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# 1 INTRODUCTION

The following report briefly describes the results of the research activities concerning the year 2002.

## Presentation

The Institut de statistique has been created in 1992. It coordinates and organises all the statistical activities at the Université catholique de Louvain: research, teaching and consulting.

## Research

The research activities of the Institute cover a large number of fields. A major part of the activities are centered on mathematical statistics (semi- and non-parametric statistics, bayesian statistics, multivariate analysis, regression estimation, mixtures models, survival analysis, time series, ...) with important implications in various fields of application (econometrics, biostatistics, insurance, industrial statistics, transportation problems,...).

Since January 2002, the Institut de statistique has been the coordinator of a IAP network : “Statistical techniques and modeling for complex substantive questions with complex data”.

This network includes 6 institutions : Université catholique de Louvain (Belgium), Katholieke Universiteit Leuven (Belgium), Limburgs Universitair Centrum (Diepenbeek, Belgium), Université Libre de Bruxelles (Belgium), Aachen Technical University (Germany) and Université Joseph Fourier (Grenoble, France).

## Teaching

In the field of teaching, the activity of the Institute is as follow:

- basic education
- second cycle education
- third cycle education.

Concerning the first and second cycle studies, the Institut is responsible for the organisation of probability and statistics courses offered at the university. Moreover, the Institute organises second and third cycle studies: the “diplôme d’études complémentaires en statistiques” (DEC), the “diplôme d’études approfondies en statistique” (DEA) with several orientations and the “doctorat en statistique”. Since this academic year, the Ph. D. degree has been organised within the context of the Graduate School in Statistics.

This year an important reform of our programs has been achieved. The idea was to provide a set of choices to still better address the needs of the market. These new programs started in September 2002. More information is available on the webpage <http://www.stat.ucl.ac.be/diploma/>.

## **Consulting**

The Institute offers consulting services to researchers using statistics in their profession. This service includes discussions on statistical problems encountered by researchers working at other departments or laboratories of the Université catholique de Louvain. Consulting services are also offered to business cooperations searching for support in dealing with statistical questions. Furthermore, service courses (continued education) are provided for interested groups.

## **Other events of the year 2002**

In May 2002, the Institut de statistique celebrated its tenth anniversary. On this occasion, the Institute organised a ceremony to confer the title of doctor honoris causa to Professor Luc Devroye, Mc Gill University, Montreal, Canada, as well as an international workshop untitled “Statistical Modelling and Inference for Complex Data Structures”. This workshop was a big success and was attended by many Belgian and foreign statisticians, and was a part of the first workshop of the IAP-statistics research network.

During this academic year, the Institut de statistique has organised several conferences (described in point 7 in this report) :

- An IAP one-day meeting (workshop I, Part I) on February 22, Louvain-la-Neuve.
- A Bonus-Malus colloquium on March 13, Louvain-la-Neuve, in collaboration with the ACTU unit, UCL.
- A FNRS contact day on March 27, Louvain-la-Neuve, on the theme Actuarial Sciences (Insurance and Finance) in collaboration with the research team “Financial Mathematics and Stochastic”, RUG, Belgium.
- The “XXXIVèmes Journées de Statistique”, Brussels and Louvain-la-Neuve, May 13 - May 17. This conference was organised by the Société Française de Statistique (SFdS) at the Université libre de Bruxelles and at the Université catholique de Louvain. The organisation was in charge of the Institut de Statistique et de la Recherche Opérationnelle, ULB, and the Institut de statistique, UCL.
- An IAP one-day meeting (workshop I, Part II) on May 24, Louvain-la-Neuve.

- A workshop “Central & Eastern Europe Workshop on Efficiency & Productivity Analysis (CEE-WEPA)”, June 28 - June 29, in collaboration with the Academia de Studii Economice, Bucarest, Romania.

The Academic Council of the Université catholique de Louvain approved on March 25, 2002, the creation of an interdepartmental Institute of Actuarial Sciences. This institute will be managed jointly by IAG and STAT departments (see section 3 below).

### **Scientific Honor**

Finally, some members of the Institut de statistique received some honours during the year 2002 :

- I. Gijbels has been elected fellow of the ASA (American Statistical Association) for “outstanding contributions to the statistical profession” ;
- I. Gijbels and L. Simar have been elected members of the ISI (International Statistical Institute) ;
- A paper by L. Simar and P. Wilson published in 2000 was designed by the ISI Essential Science Indicators as the paper the more cited in the beginning of the year 2002 within the domain “Economics and Business”.
- L. Simar has been asked by the ISI to Chair the Program Committee of the Bernoulli Section of the 55th Session of the ISI in Sydney 2005.

For more information about the Institut de statistique, see the World Wide Web site <http://www.stat.ucl.ac.be>

## **2 PERSONNEL**

### **Academic Members**

Michel DENUIT  
Dominique DEPRINS  
Irène GIJBELS  
Bernadette GOVAERTS (Graduate Advisor)  
Philippe LAMBERT (Academic Secretary)  
Michel MOUCHART  
Christian RITTER  
Jean-Marie ROLIN  
Léopold SIMAR (Chairman)  
Ingrid VAN KEILEGOM  
Rainer von SACHS

### **Associate Academic Members**

Luc BAUWENS, Faculty of Economical, Social and Political Sciences  
Patrick BOGAERT, Faculty of Biological, Agronomic and Environmental Engineering  
Jean-Marie de KETELE, Faculty of Psychology  
Eric LE BOULENGE, Faculty of of Biological, Agronomic and Environmental Engineering  
Robert PEETERS, Faculty of Economical, Social and Political Sciences  
Annie ROBERT, Faculty of Medicine

### **Emeritus Professor**

José PARIS (em. 1998)

### **Researchers and Doctoral Students**

Carlos ALMEIDA  
Claire BEGUIN

Taoufik BOUEZMARNI  
Natacha BROUHNS  
Céline BUGLI  
Nicolas BUYSE  
Daniela CLIMOV  
Aurore DELAIGLE  
Véronique DELOUILLE  
Isabelle DE MACQ  
Anouar EL GHOUGH  
Nancy FRANCOIS  
Géry GEENENS  
Anne-Cécile GODERNIAUX  
Cédric HEUCHENNE  
Astrid JULLION  
Maria KEY PRATO  
Alexandre LAMBERT  
Céline LE BAILLY DE TILLEGHEM  
Eric LECOUTRE (until July 31, 2002)  
Abderrahim OULHAJ  
Oana PURCARU  
Giovanna SANTAMARIA  
Abdelouahid TAJAR  
Bianca TEODORESCU  
Sébastien VAN BELLEGEM  
Marie VANDRESSE

**Associate Researchers**

Daniela CLIMOV (since September 1, 2002)  
Philippe VANDEN EECKAUT (since August 1, 2002)  
François VANDENHENDE

## **Trainees**

Antoine DELWARDE (ARAB)

Marie HADERER (SECURA)

## **Computer Scientists**

Eric LECOUTRE (since August 1, 2002)

Jean-Luc MARRION (Responsible)

Philippe VANDEN EECKAUT (until July 31, 2002)

Jean-Marie ZELIS (Responsible of the University statistical server)

## **Administrative Responsibilities**

Dominique ANDRE (from April 8, 2002)

Claudia LEMOINE (till April 1, 2002)

Evelyne VANDEVOORDE (till May 30, 2002)

## **Administrative Staff**

Anne BALFROID

Anne-Marie BELLEMANS

Monique DESCAMPS

Sophie MALALI

## **Short Term Visitors**

Anestis ANTONIADIS<sup>1</sup>, Université Joseph Fourier, Grenoble, France

Isabelle BRAY, University of Plymouth, UK

Ricardo CAO-ABAD<sup>2</sup>, Universidade La Coruña, Spain

Luc DEVROYE<sup>2</sup>, McGill University, Montreal, Canada

Farida ENIKEEVA, Moscow State University, Russia

Jianqing FAN, University of North Carolina, Chapel Hill, USA

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<sup>1</sup>Financed by the IAP network, OSTC

<sup>2</sup>Financed by the Institut de mathématique pure et appliquée (MAPA), UCL

Piotr FRYZLEWICZ<sup>3</sup>, University of Bristol, UK  
Gérard GREGOIRE<sup>4</sup>, Université Joseph Fourier, Grenoble, France  
Jeffrey HART, Texas A&M University, College Station, USA  
Nils L. HJORT<sup>5</sup>, University of Oslo, Norway  
Zdenek HLAVKA, Humboldt Universität, Berlin, Germany  
Alois KNEIP, University of Mainz, Germany  
Stefan LANG, University of Munich, Germany  
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Mhamed MESFIOUL, Université de Québec, Trois-Rivières, Canada  
Guillen MONTSERRAT, University of Barcelona, Spain  
Hans-Georg MÜLLER<sup>5</sup>, University of California, Davis, USA  
Michael NEUMANN, Universität Köln, Germany  
Daniel NORDMAN, University of Dortmund, Germany  
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Byeong PARK, Seoul National University, South Korea  
Valentin PATILEA, University of Orleans, France  
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Marco SCARSINI, University of Annunzio, Pescara, Italy  
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Robin SICKLES, Rice University, Houston, USA  
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<sup>3</sup>Financed by his own funds

<sup>4</sup>Financed by the IAP network, OSTC

<sup>5</sup>Financed by the Institut de mathématique pure et appliquée (MAPA), UCL

<sup>6</sup>Financed by an OSTC project (promoter: M. Mouchart)

### **3 THE INSTITUTE OF ACTUARIAL SCIENCE**

The Institute of Actuarial Science has been officially created on March 22, 2002, by the UCL academic authorities. It is run by the Institut de statistique in collaboration with the UCL Business School (IAG).

The Institute organizes the actuarial studies. A programme of two years, at Master's level, allows to get a diploma recognised by the Belgian Society of Actuaries to become a fully qualified actuary, as well as by the Belgian Regulatory Authorities to be certified Appointed Actuary. The Institute also develops research programs in the field and offers services to the community.

The Institute has initiated several projects in collaboration with industry (insurance companies and banks), the American Society of Actuaries (joint with KULeuven), the Belgian Actuarial Society and the Belgian Ministry of Finance. Members of the Institute serve as Editors for several actuarial journals as well as for the Encyclopedia of Actuarial Science. They are members of scientific committees of major events in the field (International Congress on Insurance: Mathematics & Economics 2003 and International Congress of Actuaries 2006).

During the period 1999-2002, the researchers have published 7 books, 118 articles in national and international journals and produced 18 research reports submitted for publication. They also organized several colloquia in Belgium, France and Greece.

Those readers interested in a thorough description of the activities of the Institute of Actuarial Science are referred to the website <http://www.actu.ucl.ac.be> where a research report will be available.

## 4 PUBLICATIONS AND EDITING ACTIVITIES

The Institute publishes a Discussion Papers series and a Reprint series. The papers in both series are the output from the statistical research activities. Many collaborations (national and international) are going on with researchers from abroad. The following Discussion Papers and Reprints were issued during the period concerned by this report.

### 4.1 Discussion Papers

0201. BROUHNS, N. and M. DENUIT, Rentes viagères : des bases réglementaires dépassées.

Au moment où de nouvelles dispositions légales visent à favoriser la liquidation des capitaux sous forme de rentes, pour des raisons sociales évidentes, et où de nombreux assureurs affirment vouloir promouvoir ce type de produits, Natacha Brouhns et Michel Denuit font le point sur le risque de longévité. Leur conclusion est formelle: les assureurs qui utiliseraient les tables officielles MR et FR pour tarifier des rentes courent droit à la catastrophe.

0202. BROUHNS, N., DENUIT, M., MASUY, B. and R. VERRALL, Ratemaking by geographical area : a case study using the Boskov and Verrall model.

This paper uses a method proposed by Boskov & Verrall (1994) for premium rating by postcode area. The aim is to analyze geographical variation in claim frequencies in order to estimate the local risk in each geographical area and to build homogeneous rating regions. The method accounts for spatial correlation in an hierarchical Bayesian framework and uses computer-intensive MCMC methods for statistical inference.

0203. PURCARU, O. and M. DENUIT, On the dependence induced by frequency credibility models. II. Dynamic random effects.

In an effort to incorporate the date of claims in risk prediction, Pinquet, Guillén & Bolancé (2001) specified a stationary process for the random effects. This paper aims to investigate the type of dependence induced by such a dynamic heterogeneity. Contrarily to the static case studied in Purcaru & Denuit (2001), the correlation structure between latent variables now crucially affects the association between claim numbers. In particular, taking comonotonic random effects gives the static credibility model considered by these authors, whereas taking different copulas yields various dependence structures.

