statistic	-0.86	-0.71	-1.56	-1.71	-1.21	-0.63	0.04	0.08	0.83
p-value	0.39	0.47	0.13	0.11	0.24	0.54	0.96	0.93	0.43

21st simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.07	-0.10	0.05	0.04	0.18	0.14	0.19	0.28	0.19
t-statistic	-0.49	-0.90	0.30	0.33	0.76	1.05	0.83	1.10	0.77
p-value	0.62	0.37	0.76	0.73	0.46	0.31	0.42	0.30	0.46

22nd simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	$-9*10^{-4}$	0.09	$4*10^{-4}$	0,06	0.14	-0.01	-0.12	-0.16	-0.29
t-statistic	-0.005	0.59	0.001	0.45	0.80	-0.09	-0.75	-0.68	-1.56
p-value	0.99	0.55	0.99	0.65	0.43	0.93	0.47	0.51	0.16

23rd simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	0.03	-0.13	-0.15	0.01	0.03	-0.11	-0.05	-0.10	0.12
t-statistic	0.26	-1.02	-0.78	0.07	0.15	-0.58	-0.20	-0.39	0.74
p-value	0.79	0.31	0.44	0.94	0.88	0.57	0.84	0.70	0.48

24th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.20	-0.29	-0.15	-0.15	-0.15	-0.09	-0.27	-0.23	-0.01
t-statistic	-1.41	-1.70	-1.05	-1.34	-1.21	-0.86	-1.66	-1.11	-0.05
p-value	0.16	0.10	0.30	0.20	0.25	0.40	0.13	0.30	0.96

25th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.005	0.06	0.10	-0.09	0.21	-0.17	0.20	0.28	-0.02
t-statistic	-0.05	0.50	0.61	-0.58	1.61	-1.03	1.27	2.18	-0.11
p-value	0.95	0.62	0.54	0.56	0.13	0.32	0.23	0.06	0.91

26th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.14	-0.07	-0.18	-0.25	-0.04	-0.06	-0.14	-0.08	-0.01
t-statistic	-0.93	-0.45	-1.26	-1.22	-0.22	-0.29	-0.60	-0.27	-0.06
p-value	0.35	0.65	0.22	0.24	0.82	0.77	0.56	0.78	0.95

27th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.15	-0.08	-0.32	-0.23	0.17	0.17	0.16	0.003	-0.19
t-statistic	-1.28	-0.48	-1.34	-0.91	0.52	0.50	0.42	0.006	-0.52
p-value	0.20	0.63	0.19	0.37	0.60	0.62	0.68	0.99	0.61

28th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.05	-0.07	-0.12	0.17	-0.32	0.26	-0.09	-0.18	0.35
t-statistic	-0.36	-0.45	-0.66	0.77	-1.51	1.03	-0.34	-0.64	1.10
p-value	0.71	0.65	0.51	0.45	0.15	0.32	0.73	0.54	0.30

29th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.11	-0.22	0.01	-0.02	-0.01	0.05	0.03	0.14	0.01
t-statistic	-0.93	-1.17	0.08	-0.17	-0.04	0.21	0.10	0.45	0.04
p-value	0.35	0.25	0.93	0.86	0.96	0.83	0.91	0.66	0.96

30th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.17	-0.22	-0.15	-0.31	0.08	-0.27	-0.04	0.19	-0.02
t-statistic	-1.03	-1.05	-0.63	-0.94	0.38	-1.14	-0.16	0.53	-0.08
p-value	0.31	0.30	0.53	0.36	0.70	0.28	0.87	0.60	0.93

31st simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.06	-0.02	0.13	0.17	-0.04	0.12	0.13	0.11	0.19
t-statistic	-0.40	-0.11	0.72	1.03	-0.17	0.64	0.57	0.59	1.17
p-value	0.68	0.90	0.47	0.32	0.86	0.53	0.58	0.57	0.28

32nd simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.19	-0.12	-0.02	-0.27	-0.48	-0.64	-0.79	-0.91	-0.48
t-statistic	-1.29	-0.74	-0.14	-1.46	-1.84	-2.07	-2.02	-1.85	-0.92
p-value	0.20	0.46	0.89	0.16	0.09	0.06	0.07	0.10	0.39

33rd simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.27	-0.28	-0.25	0.03	-0.19	-0.28	0.12	0.04	-0.007
t-statistic	-1.25	-1.19	-1.49	0.14	-0.76	-0.80	0.45	0.17	-0.02
p-value	0.21	0.24	0.15	0.89	0.45	0.44	0.66	0.86	0.98

34th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	0.02	-0.02	-0.13	0.06	0.07	-0.03	-0.31	0.13	-0.08
t-statistic	0.23	-0.22	-0.74	0.40	0.43	-0.13	-0.90	0.45	-0.19
p-value	0.81	0.82	0.46	0.69	0.67	0.89	0.39	0.66	0.85

35th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	0.006	-0.05	0.006	0.08	-0.08	0.07	0.14	-0.09	-0.02
t-statistic	0.04	-0.34	0.03	0.50	-0.38	0.43	0.59	-0.30	-0.08
p-value	0.96	0.73	0.96	0.62	0.70	0.67	0.57	0.76	0.93

36th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.10	-0.03	-0.18	-0.34	-0.19	-0.28	-0.08	-0.27	-0.14
t-statistic	-0.76	-0.31	-1.27	-1.96	-1.29	-1.81	-0.44	-1.42	-0.65
p-value	0.45	0.75	0.21	0.07	0.22	0.10	0.66	0.19	0.53

