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OxMetrics news

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Announcing the release of OxMetrics™5

OxMetrics™ is a modular software system providing an integrated solution for the econometric analysis of time series, forecasting, financial econometric modelling, or statistical analysis of cross-section and panel data. The OxMetrics modules are:

- **Ox™** Professional is a powerful matrix language, which is complemented by a comprehensive statistical library. Among the special features of Ox are its speed, well-designed syntax and editor, and graphical facilities. Ox can read and write many data formats, including spreadsheets; Ox can run most econometric GAUSS programs. **Ox™ Packages** extend the functionality of Ox in various ways. Once installed, they become an integrated part of Ox. Some packages just add a few useful functions, whereas others offer an extensive econometric or statistical technique which can also be used interactively using Ox Professional. Most of these packages are FREE of charge (see www.doornik.com for full list of available packages)
- **PcGive™** aims to give an operational and structured approach to econometric modelling using the most sophisticated yet user-friendly software. The accompanying books transcend the old ideas of `textbooks' and `computer manuals' by linking the learning of econometric methods and concepts to the outcomes achieved when they are applied. The econometric techniques of PcGive include: VAR, cointegration, simultaneous equations models, ARFIMA, logit, probit, GARCH modelling, static and dynamic panel data models, X12ARIMA, and more.
- **STAMP™** is designed to model and forecast time series, based on structural time series models. These models use advanced techniques, such as Kalman filtering, but are set up so as to be easy to use -- at the most basic level all that is required is some appreciation of the concepts of trend, seasonal and irregular. The hard work is done by the program, leaving the user free to concentrate on formulating models, then using them to make forecasts
- **G@RCH™** is dedicated to the estimation and forecasting of ARCH and GARCH-type models. G@RCH provides a user-friendly interface (with rolling menus) as well as some graphical features.
- **SsfPack™** provides Ox with additional facilities when carrying out computations involving the statistical analysis of univariate and multivariate models in state space form. SsfPack allows for a full range of different state space forms: from a simple time-invariant model to a complicated multivariate time-varying model. Functions are provided to put standard models such as ARIMA, Unobserved components, regressions and cubic spline models into state space form. Basic functions are available for filtering, moment smoothing and simulation smoothing. Ready-to-use functions are provided for standard tasks such as likelihood evaluation, forecasting and signal extraction. SsfPack can be easily used for implementing, fitting and analysing Gaussian models relevant to many areas of econometrics and statistics. Furthermore it provides all relevant tools for the treatment of non-Gaussian and nonlinear state space models. In particular, tools are available to implement simulation based estimation methods such as importance sampling and Markov chain Monte Carlo (MCMC) methods (not yet released).
- **TSP/GiveWin™** by TSP International (founded in 1982 by Bronwyn H. Hall) is an econometric software package, with convenient input of commands and data, all the standard estimation methods (including non-linear), forecasting, and a flexible language for programming your own estimators. The philosophy behind TSP is that of a command-driven language tailored to econometric problems, whatever the platform used. For those working in a Windows environment, TSP can be installed as a module of OxMetrics - **TSP/GiveWin.** This eases the use of the command-line environment by providing context sensitive help, syntax highlighting, and a dialog-driven command builder.

Four of these modules have been grouped in a single product OxMetrics™ Enterprise Edition. **OxMetrics™ Enterprise Edition** is a single product that includes and integrates all the important components for theoretical and empirical research in econometrics, time series analysis and forecasting, applied economics and financial time series: Ox Professional, PcGive, G@RCH, and STAMP.

OxMetrics™ is distributed and published by Timberlake Consultants Ltd (www.timberlake.co.uk). **Timberlake Consultants Limited**, with head office in the U.K., is celebrating its 25th anniversary in 2007. The Company has a growing number of offices and agents worldwide, including Brazil, Japan, Poland, Portugal, Spain and the USA. We also have partners in other countries to help with the distribution of the OxMetrics software.

In OxMetrics™ 5, all the modules of OxMetrics™ Enterprise Edition have been upgraded.
The details of new features are described below:

New feature: Autometrics™

by Jurgen. A. Doornik

1 Autometrics

1.1 Introduction

With their publication in 1999, [1] Hoover and Perez revisited the earlier experiments of Lovell, and showed that an automated general-to-specific model selection (*Gets*) algorithm can work successfully. This contrasts with the results of Lovell, who only considered simplistic methods such as forward selection, showing that these can fail badly.

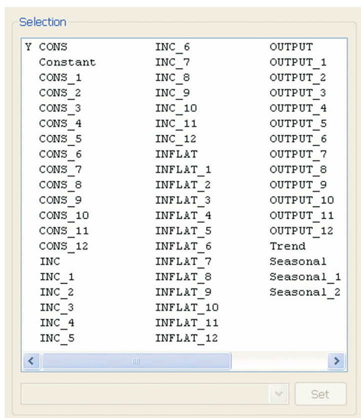
The success of automated Gets created renewed interest in computer-based algorithms. In particular, Hendry and Krolzig extended the algorithm of Hoover–Perez and developed *PcGets*, a user-friendly computer program aimed at the empirical modeller. *PcGets* was part of *GiveWin 2*.