0204. CHEN, X., LINTON, O. and I. VAN KEILEGOM, Estimation of semiparametric models when the criterion function is not smooth.

We provide easy to verify sufficient conditions for the consistency and asymptotic normality of a class of semiparametric optimization estimators where the criterion function does not obey standard smoothness conditions and simultaneously depends on some preliminary nonparametric estimators. Our results extend existing theories like those of Pakes and Pollard (1989), Andrews (1994a), and Newey (1994). We apply our results to an example.

0205. OULHAJ, A. and M. MOUCHART, The role of the exogenous randomness in the identification of conditional models.

This paper draws the attention on several subtleties requiring a proper approach to both conditional models and their identification. We start with a definition of identification in conditional models called weak identification, derived from the usual concept of identification in standard statistical models. We show, in theorem 1, that weak identification coincides with that one usually met in the statistical literature. Theorem 4 shows, however, an undesirable property of weak identification, namely that under rather general conditions, the weak identification does not depend on the sample size. An example of a standard regression model is given to illustrate why such property is undesirable. As an alternative, three other levels of identification are given, stressing the role of the randomness of the conditioning variables. Similar distinctions are also shown to be relevant for properties of estimators, such as unbiasedness or consistency. The relation between these different levels of identification, unbiasedness and consistency are given in theorems 2, 3, 5 and 6.

0206. HALL, P. and I. VAN KEILEGOM, Using difference-based methods for inference in nonparametric regression with time-series errors.

We show that difference-based methods can be used to construct simple and explicit estimators of error covariance and autoregressive parameters in nonparametric regression with time-series errors. When error process Gaussian estimators are efficient, they are available beyond Gaussian case. As an illustration of their usefulness we show that difference-based estimators used produce a simplified version of time-series cross-validation (TSCV). This new approach produces a bandwidth selector that is equivalent, both in first and second orders, to the full TSCV algorithm. Other applications of difference-based methods include variance estimation and construction of confidence bands in nonparametric regression.

0207. BROUHNS, N., DENUIT, M. and J. VERMUNT, A Poisson log-bilinear regression approach to the construction of projected life tables.

This paper implements Wilmoth's (1993) and Alho's (2000) recommendation for improving the Lee-Carter approach to forecasting demographic components. Specifically, the original method is embedded in a Poisson regression

model, which is perfectly suited for age-sex-specific mortality rates. This model is fitted for each sex to a set of age-specific Belgian death rates. A time-varying index of mortality is forecasted in an ARIMA framework. These forecasts are used to generate projected age-specific mortality rates, life expectancies and life annuities net single premiums. Finally, a Brass-type relational model is proposed to adapt the projections to the annuitants population, allowing for estimating the cost of adverse selection in the Belgian whole life annuity market.

0208. FRYZLEWICZ, P., VAN BELLEGEM, S. and R. von SACHS, Forecasting non-stationary time series by wavelet process modelling.

Many time series in the applied sciences display a time-varying second order structure. In this article, we address the problem of how to forecast these non-stationary time series by means of non-decimated wavelets. We first consider a model in which only the variance evolves with time. We define a predictor for this model and show an application to the Dow Jones index. Then, we generalise the definition to the case of time-varying covariance using the class of Locally Stationary Wavelet processes. We introduce a new predictor based on wavelets and derive the prediction equations as a generalisation of the Yule-Walker equations. We propose an automatic computational procedure for choosing the parameters of the forecasting algorithm. Finally, we apply the general prediction algorithm to a meteorological time series.

0209. CEBRIAN, A., DENUIT, M. and O. SCAILLET, Testing for concordance ordering.

We propose inference tools to analyse the ordering of concordance of random vectors. The analysis in the bivariate case relies on tests for upper and lower quadrant dominance of the true distribution by a parametric or semi-parametric model, i.e. for a parametric or semi-parametric model to give a probability that two variables are simultaneously small or large at least as great as it would be were they left unspecified. Tests for its generalisation in higher dimensions, namely joint lower and upper orthant dominance, are also analysed. The parametric and semiparametric setting are based on the copula representation for multivariate distribution, which allows for disentangling behaviour of margins and dependence structure. We propose two types of testing procedures for each setting. The first procedure is based on a formulation of the dominance concepts in terms of values taken by random variables, while the second procedure is based on a formulation in terms of probability levels. For each formulation a distance test and an intersection-union test for inequality constraints are developed depending on the definition of null and alternative hypotheses. An empirical illustration is given for US insurance claim data.

0210. DHAENE, J., DENUIT, M., GOOVAERTS, M.J., KAAS, R. and D. VYNCKE, The concept of comonotonicity in actuarial science and finance : applications.

In an insurance context, one is often interested in the distribution function of a sum of random variables. Such a sum appears when considering the aggregate claims of an insurance portfolio over a certain reference period. It also appears when considering discounted payments related to a single policy or a portfolio at different future points in time. The assumption of mutual independence between the components of the sum is very convenient from a computational point of view, but sometimes not realistic. In Dhaene, Denuit, Goovaerts, Kaas, Vyncke (2001), we determined approximations for sums of random variables, when the distributions of the components are known, but the stochastic dependence structure between them is unknown or too cumbersome to work with. Practical applications of this theory will be considered in this paper. Both papers are to a large extent an overview of recent research results obtained by the authors, but also new theoretical and practical results are presented.

0211. CLAESKENS, G. and I. VAN KEILEGOM, Bootstrap confidence bands for regression curves and their derivatives.

Confidence bands for regression curves and their first  $p$  derivatives are obtained via local  $p$ -th order polynomial estimation. The method allows for multiparameter local likelihood estimation as well as other unbiased estimating equations. As an alternative to the confidence bands obtained by asymptotic distribution theory, we also study smoothed bootstrap confidence bands. Simulations illustrate the finite sample properties of the methodology.

0212. DENUIT, M. and Ph. LAMBERT, Constraints on concordance measures in bivariate discrete data.

This paper aims to investigate the constraints on dependence measures based on the concept of concordance when discrete random variables are involved. The main technical argument consists in continuing integer-valued random variables by convolution with unit support kernels.

0213. PITREBOIS, S., DE LONGUEVILLE, Ph., DENUIT, M. and J-F. WALHIN, Etude de techniques IBNR modernes.

L'estimation de réserve de sinistre se fait généralement par des techniques dites IBNR. Cet article a pour but principal d'examiner l'une d'entre elles, la méthode Chain Ladder, dans un cadre stochastique. Ce type d'analyse permet de dégager des formules pour estimer la variabilité des réserves calculées et, par suite, de construire des intervalles de confiance pour ces réserves. Nous verrons également comment adapter facilement les formules étudiées pour des cas particuliers d'utilisation pratique de la méthode de Chain Ladder.

0214. BROUHNS, N., DENUIT, M., GUILLEN, M. and J. PINQUET, Optimal Bonus-Malus scales in segmented tariffs.

This paper proposes a practical computer-intensive methodology to build bonus-malus scales in automobile insurance. The claim frequency model is taken from Pinquet, Guillén and Bolancé (2001). It accounts for overdispersion, heteroscedasticity and dependence among repeated observations. Explanatory variables are taken into account in the determination of the relativities, yielding an integrated automobile ratemaking scheme. In that respect, it complements the study of Taylor (1997) and solves an outstanding open problem in the actuarial literature.

0215. DELAIGLE, A. and I. GIJBELS, Comparison of data-driven bandwidth selection procedures in deconvolution kernel density estimation.

We consider kernel estimation of a density based on contaminated data and discuss the important issue of how to choose the bandwidth parameter in practice. We propose some plug-in type of bandwidth selectors, which are based on non-parametric estimation of an approximation of the mean integrated squared error. The selectors are a refinement of the simple normal reference bandwidth selector, which is obtained by parametrically estimating the approximated mean integrated squared error by referring to a normal density. In a simulation study we compare these plug-in bandwidth selectors, with a bootstrap and a cross-validated bandwidth selector. We conclude that in finite samples, an appropriately chose plug-in bandwidth selector and the bootstrap bandwidth selector perform comparably and both outperform the cross-validated bandwidth. We also illustrate the use of the various practical bandwidth selectors on a real data example.

0216. BEGUIN, C. and L. SIMAR, Analysis of the expenses linked to hospital stays : how to detect outliers?

Since the hospital financing is more and more based on a budget in function of the pathologies, it appears necessary to detect hospital stays presenting discrepancy between the resources they used and the medical characteristics they present. We propose the use of deterministic nonparametric frontier models to rank hospital stays in function of their expenses taking into account the severity level of the patient. In this case, the hospital stays with the lowest total expenses for a given level of severity are considered as efficient. But, deterministic models are very sensitive to the extreme stays so that some efficient stays could be in fact "too" efficient and considered as outliers. We try to highlight these stays using the method of Simar (2001) which is based on the concept of order-m frontier. The idea is to define a "benchmark" frontier that doesn't envelope all the data. Indeed, for a given level of severity, a reasonable minimal value could be considered as "outlier" and require further analysis. We compare our results with the obtained in Beguin (2001) which relies on a method proposed by Wilson (1995). As a

conclusion, we recommend the use of both methods to detect the outlier and so to obtain a better ranking of the other hospital stays.

0217. PURCARU, O. and M. DENUIT, On the stochastic increasingness of future claims in the Bühlmann linear credibility premium.

Since Nelder & Verrall (1997), the connection between Generalized Linear Models (GLM's) and credibility theory has been recognized in actuarial science. Specifically, the credibility construction amounts to add a random effect on the same scale as the fixed effects to model unexplained heterogeneity. The present paper aims to examine the dependence existing between future claims (severity or frequency components) and the Bühlmann linear credibility premium. As expected, future claims are shown to increase with the amount of Bühlmann premium.

0218. BROUHNS, N., DENUIT, M. and J.K. VERMUNT, Measuring the longevity risk in mortality projections.

Projected lifetables are used to price life annuities because they include a forecast of the future trends in mortality. However, such tables may not properly represent future mortality, originating the so-called longevity risk. The present work purposes to quantify the uncertainty inherent to mortality projections in the framework of the log-bilinear Poisson regression model of Brouhns, Denuit & Vermunt (2002).

0219. DELWARDE, A. and M. DENUIT, Importance de la période d'observation et des âges considérés dans la projection de la mortalité selon la méthode de Lee-Carter.

Cet article a pour but d'examiner comment les projections de mortalité obtenues à l'aide de la méthode de Lee-Carter sont influencées par la période d'observation et par les âges considérés.

0220. BROUHNS, N. and M. DENUIT, Actuarial modelling of longitudinal claims data through GAMM's : some methodological results.

This paper discusses the type of dependence induced by the Generalized Additive Mixed Model (GAMM) approach to regression analysis with correlated data. In this framework, random effects are added on the same scale as the fixed effects. Dependence between outcomes is thus generated by their sharing of common/correlated latent variables. In many cases, this results in strong positive association.

0221. MESFIOUI, M. and A. TAJAR, On the properties of some nonparametric concordance measures in the discrete case.

It is shown here that Kendall's  $\tau$  and Spearman's  $\rho$  are monotone with respect to the concordance ordering of pairs of discrete as well as continuous

random variables. This extends and completes results of Tchen (1980) and Yanagimoto and Okamoto (1969). It is also shown that various relationships between Kendall's  $\tau$  and Spearman's  $\rho$  mentioned in Nelsen (1999) remain valid for discrete variables. In particular, a result of CaperaEa and Genest (1993) is extended to the case of discrete random pairs. Finally, an analytic expression is given for the most extreme values of Kendall's  $\tau$  and Spearman's  $\rho$  associated with discrete uniform variates.

0222. FLORENS, J-P. and L. SIMAR, Parametric approximations of nonparametric frontiers.

A large amount of literature has been developed on how to estimate frontier functions. The idea is to analyze how firms combine their inputs to produce in an efficient way, the output. The maximal achievable level of output for a given level of inputs defines the production frontier. The efficiency of a particular firm is then characterized by the distance between its level of output and this optimal level it should obtain if it were efficient. From a nonparametric perspective, envelopment estimators have been mostly used, like the Free Disposal Hull (FDH) or the Data Envelopment Analysis (DEA). The statistical theory of these estimators is now available. Nonparametric estimators are very appealing because they rely on very few assumptions, on the other hand, a parametric form for the production function allows for a richer economic interpretation of the production process under analysis. Here, in a deterministic frontiers framework, most of the approaches rely on "ad hoc" procedures based on standard regression methods (shifted OLS, corrected OLS, and MLE) and are based on strong distributional assumptions on the production process. Also they characterizes rather properties of the center of the cloud of points rather than its boundary. In this paper, we investigated a new approach, which tries to capture the shape of the cloud points near its boundary. It combines the nonparametric and the parametric approaches, by offering parametric approximations of nonparametric frontiers. For the nonparametric part, we use the FDH estimator or expected frontier of order- $m$ , introduced by Cazals, Florens and Simar (2002). We provide the statistical theory for the obtained estimators (consistency and asymptotic distribution). We illustrate with some simulated examples, showing the advantages of our method compared with the regression-type estimators.

