A DETAILED COMPARISON OF VALUE AT RISK IN INTERNATIONAL STOCK EXCHANGES

PILAR ABAD
SONIA BENITO
De conformidad con la base quinta de la convocatoria del Programa de Estímulo a la Investigación, este trabajo ha sido sometido a evaluación externa anónima de especialistas cualificados a fin de contrastar su nivel técnico.

ISSN: 1988-8767

La serie DOCUMENTOS DE TRABAJO incluye avances y resultados de investigaciones dentro de los programas de la Fundación de las Cajas de Ahorros.
Las opiniones son responsabilidad de los autores.
A Detailed Comparison of Value at Risk in International Stock Exchanges*

Pilar Abad*
Sonia Benito**

Abstract:

This work investigates the performance of different models of Value at Risk (VaR). We include a wider range of methods (Parametric, Historical simulation, Monte Carlo simulation, and Extreme value theory models) and several models to compute the conditional variance (exponential moving averages, GARCH and asymmetric GARCH models) under Normal and Student’s t-distribution of returns. We analyse four European indexes (IBEX-35, CAC40, DAX and FTSE100), the American Dow Jones and S&P 500 indexes, the Japanese Nikkei 225 index and the Hong Kong Hang Seng index. We examine two periods: a stable period and a volatile one. To choose the best model, we employ a two-stage selection approach. First, we test the accuracy of different models of VaR. We use the unconditional and conditional coverage test, the Back-Testing criterion and the dynamic quantile test. A model survived if all tests indicated the model is accurate. With regard to the first stage, the best models are Parametric and Extreme value theory methods, when they use asymmetric and non-asymmetric GARCH models under Student’s t-distribution of returns. Second, we evaluate the loss function of these models. We use several non-parametric tests to test the superiority of a VaR model in terms of the loss function. The result of the second stage indicates that the best model is a Parametric model with conditional variance estimated by asymmetric GARCH model under Student’s t-distribution of returns. Nowadays the Parametric models are not as popular because some authors argue that the most conventional parametric specifications have failed in capturing some rare events. However, this paper shows that these models can obtain successful VaR measures if conditional variance is estimated with a GARCH model to capture the characteristic of the returns. This model is usually an exponential GARCH under Student’s t-distribution of returns.

JEL: G32, G11, C52.

Keywords: Value at Risk (VaR), Parametric model, Extreme theory value model, GARCH model, Risk management.

* Universidad Rey Juan Carlos and IREA-RFA (Universidad de Barcelona) Paseo Artilleros s/n. 28032, Madrid (Spain) E-mail: pilar.abad@urjc.es
** Universidad Nacional de Educación a Distancia (UNED) Senda del Rey 11 28223, Madrid, Spain E-mail: soniabm@cee.uned.es

*The authors acknowledge and appreciate the funding from the Ministry of Science and Technology through projects ECO2008-02752/ECON, SEJ2006-14354/ECON.
1. Introduction

Market risk management is a fundamental duty of financial institutions and regulators. Hence, knowing the most appropriate methodology for risk measurement in each context is of utmost importance, and we contribute to that undertaking with a detailed statistical comparison of the performance of the most popular Value at Risk (VaR) methodologies.

In spite of a wide variety of available methodologies to estimate the VaR of a given portfolio, there is an active stream of literature that keeps proposing new avenues for VaR estimation to try to improve upon the existing ones. However, there are surprisingly few empirical studies that attempt to compare VaR measures.

Recent work includes a wide range of methods: Historical simulation, Monte Carlo simulation, Parametric under non-parametric distribution, and Extreme value theory methods [see Bao et al. (2006), Consigli (2002) and Danielson (2002), among others, who show that in stable periods Parametric models provide satisfactory results that become less satisfactory during high volatility periods]. Additional studies that find evidence in favour of Parametric methods are Sarma et al. (2003), who compare Historical simulation and Parametric methods, and Danielson and Vries (2000) in a similar comparison that also includes Extreme value theory methods. Chong (2004), who uses Parametric methods to estimate VaR under a Normal distribution and under a Student’s t-distribution, finds a better performance under Normality.

Another issue is related to the appropriate modelling of the conditional variance of returns. With the exception of Sarma et al. (2003), the papers mentioned above do not compare volatility models. However, some authors show that there are differences in VaR accuracy depending on the volatility models. Hansen and Lunde (2005) find evidence that GARCH models, which allow for a leverage effect, have a better forecasting performance for future returns. Gonzalez-Riviera et al. (2004) and Ñiguez (2008) find that more sophisticated volatility models are preferred when the aim is VaR forecasting. Unfortunately, both papers consider only Parametric models.

Unlike the above mentioned literature, the aim of this paper is to provide an extensive comparison of a wide array of VaR methodologies. The main differences with the previous literature are: (1) we consider a more exhaustive set of methods: Historical and Monte Carlo simulation, Parametric approach and Extreme value theory method, (2) when conditional variance needs to be modelled, we include several models (one of
them is the asymmetric GARCH model under both a Normal and a Student’s t-distribution of returns that allows for the leverage effect usually observed in financial returns), (3) we analyse the VaR performance in stable and volatile periods, and (4) we evaluate VaR methods on the basis of two criteria: from the point of view of their forecasting accuracy and also from the point of view of a reasonable loss function that might represent investors’ or regulators’ concerns.