Autometrics can be seen as the third generation, taking many features of the earlier implementations, but also differing in some aspects. Starting with **OxMetrics 5,** *Autometrics* is part of *PcGive* - now automatic model selection can be activated with as little as a single click.

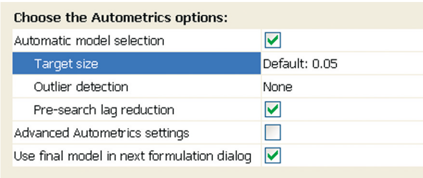
1.2 An example

To illustrate the use of *Autometrics*, we use the tutorial data set of *PcGive*, taking 12 lags of all variables.

The initial model is formulated in PcGive as any other dynamic model:



This general unrestricted model, or GUM, is the starting point for the automatic model selection procedure. The model settings dialog now has an Autometrics section:



The main choice is the significance level of the reduction, kept at 5%.
Autometrics finds four terminal models, and chooses:

	Coefficient	Std.Error	t-value
CONS_1	0.821298	0.03277	25.1
CONS_4	0.145121	0.05118	2.84
CONS_5	-0.119526	0.04076	-2.93
INC	0.519890	0.02719	19.1
INC_1	-0.293790	0.03266	-9.00
INFLAT	-1.00600	0.09926	-10.1
INFLAT_8	0.390943	0.1237	3.16
OUTPUT_12	-0.0557579	0.01388	-4.02

The entries with lag 2 or more are not in the DGP. However, the DGP also has a break, which is not allowed for in the model.

With presearch lag reduction switched off, PcGive finds six terminal models. But the one with the lowest Schwarz criterion is the same as before. One of the objectives of Autometrics was to reduce the dependence on presearch.

1.3 Stepwise versus Gets

It is well-established that stepwise regression is not a good model selection method. Here we give an example from the Hoover–Perez experiments 7 and 8, with DGP:

$$
\begin{aligned}
y_{7,t} &= 0.75 y_{7,t-1} + 1.33 x_{11,t} - 0.9975 x_{11,t-1} \\
&\quad + 6.44 u_t, \quad R^2 = 0.58 \\
y_{8,t} &= 0.75 y_{8,t-1} - 0.046 x_{3,t} + 0.0345 x_{3,t-1} \\
&\quad + 0.073 u_t, \quad R^2 = 0.93
\end{aligned}
$$

In addition to the 3 variables that matter, there are 37 irrelevant variables in the GUM. Using 1000 replications and a sample size of 139, we find:

	$y_{7,t}$	$y_{8,t}$	$y_{7,t}$	$y_{8,t}$
	Stepwise		*Autometrics*	
	1% nominal size			
Size	0.7	3.3	1.3	1.7
Power	100.0	52.5	100.0	99.3
	5% nominal size			
Size	3.0	5.9	5.2	6.0
Power	100.0	69.5	100.0	99.8

Stepwise regression differs from forward selection: both keep adding variables while they are significant, but stepwise will remove variables if they become insignificant when a new variable enters the model.
Size refers to the failure rate: the fraction of irrelevant variables selected into the final model. Power is the success rate in detecting the variables that should be in. We see that stepwise regression can sometimes work (experiment 7 has high t-values), but also fail badly compared to *Autometrics*.

[1] Hoover, K.D. & Perez, S.J. (1999), *Econometrics Journal*, **2**, 167–191.
Lovell, M. C. (1983), *Review of Economics and Statistics*, **65**, 1–12.
Hendry, D. F. & Krolzig, H.-M. (1999) *Econometrics Journal*, **2**, 202–219.

2 More variables than observations

One exciting development is that *Autometrics* can handle more variables than observations. Traditionally, this is considered infeasible — indeed, up to now *PcGive* would refuse to estimate such an equation. However, recently David Hendry, Søren Johansen and Carlos Santos considered adding a dummy variable for each observation. They study the theoretical properties, and give a feasible algorithm (which differs from the one *Autometrics* uses).

Now, when *Autometrics* is switched on, *PcGive* will switch to blocking mode when there are insufficient observations (usually $k > 0.8T$). This happens automatically, whether such a model was formulated on purpose or by accident!

Some caution though: the blocking algorithm does not fit the *Gets* framework anymore, and complex interactions may be missed.

To illustrate the procedure, we added 20 white noise variables to the dataset, labelled z.
The GUM is:

CONS,INC,INFLAT,OUTPUT	lags up to 12
$z_0 \ldots z_{19}$	lags up to 12
trend, seasonals	
constant	fixed
observations	**147**
variables	**315**

Now a reduction of 5% would almost surely result in severe overfitting.

When we run the reduction at 1% we find the same model as we did before at 5%, with an additional 13 z variables. This takes less than 10 seconds.