0223. LAMBERT, Ph., COLLETT, D., KIMBER, A. and R. JOHNSON, Evaluation of kidney graft survival using accelerated failure time models with random effects.

Accelerated failure time models with a shared random component are used to evaluate the effect of explanatory factors and different transplant centres on the survival times of a kidney graft following transplantation. Different combinations of the distribution of the random effects and baseline hazard function are considered and the fit of such models to the transplant data is critically assessed. Lack of

fit of these models leads to the development of a mixture model that combines short-term and long-term components of a hazard function. The model can incorporate different explanatory variables and random effects in each component. The extent of correlation between the random effects in each component can also be investigated. The model is straightforward to fit using standard software, and is shown to be a good fit to the transplant data.

0224. TILQUIN, P., VAN KEILEGOM, I., COPPIETERS, W., LE BOULANGER, E. and P.V. BARET, Non-parametric interval mapping in half-sib designs : use of midranks to account for ties.

In QTL analysis of non-normally distributed phenotypes, non-parametric approaches have been proposed as an alternative to the use of parametric tests on mathematically transformed data. The non-parametric interval mapping test uses random ranking to deal with ties. Another approach is to assign to each tied individual the average of the tied ranks (midranks). This approach is implemented and compared to the random ranking approach in terms of statistical power and accuracy of the QTL position. Non-normal phenotypes such as bacteria counts showing high numbers of zeros are simulated (from 0% to 80% of zeros). We show that for low proportions of zeros, the power estimates are similar, but for high proportions of zeros, it is worth using midranks instead of the random ranking approach : e.g. with a QTL accounting for 8% of the total phenotypic variance, a gain from 8 to 11% of power can be obtained. Furthermore, the accuracy of the estimated QTL location is increased when using midranks. Therefore, if non-parametric interval mapping is chosen, the midrank approach should be preferred. This test might be especially relevant for the analysis of disease resistance phenotypes such as those observed when mapping QTL for resistance to infectious diseases. Indeed, the resistance of animals to bacterial and parasitic diseases is often based on counts that can show high number of ties.

0225. DELOUILLE, V. and R. von SACH, Properties of design-adapted wavelets transforms of nonlinear autoregression models.

We estimate nonlinear autoregressive models using a design-adapted wavelet estimator. We show two properties of the wavelet transform adapted to an autoregressive design. First, in an asymptotic setup, we derive the order of the threshold that removes all the noise with a probability tending to one asymptotically. Second, with this threshold, we estimate the detail coefficients by soft-thresholding the empirical detail coefficients. We show an upper bound on the  $l_2$ -risk of these soft-thresholded detail coefficients. Finally, we illustrate the behavior of this design-adapted wavelet estimator on simulated and real data sets.

0226. DELOUILLE, V. and R. von SACHS, Smooth design-adapted wavelets for half-regular designs in two dimensions.

In this paper, we treat nonparametric estimation of a regression function defined on a half-regular grid. By ‘half-regular’ grid, we mean a grid which is the Cartesian product of two irregular one dimensional grids. We use a wavelet-type estimator, based on a wavelet transform which is the tensor product of two one-dimensional design-adapted wavelet transforms. A denoising scheme is proposed, yielding a nonlinear wavelet estimator. We compare its performance with the one of a locally weighted regression procedure through a simulation study.

0227. VAN BELLEGEM, S. and R. von SACHS, Forecasting economic time series using models of nonstationarity.

The classical forecasting theory of stationary time series exploits the second-order structure (variance, autocovariance and spectral density) of an observed process in order to construct some prediction intervals. However, some economic time series show a time-varying unconditional second-order structure. This article focus on a simple and meaningful model allowing this nonstationary behaviour. We show that this model satisfactory explains the nonstationary behaviour of several economic data sets, among which are the U.S. stock returns and exchange rates. The question how to forecast these processes is addressed and evaluated on the data sets.

0228. HALL, P. and I. VAN KEILEGOM, Testing for monotone increasing hazard rate.

A test of the null hypothesis that a hazard is monotone nondecreasing, versus alternative that not, is proposed. Both the test statistic the means of calibrating it are new. Unlike previous approaches, neither is based the assumption that the null distribution is exponential. Instead, empirical information is used effectively identify, eliminate from further consideration, parts of the line where hazard rate is clearly increasing; and to confine subsequent attention only to those parts that remain. This produces a test with greater apparent power, without the excessive conservatism of exponential-based tests. Our approach to calibration borrows from ideas used in certain tests unimodality of a density, that a bandwidth is increased until a distribution with the desired properties is obtained. However, the test statistic does not involve any smoothing, and is in fact based directly assessment of convexity of the distribution function, using the conventional empirical distribution. The test is shown to have optimal power properties in difficult cases, where it is called upon to detect small departure, in the form of a bump, from monotonicity. More general theoretical properties of the test, and its numerical performance, are explored.

0229. VANDENHENDE, F., LAMBERT, Ph. and N. RAMADAN, Statistical models for the analysis of controlled trials on acute migraine.

Specific efficacy criteria were defined by the International Headache Society for controlled clinical trials on acute migraine. They are derived from the pain profile and the timing of rescue medication intake. We present a methodology to improve the analysis of those trials. Instead of analysing each endpoint separately, we model the joint distribution and derive success rates in any criteria as predictions. We use cumulative regression models for each response at a time and a multivariate normal copula to model the dependence between responses. Parameters are estimated using maximum likelihood. Benefits of the method include a reduction in the number of tests performed and an increase in their power. The method is well suited to dose-response trials from which predictions can be used to select doses and optimise the design of subsequent trials. More generally, our method permits a very flexible modelling of longitudinal series of ordinal data.

0230. WANG, L., AKRITAS, M.G. and I. VAN KEILEGOM, Nonparametric goodness-of-fit test for heteroscedastic regression models.

For the heteroscedastic nonparametric regression model  $Y_{ni} = m(x_{ni}) + \sigma(x_{ni})\epsilon_{ni}$   $i = 1 \dots n$ , we propose a new test procedure for testing that the regression function  $m$  is constant. The test statistic is modeled after the usual lack-of-fit statistic for constant regression in the case of replicated observations, and thus is very easy to compute. The asymptotic theory uses recent developments in the asymptotic theory for analysis of variance when the number of factor levels is large. Comparisons with competing procedures and analysis of a data set are included.

## 4.2 Consulting Reports

LECOUTRE E., GOVAERTS, B. and P. VANDEN EECKAUT (2002), *Assessment of the concentration level of chemical substances in river networks. Part IV : Calculation of confidence intervals for regional parameters of interest*, a consulting work for Eurochlor, Consulting Report 0201, Institut de statistique, UCL.

MOUCHART M. and L. SIMAR (2002), *Efficiency analysis of air navigation services provision : first insights*, a consulting work for Eurocontrol, Consulting Report 0202, Institut de statistique, UCL.

BROUHNS, N., DELWARDE, A. and M. DENUIT (2002). *Méthodes d'élaboration de tables de mortalité prospectives ou comment tarifer des rentes viagères lorsque la mortalité évolue*, a consulting work for the "Association Royale des Actuaires Belges", Consulting Report 0203, Institut de statistique, UCL.

### 4.3 Published Papers

149. KAIDI, S., DONNAY, I., LAMBERT, Ph., DESSY, F. and A. MASSIP. Osmotic behavior of in Vitro produced bovine blastocysts in cryoprotectant solutions as a potential predictive test of survival. *Cryobiology*. 41, 106-115, 2000.
150. KAIDI, S., BERNARD, S., LAMBERT, Ph., MASSIP, A., DESSY, F. and I. DONNAY. Effect of conventional controlled-rate freezing and vitrification on morphology and metabolism of bovine blastocysts produced in vitro. *Biology of Reproduction*. 65, 1127-1134, 2001.
151. LU, Z. Asymptotic normality of kernel density estimators under dependence. *Annals of the Institute of Statistical Mathematics*. 53, 3, 447-468, 2001.
152. OMBAO, H., RAZ, J., STRAWDERMAN R. and R. von SACHS. A simple generalised crossvalidation method of span selection for periodogram smoothing. *Biometrika*. 88, 4, 1186-1192, 2001.
153. BOUCKAERT, A. and M. MOUCHART. SORE modeling for clinical trials: a bayesian perspective. *Journal of the Chilean Statistical Society*. 16 and 17, 7-28, 1999-2000.
154. DENUIT, M. S-convex extrema, Taylor-type expansions and stochastic approximations. *Scandinavian Actuarial Journal*. 1, 45-67, 2002.
155. VAN KEILEGOM, I. and N. VERAVERBEKE. Hazard rate estimation in nonparametric regression with censored data. *Annals of the Institute of Statistical Mathematics*. 4, 730-745, 2001.
156. OMBAO, H., RAZ, J., von SACHS, R. and W. GUO. The SLEX model of a non-stationary random process. *Annals of the Institute of Statistical Mathematics*. 54, 1, 171-200, 2002.
157. CLIMOV, D., HART, J. and L. SIMAR. Automatic smoothing and estimation in single index poisson regression. *Nonparametric Statistics*. 14, 3, 307-323, 2002.
158. DENUIT, M., LEFEVRE, C. and S. UTEV. Measuring the impact of dependence between claims occurrences. *Insurance : Mathematics and Economics*. 30, 1-19, 2002.
159. ZHANG, J. Some extensions of Tukey's depth function. *Journal of Multivariate Analysis*. 82, 134-165, 2002.
160. SIMAR, L. and P.W. WILSON. Non-parametric tests of returns to scale. *European Journal of Operational Research*. 139, 115-132, 2002.

161. HALL, P. and L. SIMAR. Estimating a changepoint, boundary, or frontier in the presence of observation error. *Journal of the American Statistical Association.* 97, 458, 523-534, 2002.
162. CLIMOV, D., DELECROIX, M. and L. SIMAR. Semiparametric estimation in single index poisson regression : a practical approach. *Journal of Applied Statistics.* 29, 7, 1047-1070, 2002.
163. LAMBERT, Ph. A mixture model to assess the effect of hormonal stimulation on the development of follicles in prepubertal heifers. *Journal of the Royal Statistical Society, Series C.* 51, 4, 405-420, 2002.
164. ANTONIADIS, A. and I. GIJBELS. Detecting abrupt changes by wavelet methods. *Nonparametric Statistics.* 14, 1-2, 7-29, 2002.
165. LAMBERT, Ph. and F. VANDENHENDE. A copula-based model for multivariate non-normal longitudinal data : analysis of a dose titration safety study on a new antidepressant. *Statistics in medicine.* 21, 3197-3217, 2002.
166. DENUIT, M. and Ph. LAMBERT. Smoothed nonparametric maximum likelihood estimation of the risk distribution underlying bonus-malus systems. *Proceedings of the Casualty Actuarial Society.* vol. LXXXVIII, Part 2, 169, 2001.
167. DELAIGLE, A. and I. GIJBELS. Estimation of integrated squared density derivatives from a contaminated sample. *Journal of the Royal Statistical Society, Series B.* 64, 4, 869-886, 2002.
168. VAN KEILEGOM, I. and T.P. HETTMANSPERGER. Inference on multivariate M estimators based on bivariate censored data. *Journal of the American Statistical Association.* 97, 457, 328-336, 2002.
169. LI, G. and I. VAN KEILEGOM. Likelihood ratio confidence bands in nonparametric regression with censored data. *Scandinavian Journal of Statistics.* 29, 547-562, 2002.
170. VAN KEILEGOM, I. and N. VERAVERBEKE. Density and hazard estimation in censored regression models. *Bernoulli.* 8, 5, 607-625, 2002.
171. VANDENHENDE, F. and P. LAMBERT. On the joint analysis of longitudinal responses and early discontinuation in randomized trials. *Journal of Biopharmaceutical Statistics.* 12, 4, 425-440, 2002.
172. DENUIT, M. and A. MÜLLER. Smooth generator of integral stochastic orders. *The Annals of Applied Probability.* 12, 4, 1174-1184, 2002.
173. KAAS, R., DHAENE, J., VYNCKE, D., GOOVAERTS, M.J. and M. DENUIT. A simple geometric proof that comonotonic risks have the convex-largest sum. *Astin Bulletin.* 32, 1, 71-80, 2002.