37th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.16	-0.27	-0.12	-0.27	-0.14	-0.23	-0.11	-0.12	-0.09
t-statistic	-1.19	-2.17	-0.82	-1.56	-0.86	-0.95	-0.42	-0.45	-0.28
p-value	0.24	0.039	0.42	0.14	0.40	0.36	0.68	0.66	0.78

38th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	0.21	0.11	0.08	-0.03	-0.13	0.01	0.09	0.12	-0.02
t-statistic	1.34	0.67	0.61	-0.20	-0.63	0.06	0.86	0.74	-0.11
p-value	0.18	0.50	0.54	0.83	0.53	0.94	0.41	0.48	0.91

39th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	0.06	0.29	0.21	0.15	0.24	0.27	0.33	0.56	0.48
t-statistic	0.50	2.40	1.18	0.88	1.38	1.07	1.09	1.74	2.41
p-value	0.61	0.024	0.25	0.39	0.19	0.30	0.30	0.12	0.052

40th simulated series with initial value 0

Subsample size (n_{ij})	5	6	8	10	12	14	16	18	20
Number of subsample pairs (i_j)	30	25	19	15	13	11	10	9	8
$\hat{\beta}_j$	-0.09	-0.03	-0.19	-0.26	-0.16	-0.12	0.05	0.10	0.19
t-statistic	-0.68	-0.24	-1.51	-1.66	-0.95	-0.52	0.20	0.49	0.99
p-value	0.49	0.80	0.14	0.12	0.36	0.61	0.84	0.63	0.35

Appendix 4.2

Test results for data transformation using TSW

LOG-LEVEL PRETEST :	
1st simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0004275 LOGS ARE SELECTED
2nd simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0004200 LOGS ARE SELECTED
3rd simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99937392 LOGS ARE SELECTED
4th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99821483 LOGS ARE SELECTED
5th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0029646 LOGS ARE SELECTED
6th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99932366 LOGS ARE SELECTED
7th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99998323 LOGS ARE SELECTED
8th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99976469 LOGS ARE SELECTED
9th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99899563 LOGS ARE SELECTED
10th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0009120 LOGS ARE SELECTED
11th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99940611 LOGS ARE SELECTED
12th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99783903 LOGS ARE SELECTED
13th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99956026 LOGS ARE SELECTED
14th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99996242 LOGS ARE SELECTED
15th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0009673 LOGS ARE SELECTED
16th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99844882 LOGS ARE SELECTED
17th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99780523 LOGS ARE SELECTED
18th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0011250 LOGS ARE SELECTED
19th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0010450 LOGS ARE SELECTED
20th simulated series with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0001285 LOGS ARE SELECTED

LOG-LEVEL PRETEST :	
21st simulated series with initial value 0	LEVELS are Selected
22nd simulated series with initial value 0	LEVELS are Selected
23rd simulated series with initial value 0	LEVELS are Selected
24th simulated series with initial value 0	LEVELS are Selected
25th simulated series with initial value 0	LEVELS are Selected
26th simulated series with initial value 0	LEVELS are Selected
27th simulated series with initial value 0	LEVELS are Selected
28th simulated series with initial value 0	LEVELS are Selected
29th simulated series with initial value 0	LEVELS are Selected
30th simulated series with initial value 0	LEVELS are Selected
31st simulated series with initial value 0	LEVELS are Selected
32nd simulated series with initial value 0	LEVELS are Selected
33rd simulated series with initial value 0	LEVELS are Selected
34th simulated series with initial value 0	LEVELS are Selected
35th simulated series with initial value 0	LEVELS are Selected
36th simulated series with initial value 0	LEVELS are Selected
37th simulated series with initial value 0	LEVELS are Selected
38th simulated series with initial value 0	LEVELS are Selected
39th simulated series with initial value 0	LEVELS are Selected
40th simulated series with initial value 0	LEVELS are Selected

Appendix 5

Test results for data transformation using TSW and log-transformed series

LOG-LEVEL PRETEST :	
1st simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0000550 LOGS ARE SELECTED
2nd simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0000529 LOGS ARE SELECTED
3rd simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99989907 LOGS ARE SELECTED
4th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99973569 LOGS ARE SELECTED
5th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0003951 LOGS ARE SELECTED
6th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99989544 LOGS ARE SELECTED
7th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99999495 LOGS ARE SELECTED
8th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99996343 LOGS ARE SELECTED
9th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99984226 LOGS ARE SELECTED
10th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0001277 LOGS ARE SELECTED
11th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99990892 LOGS ARE SELECTED
12th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99967945 LOGS ARE SELECTED
13th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99993525 LOGS ARE SELECTED
14th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99999001 LOGS ARE SELECTED
15th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0001311 LOGS ARE SELECTED
16th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99976445 LOGS ARE SELECTED
17th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 0.99966162 LOGS ARE SELECTED
18th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0001710 LOGS ARE SELECTED
19th simulated series in log-transformed data with initial value 1000	SSlevels/(SSlog*Gmean(levels)^2)= 1.0001444 LOGS ARE SELECTED
20th simulated series in log-transformed data with initial value 100	SSlevels/(SSlog*Gmean(levels)^2)= 1.0000163 LOGS ARE SELECTED

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