Six of the z variables are actually insignificant, but retained because they fail the backtest against the GUM. However, the GUM is somewhat artificial here, being constructed from the consecutive block searches. If we consecutively remove these we are left with just two z variables:

	Coefficient	Std.Error	t-value
CONS_1	0.813821	0.03258	25.0
CONS_4	0.175554	0.04976	3.53
CONS_5	-0.135373	0.03940	-3.44
INC	0.521166	0.02631	19.8
INC_1	-0.292743	0.03218	-9.10
INFLAT	-1.00229	0.09524	-10.5
INFLAT_8	0.431248	0.1192	3.62
OUTPUT_12	-0.0640259	0.01655	-3.87
z7_2	0.271571	0.08167	3.33
z7_12	-0.236731	0.08087	-2.93
Constant U	1.48692	11.25	0.132

3 Comparison with PcGets

Autometrics and *PcGets* have much in common: both are algorithms for automatic model selection within the general-to-specific framework. However, there are some important differences too:

- **Strategy**
  PcGets has two strategies: Liberal and Conservative. These correspond to 5% and 1% with carefully calibrated presearches.
  Expert mode allows for different settings, but looses the calibration between the various search components.

  In *Autometrics*, the nominal size of the reduction is specified directly, with the remainder adjusted accordingly.
- **Presearch**
  Autometrics relies much less on presearch. Simulation experiments show almost the same operating characteristics with and without presearch.
- **Path search**
  Autometrics does not implement the multiple-path search. This was introduced by Hoover–Perez to mimic the human modeller. However, the objective of using the computer is to improve on that where possible.

  Autometrics uses a tree search, systematically traversing the whole model space.
  Several strategies are used to speed this up, resulting in more frequent use of F-tests rather than t-tests, as well as cutting off irrelevant paths. Never is the same model estimated twice.
- **Diagnostic testing**
  While using roughly the same battery of diagnostic tests, *Autometrics* postpones the testing until a candidate terminal model has been found. If necessary, backtracking is used to find a valid model. This approach is faster and may result in more parsimonious models: it is possible that a test initially fails, but passes after a valid reduction.
- **Terminal models**
  As a consequence of more systematic search and less presearch, *Autometrics* tends to find more terminal models than *PcGets*.
- **k ≥ T**
  A block-search algorithm is used by *Autometrics* to handle the case of more variables than observations.
- **Dummy saturation**
  Dummy variables for each observation are optionally added to the GUM.
- **VARs and SEMs**
  Autometrics is implemented in terms of the log-likelihood and a battery of tests, and not restricted to single equation models.
  Therefore, it works just as happily with a VAR, using the vector versions of the diagnostic tests, and testing restrictions jointly in all equations.

  PcGive does not offer *Autometrics* for simultaneous equations yet, but the algorithm still applies, working within the SEM rather than equation-by-equation.

Comparisons of published *PcGets* experiments to identical experiments with *Autometrics* show that they are very similar in terms of power, but that *Autometrics* has better size performance in some cases.

New features in Ox™ Professional 5

by Jurgen. A. Doornik

1 Multi-threading

The main innovation in Ox Professional version 5 is a multi-threaded internal library.

Recent processor advances have moved towards multiple core architecture to gain speed. Not only is the single core significantly faster than three years ago, now you can get four of these in a single packet for almost the same price. Theoretically this is almost four times faster, but in practice it can be difficult to take advantage. All applications have to be redesigned to be multithreaded, so that they can run parts on different cores at the same time. Moreover, some computations can be split this way more naturally than others.

2 Some benchmarks

Many matrix and vector operations in *Ox Professional* will now work in parallel. This takes place inside the internal library, so is hidden from the Ox user: no code changes are required. The benefit depends on the type of Ox code: programs which use large matrices and vectors will benefit most. Programs that only use small matrices will not benefit at all.

To illustrate the benefits, we use the benchmark program `samples\bench\Ox2.ox`, which is heavily skewed towards large matrices. We compare Ox 4.1 to Ox 5.0 on a quad core 2.4 Ghz Intel Q6600 running Windows XP.[1] For Ox 5 we use one (-rp1), two (-rp2) and four cores (the default). The following five benchmarks are reported:

operation	dimension
1. matrix dot power	800 x 800
2. sorting	2 000 000
3. X´X	700 x 700
4. regression	600 x 600
5. full program	sum of 15 benchmarks

The full program has 15 benchmarks, 7 of which vectorize.