174. PURCARU, O. and M. DENUIT. On the stochastic increasingness of future claims in the Bühlmann linear credibility premium. *Deutsche Gesellschaft für Versicherungsmathematik.* 25, 4, 781-793, 2002.
175. COSSETTE, H., DENUIT, M. and E. MARCEAU. Distributional bounds for functions of dependent risks. *Mitteilungen der Schweiz. Aktuarvereinigung.* 1, 45-65, 2002.
176. BROUHNS, N. and M. DENUIT. Risque de longévité et rentes viagères. I. Evolution de la mortalité en Belgique de 1880 à nos jours. *Belgian Actuarial Bulletin.* 2, 1, 26-48, 2002.
177. BROUHNS, N. and M. DENUIT. Risque de longévité et rentes viagères. II. Tables de mortalité prospectives pour la population belge. *Belgian Actuarial Bulletin.* 2, 1, 49-63, 2002.
178. BROUHNS, N. and M. DENUIT. Risque de longévité et rentes viagères. II. Elaboration de tables de mortalité prospectives pour la population assurée belge, et évaluation du coût de l'antisélection. *Belgian Actuarial Bulletin.* 2, 1, 64-72, 2002.
179. PURCARU, O. and M. DENUIT. On the dependence induced by frequency credibility models. *Belgian Actuarial Bulletin.* 2, 1, 73-79, 2002.
180. BROUHNS, N., DENUIT, M. and J. K. VERMUNT. A Poisson log-bilinear regression approach to the construction of projected lifetables. *Insurance: Mathematics and Economics.* 31, 373-393, 2002.
181. DHAENE, J., DENUIT, M., GOOVAERTS, M.J., KAAS, R. and D. VYNCKE. The concept of comonotonicity in actuarial science and finance: theory. *Insurance: Mathematical and Economics.* 31, 3-33, 2002.
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183. BROUHNS, N., DENUIT, M., and J.K. VERMUNT. Measuring the longevity risk in mortality projections. *Mitteilungen der Schweiz. Aktuarvereinigung.* 2, 105-130, 2002.
185. MOUCHART, M. and J-M. ROLIN. Competing risks models : problems of modelling and of identification. *The Life Table, Modelling Survival and Death.* 245-267, 2002.
187. ALLEBE, C., GOVAERTS, B., DE WOLF, S. and J. SZLUFCHIK. Statistical process control: a straightforward way to monitor processes and keep them under control. *Control Charts and Efficient Sampling Methodologies in the Field of Photovoltaics. Proceedings of the IEEE 29th Photovoltaic Specialists Conference,* 2002.

#### 4.4 Books published by members of the Institute

FLORENS, J.P., MOUCHART, M. and J.M. ROLIN. *Elements of Bayesian Statistics*, 544 pp, New York: Marcel Dekker, 1990.

HÄRDLE, W. and L. SIMAR (editors). *Computer Intensive Methods in Statistics*, 175 pp, (*Statistics and Computing, I*), Berlin: Physica-Verlag, 1993.

HÄRDLE, W., KLINKE, S. and B.A. TURLACH. *XploRe: An Interactive Statistical Computing Environment*, 387 pp, *Statistics and Computing*, Springer-Verlag: New York, 1995.

FAN, J. and I. GIJBELS. *Local Polynomial Modelling and its Applications*, 341 pp, Chapman and Hall: London, 1996.

KAAS, R., GOOVAERTS, M.J., DHAENE, J., and M. DENUIT. *Modern Actuarial Risk Theory*, Kluwer Academic Publishers: Dordrecht, 2001.

WUNSCH, G., MOUCHART, M. and J. DUCHNE (editors). *The Life Table : Modelling Survival and Death*, book series : *European Studies of Population*, vol. 11, Kluwer Academic Publishers : Dordrecht, 2002.

#### 4.5 Tutorial papers

*Méthodes Bayésiennes en Statistique*, edited by J.-J. DROESBEKE, J. FINNE and G. SAPORTA, Paris : Editions Technip, 2002.

M. MOUCHART, chap. 3 : L'inférence bayésienne : principes généraux, pp 61-102.

M. MOUCHART, chap. 8 : Tests d'hypothèses et choix de modèles, pp 209-242.

#### 4.6 Editing activities

Michel DENUIT

Proceedings Editor for *Insurance: Mathematics and Economics*  
Editor of *Belgian Actuarial Bulletin*

Irène GIJBELS

(Associate) Editor of *Journal of Multivariate Analysis*.  
Associate Editor of *Journal of Computational and Graphical Statistics*.  
Associate Editor of *Statistica Sinica*.

Léopold SIMAR

Associate Editor of *Journal of Productivity Analysis*

Ingrid VAN KEILEGOM

Associate Editor of *Journal of the Royal Statistical Society - Series B*

## 5 SEMINARS, WORKSHOPS AND SHORT COURSES

A statistics seminar is organised each week. A diversity of subjects is presented at this seminar. Speakers are mainly coming from outside the University and visitors of the Institute are among the contributors.

From time to time, a joint statistics and econometrics seminar, organised in collaboration with CORE, takes place. At those occasions statisticians and econometricians meet and have extra opportunities to discuss on common research interests and elaborate joint research.

Further, an applied statistics workshop is organised by the Institute on a regular basis. At this applied statistics workshop, emphasis is on talks in which an applied statistical problem is presented.

There is also the doctoral seminar which is an extra stimulant for Ph.D students and other young researchers.

### 5.1 Statistics Seminars

1. February 1, 2002, Ricardo CAO-ABAD, Universidade La Coruña, Spain.  
Goodness-of-fit tests based on the kernel density estimate
2. February 15, 2002, Michael NEUMANN, Universität Köln, Germany.  
Tests for time series models
3. March 1, 2002, Ingrid VAN KEILEGOM, UCL, Belgium.  
Bootstrap confidence bands for regression curves and their derivatives
4. March 8, 2002, Louis FERRE, UTM, France.  
Régression inverse pour variables fonctionnelles
5. March 8, 2002, Alois KNEIP, University of Mainz, Germany.  
The registration problem in functional data analysis
6. March 15, 2002, Zdenek HLAVKA, Humboldt-Universität, Berlin, Germany.  
A robust three-stage procedure based on bootstrap for M-estimators
7. April 19, 2002, Marc HALLIN, ULB, Belgium.  
Semiparametric efficiency, distribution-freeness and invariance
8. April 26, 2002, Isabelle BRAY, University of Plymouth, UK.  
Projecting cancer rates: a bayesian approach
9. May 3, 2002, Richard G. BARANIUK, Rice University, Houston, USA.  
Besov, Bayes and Plato in multiscale image modeling
10. May 10, 2002, Shunpu ZHANG, University of Alaska, Fairbanks.  
Boundary kernel method in nonparametric deconvolution

11. September 20, 2002, Qiwei YAO, London School of Economics, UK.  
Modeling spatial data: ARMA and additive approaches
12. October 4, 2002, Richard G. BARANIUK, Rice University, Houston, USA.  
Multiscale edge grammars for image modeling and processing
13. October 11, 2002, Ricardo CAO-ABAD, Universidade La Coruña, Spain.  
Goodness-of-fit tests for conditional models under censoring and truncation
14. October 25, 2002, Stefan LANG, University of München, Germany.  
Analysing car insurance data using geoadditive models
15. November 8, 2002, Daniel NORDMAN, University of Dortmund, Germany.  
Empirical likelihood confidence intervals under long-range dependence
16. November 15, 2002, Stefan VAN AELST, Ghent University, Belgium.  
Robust methods for multivariate regression
17. November 22, 2002, Paul W. WILSON, University of Texas, Austin, USA.  
Estimation and inference in two-stage, semiparametric models of production processes
18. November 29, 2002, Sara VAN DE GEER, University of Leiden, The Netherlands.  
On more or less simple classifiers
19. December 13, 2002, Benedikt POETSCHER, University of Vienna, Austria.  
Performance limits for estimators of the risk or distribution of shrinkage-type estimators, and some general lower risk-bound results
20. December 13, 2002, Mhamed MESFIOUI, Université de Québec, Trois-Rivières, Canada.  
Compound Poisson approximations for individual models with dependent risk
21. December 20, 2002, Wim SWELDENS, Lucent Technologies, USA.  
Digital geometry processing

## 5.2 Joint Statistics and Econometrics Seminars

1. February 8, 2002, Peter BROCKWELL, Colorado State University, USA and TU München, Germany.  
Levy-driven CARMA processes with financial applications

## 5.3 Applied Statistics Workshops

1. February 1, 2002, Koen KNAPEN, SAS-Tervuren, Belgium.  
Data-Mining: la méthodologie au service de la pratique

2. March 1, 2002, Tomasz BURZYKOWSKI, Limburgs Universitair Centrum, Diepenbeek, Belgium.  
Validation of surrogate endpoints from multiple randomized clinical trials
3. March 22, 2002, Pascal SCHLICH, Centre Européen des Sciences du Goût, France.  
De l'analyse sensorielle vers la sensométrie. Acquis et perspectives
4. March 22, 2002, Inge DIRINCK, Catholic Technical University St.-Lieven, Gent, Belgium.  
Chemometrics applied on flavour characterisation of coffees from different origins
5. April 19, 2002, François BECKERS, SmithKline Beecham Biologicals, Rixensart, Belgium.  
Bio-équivalence et de non-infériorité dans le domaine des vaccins
6. September 20, 2002, Stephen ROBERTS, University of Oxford, UK.  
Independent component analysis: a bayesian perspective
7. October 11, 2002, Léopold SIMAR, UCL, Belgium.  
Factor analysis and DEA frontier estimation: how to reduce dimensions in productivity analysis ?
8. October 25, 2002, Marco SAERENS, UCL, Belgium.  
Un exercice concret de classification: labellisation d'images satellite
9. November 15, 2002, Jacqueline SMITS, University of Leiden, The Netherlands.  
Modeling strategies and their clinical relevance in the analysis of organ transplant data
10. November 29, 2002, Liesbeth BRUCKERS, Limburgs Universitair Centrum, Diepenbeek, Belgium.  
Persistent disturbing behaviour

#### **5.4 Applied Statistics Workshop and Doctoral Seminar**

1. May 3, 2002, Eric LECOUTRE, UCL, Belgium.  
Equations structurelles avec l'environnement SAS: la procédure CALIS

#### **5.5 Doctoral Seminars**

1. February 8, 2002, Abdelouahid TAJAR, Institut de statistique, UCL, Belgium.  
On the study of some nonparametric measures of dependence for ordinal data

2. February 15, 2002, Aurore DELAIGLE, Institut de statistique, UCL, Belgium.  
Estimation of the support of an unknown density from a sample measured with error
3. March 15, 2002, Véronique DELOUILLE, Institut de statistique, UCL, Belgium.  
Second generation wavelet transform for irregularly spaced data in two dimensions
4. March 29, 2002, Taoufik BOUEZMARNI, Institut de statistique, UCL, Belgium.  
Consistency of asymmetric kernel density estimators and smoothed histograms
5. April 26, 2002, Abderrahim OULHAJ, Institut de statistique, UCL, Belgium.  
The role of the exogenous randomness in the identification of conditional models
6. May 10, 2002, Cédric HEUCHENNE, Institut de statistique, UCL, Belgium.  
Linear regression with censored data based on preliminary nonparametric estimation
7. October 4, 2002, Alexandre LAMBERT, Institut de statistique, UCL, Belgium.  
Automatic jump detection in regression surfaces
8. November 8, 2002, Jean-Yves PIRCON, Facultés Universitaires Notre-Dame de la Paix, Namur, Belgium.  
Les arbres de clustering
9. November 22, 2002, Céline LE BAILLY de TILLEGHEM, Institut de statistique, UCL, Belgium.  
A fast exchange algorithm for designing focused libraries in lead optimization
10. December 6, 2002, Carlos ALMEIDA, Institut de statistique, UCL, Belgium.  
A view on the normality hypothesis in the model defining polychoric correlations
11. December 6, 2002, Oana PURCARU, Institut de statistique, UCL, Belgium.  
Semi-parametric archimedean copula modeling for pricing reinsurance treaties

## 5.6 Short Courses

In October 2002, a short course was given by an invited professor of the Institut de mathématique pure et appliquée (MAPA) within the context of the Graduate School in Statistics :

- Ricardo CAO-ABAD, Universidade La Coruña, Spain.  
“Goodness-of-fit tests and survival analysis”.