All timings are relative to *Ox Professional* 4.1. So we see in the graph below that for one thread (a single processor), Ox Professional 5 is 25% faster than Ox Professional 4.1 when considering the total time of the program (the 5th bar). This comes largely from the new sorting algorithm (a hybrid quick/heap sort, as in introsort). Dot-power, cross-product and regression scale well with the number of processors (or threads, to be precise). Sorting improves somewhat with two processors, but not beyond that. Many of the unreported benchmarks do not benefit from multi- threading, which is reflected in the full program timings.[2]

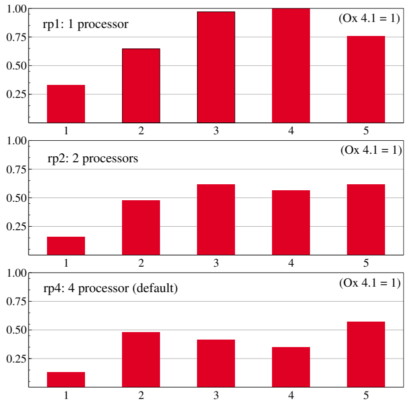


Figure: Timings of Ox 5 relative to Ox 4 on Quad core processor, using 1,2,4 threads.

3 MPI versus multi-threading

An Ox package for using MPI has been available for a while. This approach is quite different to multi- threading. When using MPI, independent processes are created which communicate via sockets. These processes typically run on separate computers. The advantage of using MPI is that, e.g., a Monte Carlo experiment can be split [3] - this is a very efficient way of using multiple processors. The drawback is that it requires rewriting the Ox code.

Later this year I plan to run comparisons linking four quad core computers together.

4 Other new features

- A 64-bit Windows version of Ox is installed in the `Ox\bin64` folder. Unlike the 64-bit Linux version, there is little speed difference with the 32-bit versions. The upper limit for the number of elements in 32- and 64-bit versions is the same: 2^{31}. But this can be fully used in the 64-bit version, allowing a matrix to take up to 8GB. The Console version will be 32-bit only.
- An `enum` can now be declared inside a class declaration. The constants defined this way behave as `static const decl` member variables. They can be `public`, and thus made visible outside the class.
- A few new functions: `ismember`, `classname`,`getfiles`.
- Some additional fixes and improvements, documented in the Ox help.

[1] A self-built computer costing less than £600!

[2] Note that Ox 5 Console will not be multi-threaded, and have lower scores in general.

[3] See Doornik, J. A., Hendry, D. F. & Shephard, N. (2002), Philosophical Transactions, Series A, **360**, 1245–1266, and (2006), Chapter 15 in Handbook of Parallel Computing and Statistics, Chapman & Hall/CRC.

New feature: Ox™ Batch Code for PcGive™ and G@RCH™

by Jurgen. A. Doornik

When estimating models in *OxMetrics*, the batch code is quietly generated in the background, to be saved using the Batch editor when needed. This now includes forecasts, test summary, and tests for linear and subset restrictions.

A new feature is that Ox code is also generated. To access it, use the new `Model` menu entry entitled `Ox Batch Code`. This will open a document window with the Ox code to estimate the most recent (or even the whole history) of estimated models.

Ox Professional (or *OxMetrics Enterprise*) is required to run the generated Ox code. The `.oxo` (i.e. compiled Ox) and `.h` (holding the declarations) files needed to run the code are part of *PcGive* (or *OxMetrics Enterprise*).

Because Ox is much more powerful than Batch, this can potentially be useful if, say, the same model has to be run routinely on new data or on very many series in turn.

G@RCH offers a similar functionality. *STAMP* will incorporate it at a later date.

New Features in G@RCH™5

by Sebastian Laurent

G@RCH is an OxMetrics module dedicated to the estimation and forecasting of univariate and multivariate ARCH-type models. G@RCH provides a menu-driven easy-to-use interface as well as some graphical features. For repeating tasks, the models can be estimated via the Batch Editor of OxMetrics or using the Ox language together with the Garch and MGarch classes.

1 Univariate GARCH Models

G@RCH is distributed with a book reviewing some of the most recent contributions in this field:

- Conditional Mean: ARMA, ARFIMA, ARCH-in-Mean, Explanatory Variables;
- Conditional Variance: GARCH, EGARCH, GJR, APARCH, IGARCH, RiskMetrics, FIGARCH, FIEGARCH, FIAPARCH, HY-GARCH; Explanatory Variables;
- (Quasi-)Maximum Likelihood: Normal, Student, GED or skewed-Student distribution; Constraint Maximum Likelihood, Simulated Annealing;
- (Mis)Specifications Tests: Information Criteria, Jarque-Bera, Box-Pierce statistics, LM ARCH test, Sign Bias Test, Pearson goodness-of-fit, The Nyblom stability test, Residual-Based Diagnostic for Conditional Heteroscedasticity, etc;
- Value-at-Risk, Expected shortfall, Backtesting (Kupiec LRT, Dynamic Quantile test);
- Realized volatility, Bi-Power variations and Jumps, Intraday Seasonality;

New features in univariate GARCH models:

- The estimation of EGARCH-type models and ARCH-in-mean model has been considerably improved.
- G@RCH 5 now provides some simulation capabilities through the menu Monte-Carlo GARCH, GJR, APARCH and EGARCH models are available with an ARMA in the conditional mean and normal, student, GED or skewed student errors. The simulated data can be plotted and stored in a separated dataset.
- Three unit root tests (ADF, KPSS and SP) and two long-memory tests (GPH and GSP) have been added (available through the 'descriptive statistics' menu).

2 Multivariate GARCH Models

It is now widely accepted that financial volatilities move together over time across assets and markets. To illustrate, Figure 1 plots the daily returns (in %) of two major US indices, namely the Dow Jones and Nasdaq (from 1989-09-28 to 2004-09-27). The unconditional correlation between the two series is about 70%.

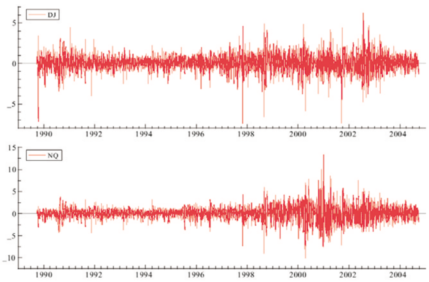


Figure 1: Dow Jones and Nasdaq indices. Daily returns in% from 1989-09-28 to 2004-09-27

Recognizing this feature through a multivariate GARCH (MGARCH) framework would lead to more relevant empirical models than working with separate univariate GARCH models. From a financial point of view, MGARCH models open the door to better decision tools in various areas, such as asset pricing, portfolio selection, option pricing, hedging, and risk management. Indeed, unlike at the beginning of the 1990s, several institutions have now developed the necessary skills to use the econometric theory in a financial perspective.

MGARCH framework

Consider a vector stochastic process $\{y_t\}$ of dimension $N \times 1$ and let Ω_{t-1} be the information set up to time $t-1$. MGARCH models belong to the following family of model:

$$y_t = \mu_t(\theta) + \varepsilon_t, \qquad (1)$$

where θ is a finite vector of parameters, $\mu_t(\theta)$ is the conditional mean vector and,

$$\varepsilon_t = H_t^{1/2}(\theta) z_t \qquad (2)$$

where $H_t^{1/2}(\theta)$ is a $N \times N$ positive definite matrix. See Bauwens, Laurent and Rombouts (2006) for a recent survey on MGARCH models.[1]

Several MGARCH models are now available in G@RCH 5.0: scalar BEKK, diagonal BEKK, RiskMetrics, CCC, two DCC models, OGARCH and two GOGRACH models.

The popular DCC model

Engle (2002) and Tse and Tsui (2002) propose a generalization of the CCC model by making the conditional correlation matrix time dependent.[2]

The DCC model of Engle (2002) is defined as:

$$H_t = D_t R_t D_t, \qquad (3)$$

where $D_t = \text{diag}(h_{11t}^{1/2} \dots h_{NNt}^{1/2})$ and h_{iit} can be defined as any univariate GARCH model, and

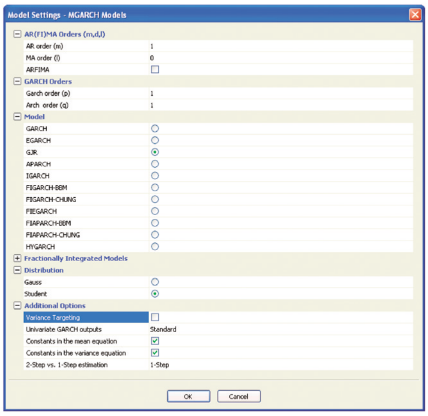
$$R_t = \text{diag}(q_{11,t}^{-1/2} \dots q_{NN,t}^{-1/2})\, Q_t\, \text{diag}(q_{11,t}^{-1/2} \dots q_{NN,t}^{-1/2}),$$

Where the $N \times N$ symmetric positive definite matrix $Q_t = (q_{ij,t})$ is given by:

$$Q_t = (1-\alpha-\beta)\bar{Q} + \alpha u_{t-1} u'_{t-1} + \beta Q_{t-1}, \qquad (4)$$

with $u_t = (u_{1t}\, u_{2t} \dots u_{Nt})'$ and $u_{it} = \varepsilon_{it}/\sqrt{(h_{iit})}$. $\bar{Q}$ is the $N \times N$ unconditional variance matrix of u_t, and α and β are nonnegative scalar parameters satisfying $\alpha + \beta < 1$.

The estimation of a DCC model with G@RCH 5 is extremely simple. Select 'DCC (Engle)' or 'DCC (TSE and TSUI)' in the Settings dialog box. A new dialog box Model Settings is launched and the user is asked to choose the specification of the model. We select an AR(1)-GJR(1,1)-DCC with a Student distribution for the error term. The DCC model can be estimated with a 2-step or 1-step estimation procedure. Part of the output of the 1-step procedure is reported below.




```
                       Coefficient          t-prob
Part: DJ
Cst(M)                    0.052200          0.0000
AR(1)                     0.016138          0.2099
Cst(V)                    0.008609          0.0001
ARCH(Alpha1)              0.022071          0.0003
GARCH(Beta1)              0.942047          0.0000
GJR(Gamma1)               0.050266          0.0000
Part: NQ
Cst(M)                    0.084663          0.0000
AR(1)                     0.095534          0.0000
Cst(V)                    0.007711          0.0024
ARCH(Alpha1)              0.044585          0.0000
GARCH(Beta1)              0.933715          0.0000
GJR(Gamma1)               0.035830          0.0013
Part:
Correlation
rho_21                    0.729203          0.0000
alpha                     0.038650          0.0000
beta                      0.951213          0.0000
df                        8.256183          0.0000

No.Obs.: 3913             No. Par.: 16
No.Series: 2              Log Lik.: -9645.358
```