## 6 DOCTORATES

### 6.1 Doctor honoris causa

Peter HALL, Australian National University, Canberra (1997)

Luc DEVROYE, McGill University, Montréal, Canada (2002)

On 21st May 2002, the Institut de statistique organised an official ceremony for awarding the title of Doctor honoris causa to Professor Luc Devroye, McGill University, Montreal, Canada.

On that occasion, Professor Luc Devroye presented a lecture on “Combinatorial methods in density estimation”.

Professor Luc Devroye is an outstanding scientist, who enjoys a high international reputation for his high-quality research. He is particularly known for his fundamental contributions to a variety of statistical fields, such as the L1-convergence of non-parametric estimators, the evaluation of the error in non-parametric discriminant analysis and the use of combinatorial analysis in statistics.

### 6.2 Doctoral dissertations

Daniela CLIMOV (May 28, 2002)

“Statistical analysis of single index Poisson regression models”  
Promoter: Léopold SIMAR

Claire BEGUIN (July 12, 2002)

“Analysing expenses linked to hospital stays: a frontier approach”  
Promoter: Léopold SIMAR

Véronique DELOUILLE (December 20, 2002)

“Nonparametric stochastic regression using design-adapted wavelets”  
Promoter: Rainer von SACHS

### 6.3 Ph.D thesis in progress

Carlos ALMEIDA

“Structural equation modeling with categorical ordered variables”  
Promoter: Michel MOUCHART

Taoufik BOUEZMARNI

“Bernstein polynomials estimate for unbounded density”  
Promoter: Jean-Marie ROLIN

Natacha BROUHNS

“An integrated ratemaking tool for life and non life insurance”  
Promoter: Michel DENUIT

Aurore DELAIGLE

“Kernel estimation in deconvolution problems”  
Promoter: Irène GIJBELS

Isabelle DE MACQ

“Classification trees and methods based on projections”  
Promoter: Léopold SIMAR

Nancy FRANCOIS

“Statistical analysis of time intensity curves in sensory analysis”  
Co-Promoters: Bernadette GOVAERTS and Philippe LAMBERT

Cédric HEUCHENNE

“Nonparametric regression with censored data : several applications”  
Promoter: Ingrid VAN KEILEGOM

Maria KEY PRATO

“Detection and quantification of treatment effect on blood pressure  
profile curves”  
Promoter: Philippe LAMBERT

Alexandre LAMBERT

“Nonparametric estimation of discontinuous functions and surfaces”  
Promoter: Irène GIJBELS

Céline LE BAILLY DE TILLEGHEM

“Multiobjective optimization by computer simulations”  
Co-Promoters: Bernadette GOVAERTS and Léopold SIMAR

Abderrahim OULHAJ

“Conditional discrete choice models”  
Promoter: Michel MOUCHART

Oana PURCARU

“Modeling dependence in actuarial science”  
Promoter: Michel DENUIT

Abdelouahid TAJAR

“Measuring and modeling dependence”  
Co-Promoters: Michel DENUIT and Jean-Marie ROLIN

Sébastien VAN BELLEGEM

“Sparse representation of nonstationary time series by wavelets, development of methods to test the significance of the coefficients of this representation and to estimate these second-order parameters”  
Promoter: Rainer von SACHS

François VANDENHENDE

“Modeling longitudinal ordinal data using copulas”  
Promoter: Philippe LAMBERT

## 7 CONTACT DAYS AND CONFERENCES

### 7.1 IAP one-day meeting (workshop I - Part I)

Louvain-la-Neuve, Belgium, February 22, 2002

Sponsored by Internuniversity Attraction Pole (P24/5)

Organiser : Irène GIJBELS, Université catholique de Louvain, Belgium

About 70 researchers participated in that one-day meeting. Among these a lot of young researchers affiliated to the institutions of the partners of the network. This one-day meeting consisted of presentations, one for each work package (see the programme below). The many lively discussions during the meeting were a simple illustration of the potential to fruitful joint work on the research project.

#### PROGRAM

##### **WP 1: Functional estimation**

Promotor coordinating the presentation: Irène GIJBELS, UCL, Belgium

Speakers:

- Aurore DELAIGLE, UCL, Belgium,
- Anne-Cécile GODERNIAUX, UCL, Belgium,
- Véronique DELOUILLE, UCL, Belgium,
- Anestis ANTONIADIS, Université Joseph Fourier, Grenoble, France, *discussant*

##### **WP 2: Time series**

Promotor coordinating the presentation: Marc HALLIN, ULB, Belgium

Speakers:

- Marc HALLIN, ULB, Belgium,
- Rainer von SACHS, UCL, Belgium,
- Guy MÉLARD, ULB, Belgium, *discussant*

**WP 3: Survival Analysis**

Promotor coordinating the presentation: Noël VERAVERBEKE, LUC, Diepenbeek, Belgium

Speakers:

- Roel BRAEKERS, LUC, Diepenbeek, Belgium,
- Paul JANSSEN, LUC, Diepenbeek, Belgium,
- Philippe LAMBERT, UCL, Belgium,
- Ingrid VAN KEILEGOM, UCL, Belgium

**WP 4: Mixed Models**

Promotor coordinating the presentation: Emmanuel LESAFFRE, KUL, Belgium

Speakers:

- Emmanuel LESAFFRE, KUL, Belgium,
- Geert VERBEKE, KUL, Belgium,
- Steffen FIEUWS, KUL, Belgium,
- Bart SPIESSENS, KUL, Belgium,
- Geert MOLENBERGHS, LUC, Diepenbeek, Belgium

**WP 5: Classification and mixture models**

Promotor coordinating the presentation: Paul DE BOECK, KUL, Belgium

Speakers:

- Paul DE BOECK, KUL, Belgium,
- Iven VAN MECHELEN, KUL, Belgium

**WP 6: Incompleteness and latent variables**

Promotor coordinating the presentation: Geert MOLENBERGHS, LUC, Diepenbeek, Belgium

Speakers:

- Geert MOLENBERGHS, LUC, Diepenbeek, Belgium,
- Geert VERBEKE, KUL, Belgium

## 7.2 Colloque Bonus-Malus

Louvain-la-Neuve, Belgium, March 13, 2002

Organisers : Michel DENUIT and Christian JAUMAIN, Université catholique de Louvain, Belgium

### PROGRAM

Christian JAUMAIN, UCL, Belgium  
“Introduction”

Jean-François WALHIN, Secura Belgian Re and UCL, Belgium  
“Systèmes bonus-malus en RC auto”

Michel DENUIT, UCL, Belgium  
“Grands principes de tarification a priori et a posteriori”

Sandra PITREBOIS, Secura Belgian Re, Belgium  
“Une approche pratique de la tarification a priori et de la crédibilité avec SAS”

Natache BROUHNS, UCL, Belgium  
“Le calibrage des échelles bonus-malus avec SAS”

Bernard DUBUISSON and Séphanie Van Caeneghem, UCL, Belgium  
“Le bonus-malus: chronique d’une mort annoncée”

Pierre DEVOLDER, AXA Royale Belge and UCL, Belgium  
“Introduction”

Bertrand LETON, Ministère de l’Economie, Belgium  
“Tarification d’expérience en Belgique: genèse et perspectives”

Christian PARTRAT, University of Lyon 1, France  
“Le point sur la situation française”

Montserrat GUILLÈN, University of Barcelona, Spain  
“Le point sur la situation espagnole”

Ivo DE BONDT, Naviga, Belgium  
“L’expérience Naviga”

Jean-Paul COTEUR, Test-Achats, Belgium  
“Ce qu’en pensent les consommateurs”

### 7.3 FNRS contact day :“Insurance and Finance”

Louvain-la-Neuve, Belgium, March 27, 2002

Supported by Secura Belgian Re, Belgium

Group of Actuarial Sciences : “Insurance & Finance”

Organiser : Michel DENUIT, UCL, Belgium, in collaboration with the research group “Financial Mathematics and Stochastic”, RUG, Belgium.

#### PROGRAM

Stefan LANG, University of Munich, Germany

“Bayesian geoadditive models with application to insurance data”

Oana PURCARU, UCL, Belgium

“On the dynamic random effects and their impact on a posteriori risk evaluation”

Claude LEFÈVRE, ULB, Belgium

“Ruin theory in a discrete-time model”

Céline AZIZIEH, ULB, Belgium

“Modelling financial time series by a multifractal model”

Philippe BALLAND, Merrill Lynch, London, UK

“On interest rate and Libor rate models”

Michèle VANMAELE, RUG, Belgium

“Bounds for the price of discrete arithmetic Asian options”

Damien LANOTTE, SAS, Belgium

“SAS ® Risk Management: a tool for risk modelling and simulations”

Griselda DEELSTRA, RUG, Belgium

“Optimal investment strategies for defined contribution funds”

## 7.4 XXXIVèmes Journées de Statistique by the Société Française de Statistique (SFdS)

Brussels and Louvain-la-Neuve, Belgium, May, 13 - 17, 2002

Sponsored by the FNRS, Ministère de la Communauté française, Ministère Région Bruxelles-Capitale, Ministère des Affaires Economiques, Institut de Recherche Intern. Servier, National Bank van België, AXA Royale Belge, Sanofi-Synthelabo, UCB, the Société Belge de Statistique and the Institut National de Statistique.

The organisation of these “XXXIVèmes Journées de Statistique” was in charge of the Institut de statistique et de la recherche opérationnelle, ULB, and the Institut de statistique, UCL.

Organising Committee :

Chairman : Léopold SIMAR, UCL, Belgium

Members : Jean-Jacques DROESBEKE, ULB, Belgium; Claude CHERUY, INS, Brussels, Belgium; Michel DENUIT, UCL, Belgium; Bernadette GOVAERTS, UCL, Belgium; Nelly HANOUNE, USTL, France, Evelyne VANDEVOORDE, UCL, Belgium and Catherine VERMANDELE, ULB, Belgium.

Scientific Committee :

Chairman : Marc HALLIN, ULB, Belgium

Members : Lucien BIRGE, Paris 6, France; Henri CAUSSINUS, Université Paul Sabatier, Toulouse, France; Christian GENEST, Université Laval, Québec; Irène GIJBELS, UCL, Belgium; Ludovic LEBART, ENST-CNRS, France and Bernard YCART, Paris 5, France.

Privileged themes :

- Statistical analysis of functional data
- Financial and actuarial econometrics
- Resampling methods
- Modelling and nonparametric inference
- Speech and writing recognition
- Statistics and epidemics
- Statistics and genomics

About 500 researchers participated in that meeting.

### PROGRAM

The exhaustive programme is available on the web page at the address :  
<http://www.stat.ucl.ac.be/ISarchives/IScolloques/jsbl2002/>

## 7.5 International Workshop on “Statistical Modeling and Inference for Complex Data Structures”

Louvain-la-Neuve, Belgium, May 21 - 23, 2002

Sponsored by the Internuniversity Attraction Pole (P24/5), ARC Project 98/03-217 (Institut de statistique), Institut de Mathématiques Pures et Appliquées (UCL) and the Fonds National de la Recherche Scientifique (FNRS).

Organising Committee :

Anestis ANTONIADIS, Université Joseph Fourier, Grenoble, France; Noël VER-AVERBEKE, Limburgs Universitair Centrum, Diepenbeek, Belgium;

Local organisers : Irène GIJBELS, Philippe LAMBERT, Ingrid VAN KEILEGOM and Rainer von SACHS, Université catholique de Louvain, Belgium.

The aim of this international workshop organised by the Institut de statistique, UCL, Belgium, was to stimulate discussion about the state of the art of statistical modelling and inference for complex data structures. As such it was part of the *1st workshop of the research network Interuniversity Attraction Pole (P24/5)* between six different Belgian and international universities : RWTH (Aachen, Germany), UJF (Grenoble, France), KUL (Leuven, Belgium), LUC (Diepenbeek, Belgium), ULB (Brussels, Belgium) and UCL (Louvain-la-Neuve, Belgium).

### PROGRAM

#### May 21, 2002

Peter HALL, Australian National University, Canberra  
“Relative efficiencies of kernel and local likelihood density estimators”

David SCOTT, Rice University, Houston, USA  
“Remarks on handling outliers in data and regression”

Gabor LUGOSI, Pompeu Fabra University, Barcelona, Spain  
“Consistency of boosting methods in classification”

Luc DEVROYE, McGill University, Montreal, Canada  
“Combinatorial methods in density estimation”

**May 22, 2002**

Anestis ANTONIADIS, Université Joseph Fourier, Grenoble, France  
“Optimal testing in functional analysis of variance models”

Hans-Georg MÜLLER, University of California, Davis, USA  
“Generalized functional linear models for curve data”

Marie HUSKOVA, Charles University, Prague, Czech Republic  
“MOSUM type procedures for detection of change”

Jianqing FAN, University of North Carolina, Chapel Hill, USA  
“Semi-parametric estimation of value-at-risk”

Jürgen FRANKE, University of Kaiserslautern, Germany  
“Local nonparametric estimators for nonlinear time series”

Paul EMBRECHTS, ETH Zürich, Switzerland  
“Modelling dependence in insurance and finance”

**May 23, 2002**

Noël VERAVERBEKE, Limburgs Universitair Centrum, Diepenbeek, Belgium  
“Partially informative censoring”

Nils L. HJORT, University of Oslo, Norway  
“Frequentist model average estimators”

Bernard SILVERMAN, University of Bristol, UK  
“Empirical Bayes approaches to wavelet smoothing and other problems”

## 7.6 IAP one-day meeting (workshop I - Part II)

Louvain-la-Neuve, Belgium, May 24, 2002

Sponsored by Interuniversity Attraction Pole (P24/5)

Organiser : Irène GIJBELS, Université catholique de Louvain, Belgium

The international workshop on “Statistical Modelling and Inference for Complex Data Structures” was followed by a one-day meeting for members of the IAP-network. The aim of this one-day satellite meeting was to have a further intensive brainstorming on the problems discussed during the one-day meeting in February, and to exchange interesting ideas that have been encountered during the international workshop.

### PROGRAM

#### **“Exploring and modelling of heterogeneity”**

Moderator : Hans-Hermann BOCK, RWTH, Germany

Panel members : Jean-Paul RASSON, FUNDP, Belgium and Iven VAN MECHELEN, KUL, Belgium

#### **“Modelling frailties and extensions of Cox model”**

Moderator : Paul JANSSEN, LUC, Diepenbeek, Belgium

Panel members : Tomasz BURZYKOWSKI, LUC, Diepenbeek, Belgium, Philippe LAMBERT, UCL, Belgium and Noël VERAVERBEKE, LUC, Diepenbeek, Belgium

#### **Session 1A: “Modelling and analysis of multivariate time series”**

Moderator : Rainer von SACHS, UCL, Belgium

Panel members : Anestis ANTONIADIS, UJF, Grenoble, France, Céline BUGLI, UCL, Belgium, Christine DE MOL, ULB, Belgium, Marc HALLIN, ULB, Belgium, Philippe LAMBERT, UCL, Belgium and Volker SCHMITZ, RWTH, Aachen, Germany

#### **Session 2A: “Mixture models: Bayesian and nonparametric approaches to random effects”**

Moderator : Emmanuel LESAFFRE, KUL, Belgium

Panel members : Paul EILERS, University of Leiden, The Netherlands, Wendim GHIDEY, KUL, Belgium and Iven VAN MECHELEN, KUL, Belgium

**Session 1B: “Hierarchical models for multivariate data of mixed types”**

Moderator : Helena GEYS, LUC, Diepenbeek, Belgium

Panel members : Ariel ALONSO, LUC, Diepenbeek, Belgium and Tomasz BURZYKOWSKI, LUC, Diepenbeek, Belgium

**Session 2B: “Issues in heterogeneity”**

Moderator : Paul DE BOECK, KUL, Belgium

Panel members : Hans-Hermann BOCK, RWTH, Aachen, Germany and Emmanuel LESAFFRE, KUL, Belgium

## 7.7 Workshop on “Central & Eastern Europe Workshop on Efficiency & Productivity Analysis”

Bucharest, Roumania, June 28 - 29, 2002

Sponsored by the European Community (Inco-Copernicus project, STEFAN CELMARE)

Organised in collaboration between the Université catholique de Louvain, Belgium and the Academia de Studii Economice, Bucharest, Romania

Organising committee :

Crisan ALBU, Academia de Studii Economice, Bucharest, Romania; Valentin PATILEA, Université d’Orléans, France; Liliane SPIRCU, Academia de Studii Economice, Bucharest, Romania and Philippe VANDEN EECKAUT, UCL, Belgium

Scientific coordinator : Léopold SIMAR, UCL, Belgium

### Invited sessions

Daniel DAIANU, Academia de Studii Economice, Bucharest, Romania  
“Transition in Romania: a comparative perspective”

Finn FORSUND, Oslo University, Oslo, Norway  
“Circularity of the Malmquist index”

Lennart HJALMARSSON, Göteborg University, Sweden  
“Are all scales optimal in DEA ? Theory and empirical evidence”

Léopold SIMAR, UCL, Belgium  
“Statistical inference in nonparametric frontier models: recent developments”

Paul WILSON, University of Texas, Austin, USA  
“Some remarks on estimation and inference in non-parametric models of production processes”

More information concerning this workshop is available on the web page at the address : <http://www.copernicus.ase.ro>

## 7.8 Conference in Actuarial Science & Finance

Samos, September 20 - 22, 2002

Organised in collaboration between the University of the Aegean, Mytilene, Greece, the Katholieke Universiteit Leuven, Belgium and the Université catholique de Louvain, Belgium

Organising Committee :

Chairman : Nicolaos FRANGOS, Athens University of Economics and Business, Greece

Members : Jan DHAENE, Katholieke Universiteit Leuven, Belgium; Dimitrios KONSTANTINIDES, University of the Aegean, Greece; Oana PURCARU, Université catholique de Louvain, Belgium; Jef TEUGELS, Katholieke Universiteit Leuven, Belgium and Jean-François WALHIN, Secura Belgian Re, Belgium

The Conference allowed the presentation of the latest works in the area of actuarial science and finance. It was open to all persons interested in actuarial science and finance (from universities, insurance companies, banks, consulting firms or regulatory authorities). The conference was aimed to facilitate contact and communication between practitioners and researchers; a special session was devoted to different aspects of actuarial practice.

### PROGRAM

The exhaustive programme is available on the web page at the address :  
<http://www.stat.ucl.ac.be/Samos2002/mainpage.html>

## 8 ACADEMIC VISITS

The members of the Institute visited other institutions and most of them presented seminars.

### January 2002

Ingrid VAN KEILEGOM, “Confidence bands for regression curves and their derivatives”, invited professor, Australian National University, Canberra.

Rainer von SACHS, “Forecasting non-stationary time series by wavelet process modelling”, Humboldt Universität, Berlin, Germany,

### March 2002

Aurore DELAIGLE, “Density estimation and the deconvolution problem”, LUC, Diepenbeek, Belgium.

Michel DENUIT, “Quelques aspects de la prise en compte de la dépendance à l’aide des coupleurs”, Séminaire Lyon-Lausanne, HEC Lausanne, Switzerland.

Abdelouahid TAJAR, “On the monotonicity of some concordance measures and the construction of a discrete copula”, LUC, Diepenbeek, Belgium.

Rainer von SACHS, “Forecasting non-stationary time series by wavelet process modelling”, Séminaire statistique de Jussieu, Université de Paris VI et VII, France.

Rainer von SACHS, Weierstrass Institut für Analysis und Stochastik (WIAS), Berlin, Germany.

### June 2002

Aurore DELAIGLE, “Density estimation and the deconvolution problem”, University of Oslo, Norway.

### July 2002

Aurore DELAIGLE, University of Oslo, Norway.

Véronique DELOUILLE, “Second-generation wavelet transforms for irregularly spaced data in one and two dimensions”, Universität Kaiserslautern, Germany.

Michel DENUIT, “Building projected lifetables and managing the longevity risk”, University of Warsaw, Poland.

Michel MOUCHART, Universidad de Cantabria, Santander, Spain.

Léopold SIMAR, “Nonparametric frontier models: an overview”, invited talk,  
Universität of Mainz, Germany.

### **August 2002**

Bernadette GOVAERTS, University of Dortmund, Germany.

Léopold SIMAR, Humboldt Universität, Berlin, Germany.

Ingrid VAN KEILEGOM, “Estimation of the bivariate and marginal distributions  
with censored data”, University of Oslo, Norway.

### **September 2002**

Irène GIJBELS, Université Joseph Fourier, Grenoble, France.

Michel MOUCHART, University of Bologna, Italy.

Sébastien VAN BELLEGEM, Universität Heidelberg, Germany.

Ingrid VAN KEILEGOM, “Estimation of the bivariate and marginal distributions  
with censored data”, University of Santiago de Compostela, Spain.

Ingrid VAN KEILEGOM, “Using difference-based methods for inference in non-  
parametric regression with time-series errors”, University of La Coruña,  
Spain.

### **October 2002**

Michel MOUCHART, University of Bologna, Italy.

Sébastien VAN BELLEGEM, Universität Heidelberg, Germany.

### **November 2002**

Céline BUGLI, “Analyse statistique d’électroencéphalogramme par ICA”, Forenap-  
Pharma, Rouffach, France.

Sébastien VAN BELLEGEM, Universität Heidelberg, Germany.

### **December 2002**

Nancy FRANCOIS, “Influence du vieillissement et du pH sur les qualités organolep-  
tiques de la bière”, Séminaire bimensuel du Laboratoire de Brasserie et des  
Industries Alimentaires (INBR), UCL, Belgium.

Irène GIJBELS, “Density estimation in the deconvolution problem”, University  
of Mainz, Germany.

Jean-Marie ROLIN, Rapporteur et membre du Jury d'habilitation à diriger des recherches de Benoit Cadre, Université de Montpellier 2, France.

Ingrid VAN KEILEGOM, "Estimation of semiparametric models when the criterion function is not smooth", Katholieke Universiteit Leuven, Belgium.

## 9 CONFERENCES AND MEETINGS

The members of the Institute assisted and/or participated to the following conferences.

### February 2002

Aurore DELAIGLE, *IAP Workshop 1, Part 1*, “Nonparametric estimation of a frontier function in case of stochastic frontiers”, Louvain-la-Neuve, Belgium.

Michel DENUIT, *IAP Workshop 1, Part 1*, Louvain-la-Neuve, Belgium.

Nancy FRANCOIS, *IAP Workshop 1, Part 1*, Louvain-la-Neuve, Belgium.

Irène GIJBELS, *IAP Workshop 1, Part 1*, organiser, Louvain-la-Neuve, Belgium.

Bernadette GOVAERTS, *IAP Workshop 1, Part 1*, Louvain-la-Neuve, Belgium.

Philippe LAMBERT, *IAP Workshop 1, Part 1*, Louvain-la-Neuve, Belgium.

Michel MOUCHART, *IAP Workshop 1, Part 1*, Louvain-la-Neuve, Belgium.

Jean-Marie ROLIN, *IAP Workshop 1, Part 1*, Louvain-la-Neuve, Belgium.

Léopold SIMAR, *IAP Workshop 1, Part 1*, Louvain-la-Neuve, Belgium.

Ingrid VAN KEILEGOM, *IAP Workshop 1, Part 1*, “Ongoing projects in the domain of smoothing based methods in survival analysis”, Louvain-la-Neuve, Belgium.

Rainer von SACHS, *IAP Workshop 1, Part 1*, Louvain-la-Neuve, Belgium.

### March 2002

Natacha BROUHNS, *Colloque Bonus-Malus*, “Le calibrage des échelles bonus-malus avec SAS”, Louvain-la-Neuve, Belgium.

Michel DENUIT, *International Congress of Actuaries*, “Risk and Savings Contracts”, Cancun, Mexico.

Michel DENUIT, *Colloque Bonus-Malus*, “Grands principes de tarification a priori et a posteriori”, co-organiser, Louvain-la-Neuve, Belgium.

Michel DENUIT, *Workshop on Dependence in actuarial science*, “Beyond comonotonicity”, London, United-Kingdom.

Michel DENUIT, *Journée de Contact FNRS*, co-organiser, Louvain-la-Neuve, Belgium.

Oana PURCARU, *Journée de Contact FNRS*, “On the dynamic random effects and their impact on a posteriori risk evaluation”, Louvain-la-Neuve, Belgium.