3 Generate Ox Code

A new feature of G@RCH 5 is that an Ox code can be generated after the estimation of a model. The Model/Ox Batch Code command (or Alt+O) activates a new dialog box called 'Generate Ox Code' that allows the user to select an item for which to generate Ox code.

The code is then opened in a new window and provided Ox Professional is available, this code can be run, either from OxMetrics, or from OxEdit or the command line. This option is also available for the 'Univariate GARCH models', 'Descriptive Statistics' and 'Simulation' modules.

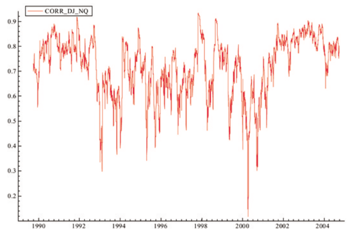
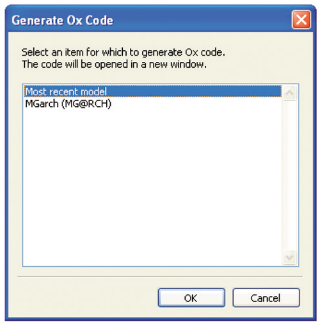


Figure 2: Conditional correlation between the Dow Jones and Nasdaq indices. AR(1)-GJR(1,1)-DCC model



Here is an example of Ox Batch code generated by G@RCH 5 after the estimation of the previous model.

```
#include <oxstd.h>
#include <oxdraw.h>
#import <packages/MGarch1/mgarch>
main()
{
//--- Ox code for MG@RCH(1)
decl model = new MGarch();

model.Load("DJNQ.xls");

model.Select(Y_VAR, {"DJ", 0, 0});
model.Select(Y_VAR, {"NQ", 0, 0});

model.CSTS(1,1);
model.DISTRI(STUDENT);
model.ARMA_ORDERS(1,0);
model.GARCH_ORDERS(1,1);
model.VARIANCE_TARGETING(1);
model.MODEL(DCC);
model.MLE(QMLE);
model.UGARCH_MODELS(GJR);
model.UGARCH_TRUNC(1000);
model.UGARCH_PrintOutput(1);
model.UGARCH_ARFIMA(0);
model.ONE_STEP(1);
model.SetSelSampleByDates(dayofcalendar(...
model.Initialization(<>);
model.PrintOutput(1);
model.DoEstimation();

delete model;
}
```

The MGarch class offers more flexibility than the rolling menus. When using the rolling menus, the same ARMA order is applied to each series. The previous code can be modified to allow different ARMA orders. Similarly, different GARCH orders and different GARCH-type models can be chosen for CCC, DCC, OGARCH and GOGARCH models. For instance, to select an AR(1)-GJR(1,1) for the Dow Jones and an MA(1)-GARCH(1,2) for the Nasdaq, the previous code has simply to be modified as follows:

```
model.ARMA_ORDERS(<1;0>,<0;1>);
model.GARCH_ORDERS(<1;1>,<1;2>);
...
model.UGARCH_MODELS(<GJR;GARCH>);
```

G@RCH 5 also provides some specific multi-variate miss-specification tests like a multivariate normality test, Hosking's portmanteau test, Li and McLead test, two constant correlation tests, etc .

[1] Multivariate GARCH Models: a Survey, *Journal of Applied Econometrics*, 21/1, 79-109.
[2] Dynamic Conditional Correlation: a Simple Class of Multivariate Generalized Autoregressive Conditional Heteroskedas- ticity Models, *Journal of Business and Economic Statistics*, 20, 339-350 and A multivariate Generalized Autoregresive Conditional Heteroskedasticity Model with Time-varying Correlations, *Journal of Business and Economic Statistics*, 20, 351-362.

New Features in STAMP™ 8: the Multivariate STAMP is back!

by S.J. Koopman

The multivariate capabilities of the STAMP program have been re-introduced in version 8. The multivariate structural time series model, where the unobserved components become vectors and the disturbance variances become disturbance variance matrices, can be considered again for the analysis of a set of multiple time series. However, the number of multivariate options has increased considerably:

New multivariate options in STAMP 8:

- Select components by equation: different components can be selected for different equations. This enables the user to analyse time series with different dynamic characteristics jointly. For example, consider two time series where one series may be subject to seasonal dynamics while the other series does not require a seasonal component. The trends of the two time series may move together. STAMP 8 allows the user to select a seasonal component for the first series but not for the second series. This applies to all components in STAMP: trend, seasonal , cycle, autoregressive, irregular, time-varying regressions, etc.
- Select regressions and interventions by equation: this option of selecting different explanatory variables and interventions for different equations was available in STAMP 5 and 6. However, the handling of this facility has improved and is more flexible.
- Multivariate models in STAMP 5 and 6 were limited in their choice of variance matrices: only full variance matrices of different ranks could be considered. A reduced-rank variance matrix implies common features in multiple time series. This option remains in STAMP but has improved. The dependence structure of a component (between the different equations) can be designed by the user in a very simple way, for each component. For example, the cycle component in equation 1 can be forced to rely on the cycles in equations 2 and 3 only.
- In STAMP 8 different variance matrices for different disturbances can be chosen. The range of variance matrices includes scalar and diagonal matrices, scaled matrices of ones (when applied to the slope component, this implies balanced growth) and rank one plus diagonal matrices. The latter case implies that each multivariate component can be decomposed into common and idiosyncratic effects. In many applications, these different specifications can be highly interesting.
- The multivariate options extend to all models introduced in STAMP 7 including the higher-order smooth trend models, the higher-order (bandpass) cycle components and the (vector) autoregressive components of orders 1 and 2 .
- STAMP 8 can handle missing observations in univariate time series but also in multivariate time series. This allows the interpolation of missing observations through time but also through different equations.
- The forecasting of multivariate time series is as simple as for univariate time series. STAMP 8 allows the incorporation of available future observations for the explanatory variables in the database.
- Estimation of parameters in multivariate time series models is based on exact procedures: the diffuse initialisation of the Kalman filter is implemented, the exact likelihood function is computed and the score function with respect to variance parameters is computed analytically and fast. This leads to a robust estimation procedure and a relatively fast estimation process.
- The amount of graphical output for multivariate models can increase rapidly. STAMP 8 offers an easy handling of the graphical output. An option for graphics output selection for each equation is provided. The powerful tools in OxMetrics 5 to edit graphical output are fully available to STAMP 8 users.

Automatic selection of outliers and breaks in trends

- STAMP 8 is able to propose a set of potential outliers and trend breaks for univariate and multivariate time series. It is a basic but effective two-step procedure based on the auxiliary residuals. First the selected model is estimated and the diagnostics are investigated. Then a first (larger) set of potential outliers and trend breaks are selected from the auxiliary residuals. After re-estimation of the model, only those interventions survive that are sufficiently significant. In the multivariate case, this selection procedure is carried out jointly for each equation in the model.
- After the automatic selection, the results are reported. All considered outliers and breaks are kept in the intervention dialog and they can be deleted from the model or added to the model in the usual way and implemented as in STAMP 7. For future use, the interventions can be saved. It prevents the manual input of outliers and breaks altogether.
- The automatic selection procedure can be repeated with the inclusion of a fixed set of explanatory and intervention variables.

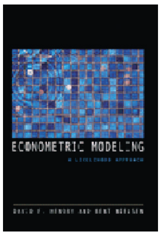
Other new features in STAMP 8

- Each parameter in the models of STAMP 8 can be edited directly. They can be kept fixed to a particular value. Variances can be kept fixed to values relative to a particular variance of another component (q-ratios). This facility also applies to multivariate models.
- The forecasting options have been extended and made more flexible. The number of output options has also increased. Future values of explanatory variables available in the database can also be used for the forecasting of the dependent variables.
- More output diagnostics are presented for predictions (one-step and multi-step), auxiliary residuals and weight and gain functions.

Timberlake Consultants' bookshop (New Books published in 2007)

These books can be found on our Website and can be bought at Timberlake Consultants.

Econometric Modelling: A Likelihood Approach



by David F. Hendry and Bent Neilsen
Published by Princeton University Press
Price: £29.95 (Paperback)

ISBN-13: 978-0-691-13089-7
Publication date: March 2007
378 pages, numerous tables and figures.
Data and solution to exercises are available on the Web.

David Hendry and Bent Nielsen introduce modelling for a range of situations, including binary data sets, multiple regression, and cointegrated systems. In each setting, a statistical model is constructed to explain the observed variation in the data, with estimation and inference based on the likelihood function. Substantive issues are always addressed, showing how both statistical and economic assumptions can be tested and empirical results interpreted. Important empirical problems such as structural breaks, forecasting, and model selection are covered and Monte Carlo simulation is explained and applied.