Rainer von SACHS, *Magdeburger Stochastik Tage*, “Forecasting non-stationary time series by wavelet process modelling”, Magdeburg, Germany.

## April 2002

Céline BUGLI, *Eli Lilly - Electroencephalograms Symposium*, “Application of independent component analysis in EEG”, invited speaker, Indianapolis, USA.

Léopold SIMAR, “Détection d’outliers dans des modèles de frontières non-paramétriques”, invited talk, Rennes, France.

## May 2002

Taoufik BOUEZMARNI, *XXXIVèmes Journées de Statistique, Société Française de Statistique*, “Bernstein estimator for unbounded density function”, Brussels, Louvain-la-Neuve, Belgium.

Taoufik BOUEZMARNI, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, “Consistency of asymmetric kernel density estimators and smoothed histograms with application to income data”, Louvain-la-Neuve, Belgium.

Céline BUGLI, *IAP Workshop 1, Part 2*, “Modelling and analysis of multivariate time series by independent component analysis - application to EEG”, Louvain-la-Neuve, Belgium.

Aurore DELAIGLE, *XXXIVèmes Journées de Statistique, Société Française de Statistique*, “Estimation du support d’une densité dans le problème de déconvolution”, Brussels, Louvain-la-Neuve, Belgium.

Aurore DELAIGLE, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, “Estimation of endpoints in the deconvolution problem”, poster session, Louvain-la-Neuve, Belgium.

Véronique DELOUILLE, *XXXIVèmes Journées de Statistique, Société Française de Statistique*, “Estimation de modèles autorégressifs non linéaires au moyen d’ondelettes adaptées au plan d’expérience”, invited session, Brussels, Belgium.

Véronique DELOUILLE, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, “Second generation wavelet transform for irregularly spaced data in two dimensions”, Louvain-la-Neuve, Belgium.

Michel DENUIT, *XXXIVèmes Journées de statistique, Société Française de Statistique*, member of the organizing committee, Brussels, Louvain-la-Neuve, Belgium.

Michel DENUIT, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, Louvain-la-Neuve, Belgium.

Michel DENUIT, *IAP Workshop 1, Part 2*, Louvain-la-Neuve, Belgium.

Nancy FRANCOIS, *XXXIVèmes Journées de statistique, Société Française de Statistique*, Brussels, Louvain-la-Neuve, Belgium.

Nancy FRANCOIS, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, Louvain-la-Neuve, Belgium.

Irène GIJBELS, *XXXIVèmes Journées de statistique, Société Française de Statistique*, member of the scientific committee and organiser of four invited sessions, Brussels, Louvain-la-Neuve, Belgium.

Irène GIJBELS, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, member of the organizing committee, Louvain-la-Neuve, Belgium.

Irène GIJBELS, *IAP Workshop 1, Part 2*, organiser, Louvain-la-Neuve, Belgium.

Bernadette GOVAERTS, *SAS Academic day*, Brussels, Belgium.

Bernadette GOVAERTS, *XXXIVèmes Journées de statistique, Société Française de Statistique*, member of the organising committee and chairman of the chemometrics sessions, Brussels, Louvain-la-Neuve, Belgium.

Bernadette GOVAERTS, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, Louvain-la-Neuve, Belgium.

Bernadette GOVAERTS, *IAP Workshop 1, Part 2*, Louvain-la-Neuve, Belgium.

Philippe LAMBERT, *XXXIVèmes Journées de statistique, Société Française de Statistique*, “Modèle à hasard accéléré pour l’analyse de données de survie hétérogènes”, invited speaker, chairman session of “Copules et leurs applications”, Brussels, Louvain-la-Neuve, Belgium.

Philippe LAMBERT, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, member of the organising committee, Louvain-la-Neuve, Belgium.

Philippe LAMBERT, *IAP Workshop 1, Part 2*, “Modeling heterogeneity in survival times using accelerated failure time models with a frailty component”, Louvain-la-Neuve, Belgium.

Céline LE BAILLY DE TILLEGHEM, *XXXIVèmes Journées de statistique, Société Française de Statistique*, Brussels, Louvain-la-Neuve, Belgium.

Céline LE BAILLY DE TILLEGHEM, *International Workshop on Statistical Modelling and Inference for Complex Data structures*, Louvain-la-Neuve, Belgium.

Michel MOUCHART, *XXXIVèmes Journées de statistique, Société Française de Statistique*, Brussels, Louvain-la-Neuve, Belgium.

Michel MOUCHART, *International Workshop on Statistical Modelling and Inference for Complex Data structures*, Louvain-la-Neuve, Belgium.

Michel MOUCHART, *IAP Workshop 1, Part 2*, Louvain-la-Neuve, Belgium.

Oana PURCARU, *XXXIVèmes Journées de Statistique, Société Française de Statistique*, “Modélisation de la dépendance stochastique en actuariat non-vie à laide des coupleurs”, Brussels, Louvain-la-Neuve, Belgium.

Jean-Marie ROLIN, *XXXIVèmes Journées de statistique, Société Française de Statistique*, “Identification et convergence forte dans les modèles à risques compétitifs non-paramétriques”, chairman session, Brussels, Louvain-la-Neuve, Belgium.

Jean-Marie ROLIN, *IAP Workshop 1, Part 2*, Louvain-la-Neuve, Belgium.

Léopold SIMAR, *XXXIVèmes Journées de Statistique, Société Française de Statistique*, chairman of the organizing committee, Brussels, Louvain-la-Neuve, Belgium.

Léopold SIMAR, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, Louvain-la-Neuve, Belgium.

Léopold SIMAR, *IAP Workshop 1, Part 2*, Louvain-la-Neuve, Belgium.

Abdelouahid TAJAR, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, “On the monotonicity of concordance measures with respect to the concordance ordering”, poster session, Louvain-la-Neuve, Belgium.

Abdelouahid TAJAR, *XXXIVèmes Journées de Statistique, Société Française de Statistique* “On the construction of a discrete bivariate copula”, Brussels, Louvain-la-Neuve, Belgium.

Sébastien VAN BELLEGEM, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, “Adaptive estimation of wavelet spectra with application to forecasting”, poster session, Louvain-la-Neuve, Belgium.

Ingrid VAN KEILEGOM, *XXXIVèmes Journées de Statistique, Société Française de Statistique*, “Données censurées I” and “Données censurées II”, chairman session, Brussels, Louvain-la-Neuve, Belgium.

Ingrid VAN KEILEGOM, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, member of the organizing committee, Louvain-la-Neuve, Belgium.

Ingrid VAN KEILEGOM, *IAP Workshop 1, Part 2*, Louvain-la-Neuve, Belgium.

Rainer von SACHS, *XXXIVèmes Journées de Statistique, Société Française de Statistique*, Brussels, Louvain-la-Neuve, Belgium.

Rainer von SACHS, *International Workshop on Statistical Modelling and Inference for Complex Data Structures*, member of the organizing committee, Louvain-la-Neuve, Belgium

Rainer von SACHS, *IAP Workshop 1, Part 2*, Louvain-la-Neuve, Belgium.

## June 2002

Léopold SIMAR, *Data Envelopment Analysis and Productivity Measurement*, “Statistical inference in nonparametric frontier models: recent developments”, invited keynote address, New-York, USA.

Léopold SIMAR, *North American Productivity Workshop II*, “Parametric approximations of nonparametric frontiers”, member of the scientific committee, New-York, USA.

Léopold SIMAR, *Central and Eastern Europ Workshop on Efficiency and Productivity Analysis*, “Statistical inference in nonparametric frontier models: recent developments”, invited keynote speaker, Bucharest, Romania.

Sébastien VAN BELLEGEM, *The 22nd International Symposium on Forecasting*, “Forecasting financial time series using models of nonstationarity”, contributed paper, Dublin, Ireland.

## July 2002

Aurore DELAIGLE, *International Meeting on “Current Advances and Trends in Nonparametric Statistics”*, “Density estimation in the deconvolution problem”, Crete, Greece

Michel DENUIT, *Sixth International Congress on Insurance: Mathematics and Economics*, “Building projected life tables for annuities”; “Dependence and a posteriori risk evaluation through random effects”, Lisbon, Portugal.

Irène GIJBELS, *International Meeting on “Current Advances and Trends in Nonparametric Statistics”*, “Bootstrap testing for discontinuities in regression functions”, special invited speaker, organiser and chairman of a session on “Inference for curves with constraints”, Crete, Greece.

Philippe LAMBERT, *Proceedings of the XXIst International Biometric Conference*, “Shared frailty accelerated failure time models for clustered survival data”, Freiburg, Germany.

Philippe LAMBERT, *Proceedings of the 17th International Workshop on Statistical Modelling*, “Flexible modelling of clustered survival data using shared frailty accelerated failure time models”, Chania, Crete, Greece.

Oana PURCARU, *Sixth International Congress on Insurance: Mathematics and Economics*, “Dependence and a posteriori risk evaluation through random effects”, Lisbon, Portugal.

Sébastien VAN BELLEGEM, *Coherent States, Wavelets, and Applications*, “Forecasting inhomogeneous time processes using a wavelet-based model”, invited speaker, Louvain-la-Neuve, Belgium.

Ingrid VAN KEILEGOM, *International Meeting on “Current Advances and Trends in Nonparametric Statistics”*, “Confidence bands for regression curves and their derivatives”, invited speaker and chairman of a session on “Empirical likelihood”, Crete, Greece.

Rainer von SACHS, *International Meeting on “Current Advances and Trends in Nonparametric Statistics”*, “Forecasting non-stationary time series by wavelet process modelling”, invited talk, Crete, Greece.

## August 2002

Isabelle DE MACQ, *COMPSTAT2002*, “Hyper-rectangular space partitioning trees: a practical approach”, short communication, Berlin, Germany.

Nancy FRANCOIS, *Sixth Sensometrics Meeting*, Dortmund, Germany.

Irène GIJBELS, *International Workshop on “Perspectives in Modern Statistical Inference II”*, “Density estimation in the deconvolution problem”, invited speaker, chairman of a session, Brno, Czech Republic.

Bernadette GOVAERTS, *Sixth Sensometrics Meeting*, Dortmund, Germany.

Léopold SIMAR, *4th International Conference on Statistical Data Analysis based on the L1-norm and related methods*, “Detection of outliers in frontiers models”, invited speaker, Neuchâtel, Switzerland.

## September 2002

Natacha BROUHNS, *Colloque “Tables de mortalité prospectives ARAB”*, “De sterfteskansen: evolutie ?”, Brussels, Belgium.

Céline BUGLI, *3rd International Workshop on Statistical Methodology in Non-Clinical R&D*, “Statistical analysis of electroencephalograms”, invited speaker, Barcelona, Spain.

Michel DENUIT, *Colloque “Tables de mortalité prospectives ARAB”*, “De sterfteskansen: evolutie ?”; “Projection de la mortalité : modèles de Lee-Carter et Poisson log-bilinéaire”; “Mesure de l’antisélection”, Brussels, Belgium.

Nancy FRANCOIS, *3rd International Workshop on Statistical Methodology in Non-clinical R&D*, “Optimal design to maximise inverse prediction precision in calibration problems - application to the linear and the four parameters logistic curve”, contributed paper, Barcelona, Spain.

Céline LE BAILLY DE TILLEGHEM, *3rd International Workshop on Statistical Methodology in Non-clinical R&D*, “A fast exchange algorithm for designing focused libraries in lead optimisation”, Barcelona, Spain.

Michel MOUCHART, *Annual Conference of the International Society for Clinical Biostatistics*, invited speaker, Dijon, France.

Oana PURCARU, *2nd Conference in Actuarial Science & Finance*, short course on “Modelling dependence in actuarial science and finance”, member of the organising committee, Samos, Greece.

Rainer von SACHS, *Workshop on High-dimensional Data*, “Multivariate analysis of non-stationary time series in the frequency domain”, invited talk, Leiden, The Netherlands.

## October 2002

Taoufik BOUEZMARNI, *10th Annual Meeting of the Belgian Statistical Society*, “Nonparametric estimation for unbounded density function”, Kerkrade, The Netherlands.

Céline BUGLI, *10th Annual Meeting of the Belgian Statistical Society*, “Statistical analysis of electroencephalograms”, poster presentation, Kerkrade, The Netherlands.

Aurore DELAIGLE, *10th Annual Meeting of the Belgian Statistical Society*, “Density estimation in the deconvolution problem”, Kerkrade, The Netherlands.

Nancy FRANCOIS, *10th Annual Meeting of the Belgian Statistical Society*, “Optimal design for non-linear calibration model”, contributed paper, Kerkrade, The Netherlands.

Irène GIJBELS, *10th Annual Meeting of the Belgian Statistical Society*, chairman of a session, Kerkrade, The Netherlands.

Bernadette GOVAERTS, *Workshop on “News on developments in experimental design”*, “Optimal designs for inverse non linear calibration models”, invited speaker, Dortmund, Germany.

Bernadette GOVAERTS, *BLUES, SAS Conference for Belgium and Luxembourg*, Leuven, Belgium.

Céline LE BAILLY DE TILLEGHEM, *10th Annual Meeting of the Belgian Statistical Society*, poster presentation, Kerkrade, The Netherlands.

Jean-Marie ROLIN, *10th Annual Meeting of the Belgian Statistical Society*, Kerkrade, The Netherlands,

Léopold SIMAR, *10th Annual Meeting of the Belgian Statistical Society*, chairman of a session, member of the scientific committee, Kerkrade, The Netherlands.

Abdelouahid TAJAR, *10th Annual Meeting of the Belgian Statistical Society*, “On the study of some nonparametric monotone dependence measures”, Kerkrade, The Netherlands.

Sébastien VAN BELLEGEM, *10th Annual Meeting of the Belgian Statistical Society*, “A wavelet-based model for locally stationary processes”, contributed paper, Kerkrade, The Netherlands.

Sébastien VAN BELLEGEM, *Time Series Workshop*, “Wavelet processes and local adaptive estimation of evolutionary wavelet spectra”, invited speaker, Heidelberg, Germany.

Rainer von SACHS, *10th Annual Meeting of the Belgian Statistical Society*, Kerkrade, The Netherlands.

## **November 2002**

Natacha BROUHNS, *Colloque “Tarification automobile et systèmes bonus-malus”*, “Nouvelle approche du zonage”, Paris, France.

Michel DENUIT, *Colloque “Tarification automobile et systèmes bonus-malus”*, “Nouvelle approche du zonage”; “SBM à classes”; “Principes modernes de construction d’un tarif technique”, Paris, France.

Nancy FRANCOIS, *Second B-ENBIS Workshop on Optimal Experimental Design*, “Optimal design for non-linear calibration model”, Tervuren, Belgium.

Bernadette GOVAERTS, *Second B-ENBIS Workshop on Optimal Experiment Design*, “Case study: an application in aerospace”, invited speaker, Tervuren, Belgium.

## **December 2002**

Bernadette GOVAERTS, *8th Chemometrics conference*, Leuven, Belgium.

## 10 RESEARCH PROJECTS UNDER CONTRACTS AND COOPERATION PROJECTS

This section discusses ongoing research projects and cooperation projects at the Institut de statistique that are financed by outside agencies in the form of grants or contracts.

**Inco-Copernicus Project, “STEFAN CEL MARE Sectorial technical efficiency and financial analysis a comparative evaluation look for Moldavian and Romanian economics” (1998 - 2002)**

Financing : European Community, Main Direction XII, Science, Research et Development.

Coordinators: L. SIMAR and Ph. VANDEN EECKAUT

Partners institutions: Academia de Studii Economice, Romania; State University of Moldova, Moldavia; Université des Sciences Sociales de Toulouse, France.

The objective of this project is to have a better evaluation of the economic performance of the productive activity of Romania and Moldavia during the important on-going process of privatisation.

**Projet d’Actions de Recherche Concertées : “Semi- and non-parametric methods as tools for analyzing complex data structures” (1998-2003)**

Financing : Ministry of Research and Education of the ‘Communauté française’ of Belgium.

Promoters : I. GIJBELS, M. MOUCHART, L. SIMAR and R. von SACHS

Researchers : G. GEENENS, C. HEUCHENNE, A. LAMBERT, O. PURCARU and A. TAJAR

The aim of this project is to adapt and to use semi- and non-parametric methods to get a better understanding of the underlying properties of an observed phenomenon. The interest is essentially in complex processes hiding underlying structures which cannot be observed directly (change-points, missing or non-observed variables, complex functional structures, unknown support of densities, reconstruction of images). Semi- and non-parametric approaches allow for a flexible and robust interpretation of the data, since they impose less restrictive assumptions on the observed process. In this project we study these approaches and apply them to domains in which the flexibility and robustness are particularly useful.

**“Actuarial aspects of dependencies in insurance portfolios ” (1999-2002)**

Financing : Committee on Knowledge Extension Research, Society of Actuaries

Promoters : M. DENUIT, in collaboration with Professors J. DHAENE and M. GOOVAERTS, Katholieke Universiteit Leuven, Belgium

This research project aims to study the impact of a possible dependency between the risks covered by an insurance company. Stochastic models taking correlations into account are proposed, allowing the actuary to measure the impact of this dependency on the aggregate claims. The sensitivity of the results obtained on the basis of the traditional independence assumption can then be evaluated.

**“Advanced casualty ratemaking techniques” (2000 - 2003)**

Financing : Université catholique de Louvain, FSR

Promoter : M. DENUIT

Researcher : N. BROUHNS

This research project aims to address the numerous problems related to the technical conception of non-life insurance products (especially car insurance). Initial risk selection, a priori risk classification and premium amounts determination as well as a posteriori ratemaking (including policy cancellation rules) are handled in an unified way within the same stochastic model.

**“Nonparametric regression with censored data : several applications” (2001 - 2003)**

Financing : Université catholique de Louvain, FSR

Promoter : I. VAN KEILEGOM

Researchers : A. EL GHOUGH and C. HEUCHENNE

In this project a heteroscedastic regression model is considered in which the response is subject to right censoring. The nonparametric estimation of the unknown functions of this model has been studied in the literature. The aim of this project is to consider two applications. In the first one, a new least squares method for a polynomial regression model is proposed. For the second one, an ANCOVA model is considered and a new procedure to test the hypotheses of interest in this model is studied.

**“Statistical techniques and modelling for complex substantive questions with complex data” (2002 - 2006)**

Financing : Interuniversity Attraction Poles, OSTC, Brussels, Belgium

Coordinators : I. GIJBELS and L. SIMAR

Partners Institutions :

- Katholieke Universiteit Leuven, Belgium
- Limburgs Universitair Centrum, Diepenbeek, Belgium
- Université Libre de Bruxelles, Belgium
- Aachen Technical University, Germany
- Université Joseph Fourier, Grenoble, France

The point of departure of the network activities is that of a broad range of complex substantive data sets and questions arising in various disciplines (including psychology, biomedical sciences, economics, and climatology). The overall aim of our project then is to develop appropriate statistical models and techniques to deal with these data and questions.

## 11 ACTIVITIES IN APPLIED STATISTICS

The Institut de statistique is developing many contacts within the Université catholique de Louvain and with several companies in the field of applied statistics. In addition to the seminars organised weekly (see point 4), the members of the Institute participate to research contracts in applied statistics and offer consulting services to other departments and institutions of the University. They also offer some courses of continued education at the University and in companies.

The major activities are described below.

### 11.1 Services for the Université catholique de Louvain

The Institut de statistique is developing its consulting service to the University community. Researchers of the others faculties receive advice concerning appropriate methodologies and suitable statistical packages for their specific problems. Hence, scientific collaborations between different disciplines are often created.

The scientific members and the computer scientists of the Institute are developing their knowledge about the evolution of many statistical software and they often give advice in this context. The Institute actively participated to the creation and animation of the group SAS'Discute, group of SAS users of the Université catholique de Louvain.

### 11.2 Applied research contracts

**“Actuarial models of multiline ratemaking”** (2000-2002)

Financing : WINTERTHUR Europe Assurance S.A.

Promoter : M. DENUIT

It concerns a prospective study, purely methodological, devoted to actuarial models describing the reality of insurance markets more adequately than traditional approaches. The study focuses on a global risk evaluation of policyholders instead of Insurance products, both a priori and a posteriori.

**“Automatic statistical analyse in the time-frequency domain”** (2000-2003)

Financing : “The National Institute of Mental Health” (USA)

Promoter : R. von SACHS

In the collaborative project with biostatisticians (H. OMBAO, Department of Statistics, University of Illinois, Champaign, USA and W. GUO, School of Public Health, UPENN, Philadelphia) and neurologist (B. LITT, UPENN, Philadelphia) we try to improve the modelling and understanding of the evolution of epileptic seizure in the brain. The final goal of this research is to try to localize the centre of the seizure more precisely in order to improve the surgical treatment. In the first phase of the project (2/2000-1/2001) we have developed a new algorithm for bivariate spectral analysis of EEG data which is more localized but still relatively close to the methods medical doctors are used to. In the second phase (2/2001-1/2003) we have generalised our method in order to treat multivariate EEG signals of higher dimension.

**“Analysis and interpretation of electroencephalograms (EEG) in drug discovery”** (2001-2003)

Financing : Eli Lilly (sponsorship)

Promoter : Ph. LAMBERT

Researcher : C. BUGLI

Electroencephalograms (EEG) can be used to improve the understanding of the effects of experimental drugs on the body. Such signals can for example be generated during a drug development process using human volunteers exposed to varying drug concentrations. EEG signals typically take the form of longitudinal continuous responses measured at high frequency during at most 10 minutes at various locations at the surface of the skull. Currently, very simple descriptive analyses of such data are undertaken. Typically, each signal (generated at one electrode) is subdivided in consecutive periods of (say) 2 seconds. It is assumed stationary in these small epochs and separately analyzed using Fourier transforms. The goal of the project is

- to evaluate the potential of independent component analysis.
- to illustrate the potential of these techniques to quantify the effect of a treatment on the brain.

EEG signals generated during cross-over trials where patients alternatively received a placebo and a drug reported to have a large and well understood effect on the brain are potential elements to use in that illustration.

**“Assessment of quality differences between freight transport modes”**  
(2001-2003)

Financing : OSTC, Brussels, Belgium (Second multiannual scientific support plan for a sustainable development policy)

Promoter : M. MOUCHART

Researchers : G. SANTAMARIA and M. VANDRESSE

The objective of this contract is to analyze the qualitative differences between means of long-distance freight transport: reliability, security, flexibility, punctuality, information, damages, etc. We will measure the impact of these qualitative factors concerning the decision of a transport mode and, if possible, we will evaluate the corresponding advantages (or costs).

**“Projected lifetables for Belgium”** (2002)

Financing : Association Royale des Actuaire Belges (KVBA-ARAB) - Belgian Royal Society of Actuaries

Promoter : M. DENUIT

The study aims to develop projected lifetables (incorporating a forecasting of future mortality) to price life insurance products sold in Belgium. Particular attention will be paid to life annuities.

**“Actuarial models for pricing longevity risk reinsurance treaties”** (2002-2003)

Financing : Secura Belgian Re, Brussels, Belgium

Promoter : M. DENUIT

This project aims to develop an actuarial model to price reinsurance treaties covering longevity risk in life annuities portfolios. The analysis of mortality forecasting errors will be used to project future cash flows and to study their variability.

### 11.3 Consulting for firms and public organisms

The principal consulting contracts treated in 2002 are the following:

Client : Cliniques universitaires Saint-Luc, Service de pédiatrie, Brussels, Belgium  
Subject : Development of a risk index in the domain of adult nutrition.  
STAT participant: I. DE MACQ

Client : Techspace Aero, Liege, Belgium  
Subject : Experimental design for the optimisation stators brazing in aerospace industry  
STAT participant : B. GOVAERTS

Client : Slegten S.A., Louvain-la-Neuve, Belgium  
Subject : Statistical modeling of grinding media wear data  
STAT participants : N. FRANÇOIS and C. RITTER

Client : Eurocontrol, Brussels, Belgium  
Subject : Efficiency analysis of air navigation services provision : first insights  
STAT participants : M. MOUCHART and L. SIMAR

Client : IMEC, Louvain, Belgium  
Subject : Set up of a sampling and control charting methodology to monitor a photovoltaic cells process  
STAT participant : B. GOVAERTS

### 11.4 Continued education for companies

2 days of course on “Statistics : data exploration, inference and modelling”  
Society : Slegten - Magotteaux, Louvain-la-Neuve, Belgium  
Stat participants : B. GOVAERTS and C. RITTER

2 days of course on “Experimental design”  
Society : Slegten - Magotteaux, Louvain-la-Neuve, Belgium  
Stat participants : B. GOVAERTS and C. RITTER

2 days of course on “Statistics : foundations and perspectives”  
Society : Centre de recherche - Glaverbel, Jumet, Belgium  
Stat participants : B. GOVAERTS and C. RITTER