An Introduction to State Space Time Series Analysis

by Jacques J.F Commandeur and Siem Jan Koopman
Published by Oxford University Press. Also sold by Timberlake Consultants.
Price: £24.99 (Hardback)

ISBN-13: 978-0-19-922887-4
Publication date: 19 July 2007
188 pages, numerous tables and figures.
!st book in the Series:
PRACTICAL ECONOMETRICS

This book provides:
- Accessible introduction to state space methods in time series analysis for those with a basic understanding of classical linear regression models
- Provides a complete exposition with a clear introduction of the ideas and workings underlying the methods
- Uses a clear step by step treatment and provides practical examples throughout

Readings in Unobserved Components Models

Edited by Andrew C. Harvey and Tommaso Proietti
Published by Oxford University Press.
Also sold by Timberlake Consultants.
Price: £27.50 (paper)

ISBN-13: 978-0-19-927869-5
Publication date: 7 April 2005
474 pages.
Series: Advanced Texts in Econometrics

This book presents a collection of readings which give the reader an idea of the nature and scope of unobserved components (UC) models and the methods used to deal with them. It contains four parts, three of which concern recent theoretical developments in classical and Bayesian estimation of linear, nonlinear, and non Gaussian UC models, signal extraction and testing, and one is devoted to selected econometric applications.

5th OxMetrics™ User Conference, 20 - 21 Sept 2007 - Agenda

(subject to slight changes)

Thursday, 20 September 2007

Session 1: Tests

Chairperson: Lorenzo Trapani

- **A Low-Dimension Collinearity-Robust Test for Non-linearity - *Jennifer L Castle*** and *David F. Hendry* (Economics Department, Oxford University, UK)

- **Testing for Dynamics in the Conditional Variance Asymmetry: a Residual-based Approach** – *Phillipe Lambert, **Sebastien Laurent** and David Veredas (Université de Liège, Belgium; University of Namur and CORE, Université Catholique de Louvain, Belgium; ECARES, Université Libre de Bruxelles and CORE, Université Catholique de Louvain,Belgium)*

- **A Distribution-Free Test for Changes in the Distribution – *Lorenzo Trapani*** *(Cass Business School, UK & Universita' di Bergamo, Italy)*

Session 2: Shifts

Chairperson: Siem Jan Koopman

- **I(2) Cointegration Analysis in the presence of Deterministic Shifts – *Takamitsu Kurita*** *(Faculty of Economics, Fukuoka University, Japan)*

- **Forecast Adjustment and Learning – *Nicholas Fawcett*** *(Oxford University, UK)*

- **Testing present value model under shift with bootstrap-based Wald test: the Japanese term structure – *Zhu Xiaoneng*** *(Division of Economics, HSS Nanyang Technological University, Singapore)*

Session 3: Tests

Chairperson: Charles Bos

- **South American Disinflation and Regime Switches: Unobserve Volatility Components – *Alberto Humala*** *(Central Reserve Bank of Peru, Peru)*

- **Forecasting good volatility and bad volatility – *Matteo Pelegatti*** *(Department of Statistics, Universita' degli Studi di Milano-Bicocca, Italy)*

- **Model-based Estimation of High Frequency Jump Diffusions with Microstructure Noise and Stochastic Volatility – *Charles Bos*** *(Department of Econometrics, Vrije Universiteit Amsterdam, The Netherlands)*

Session 4: OxMetrics Developments

Chairperson: Giovanni Urga

Round Table Discussion with OxMetrics Developers. Following a 5-10 minute introduction each from Jurgen Doornik, David Hendry, Siem Jan Koopman and Sebastien Laurent, the main aim of the round table is to provide a forum for an exchange of suggestions and ideas for future developments of the software.

Conference Dinner

Friday, 21 September

Session 5: Econometric Methodology

Chairperson: James Davidson

- **Forecasting, Structural Breaks and Non-linearities – *David F. Hendry*** *with Jennifer L. Castle, Nicholas Fawcett and James Reade (Economics Department, Oxford University, UK)*

Session 6: Estimating when p>n

Chairperson: Ugis Sprudz

- **Econometric Modelling When There Are More Variables Than Observations – *Jurgen A. Doornik*** *(Oxford University, UK)*

- **The Impact of Macro News on the Term Structure – *Daniel Braberman*** *and Giovanni Urga (Cass Business School, London, UK and Bergamo University, Italy)*

- ***Building Dynamic Marketing Models When There Are More Observations Than Variables*** – *Jurgen A. Doornik and **Ugis Sprudz** (Oxford University, UK; Marketing Department, Allstate Insurance Company, USA)*

Session 7: Time Varying Parameters

Chairperson: Jurgen Doornik

- **Extracting business cycles using semi-parametric time-varying spectra with applications to U.S. macroeconomic time series – *Siem Jan Koopman*** *and Brian Soon Yip Wong (Department of Econometrics, Vrije Universiteit Amsterdam, The Netherlands*

- **Modeling Meteorological Predictors of the Abundance of Deer Mice (Peromyscus maniculatus) in the Northwestern United States – *Robert A. Yaffee*** *et al. (New York University, USA)*

Lunch and End of Conference

TIMBERLAKE CONSULTANTS LTD
HEAD OFFICE: Unit B3, Broomsleigh Business Park, Worsley Bridge Road, London SE26 5BN UK
Tel.: +44 (0)20 8697 3377 | Fax: +44 (0)20 8697 3388 | e-mail: info@timberlake.co.uk
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