In the next section we present the VaR models we use in the paper. In the third section, we present the statistical test and the loss function that we use to evaluate the performance of the VaR measures. The fourth section presents the empirical results. The last section includes the main conclusions.

2. Characteristics of VaR Models

Let \( r_1, r_2, r_3, \ldots r_n \) be identically distributed independent random variables representing financial returns. Use \( F(r) \) to denote the cumulative distribution function, \( F(r) = \Pr(r < r / \Omega_{t-1}) \) conditional on the information set \( \Omega_{t-1} \) available at time t-1. Assume that \( \{r_i\} \) follows the stochastic process

\[
    r_i = \mu_i + \varepsilon_i = \mu_i + \sigma_i z_i
\]

where \( \mu_i = E(\varepsilon_i / \Omega_{t-1}) \), \( \sigma_i^2 = E(\varepsilon_i^2 / \Omega_{t-1}) \) and \( \{z_i\} \equiv \varepsilon_i / \sigma_i \) has conditional distribution function \( G(z) \), \( G(z) = \Pr(z_i < z / \Omega_{t-1}) \). The VaR with a given probability \( \alpha \in (0,1) \), denoted by \( \text{VaR}(\alpha) \), is defined as the \( \alpha \) quantile of the probability distribution of financial returns\(^1\):

\[
    F(\text{VaR}(\alpha)) = \Pr(r_i < \text{VaR}(\alpha)) = \alpha \tag{2}
\]

This quantile can be estimated in two different ways: (1) inverting the distribution function of financial returns, \( F(r) \), and (2) inverting the distribution function of standardized financial returns, \( G(z) \). With regard to the latter, it is also necessary to estimate \( \mu_i \) and \( \sigma_i^2 \).

\[
    \text{VaR}(\alpha) = F^{-1}(\alpha) = \mu_i + \sigma_i G^{-1}(\alpha) \tag{3}
\]

\(^1\) To avoid possible ambiguities, sometimes VaR is defined as: \( \text{VaR}(\alpha) = \inf \left\{ v \mid \Pr(r_i \leq v) = \alpha \right\} \).
Hence a VaR model involves the specifications of $F(r)$, or $\mu_t$, $\sigma_t^2$ and $G(z)$. Historical simulation, Monte Carlo simulation and unconditional Extreme value theory\(^2\) approaches all focus on estimating $F(r)$. On the other hand, the Parametric and conditional Extreme value theory approaches focus on estimating $G(z)$. We describe the general characteristics of the methods that we compare in this paper.

The **Parametric method** assumes that standardized financial returns follow a known distribution function. We have considered two types of distributions: Normal and Student’s t-distribution.

If $\{\epsilon_t\} \equiv \epsilon_t / \sigma_t$ follows a standard Normal distribution, $\Phi(z)$; then \(VaR(\alpha) = \mu_t + \sigma_t \Phi^{-1}(\alpha)\), where $\Phi^{-1}(\alpha)$ is the quantile $\alpha$ of the standard Normal distribution, and $\mu_t$ and $\sigma_t^2$ are the conditional mean and variance of financial returns, respectively. In all cases considered, we assume as the model for the mean: $\mu_t = \mu$.\(^3\) To estimate the conditional variance of financial returns, we use (1) the asymmetric GARCH model which captures the characteristic of each return (EGARCH)\(^4\), (2) the Riskmetrics model of J.P. Morgan\(^5\), and (3) the GARCH(1,1) model. These are usually used in other papers as benchmarks.

If we assume that $\{\epsilon_t\} \equiv \epsilon_t / \sigma_t$ follows a Student’s t-distribution with $v$ degrees of freedom, $(T_v(z))$; then $VaR(\alpha) = \mu_t + \sigma_t T_v^{-1}(\alpha)$, where, $T_v^{-1}(\alpha)$ is the $\alpha$ quantile of Student’s t-distribution with $v$ degrees of freedom, and $\mu_t$ and $\sigma_t^2$ are the conditional mean and variance of financial returns. To estimate $\sigma_t^2$, we use the asymmetric EGARCH model for each index.

Therefore, with the parametric method we obtain four VaR measures for each index, which we denote: *EWMA* (the exponential weighted moving average model of

---

\(^2\) The extreme value theory really focuses on direct modelling of the distribution tails.

\(^3\) This is based on the practical absence of any significant autocorrelation in returns.

\(^4\) Exponential GARCH model (EGARCH) (Nelson, 1991) captures the leverage effect, which is detected in all indexes using the bias and sign tests proposed by Engle and Ng (1993). Although there are other models that capture this effect, Nelson’s model is the most popular in the literature. The EGARCH model is: \[ \log(\sigma_t^2) = \omega + \sum_{j=1}^{p} \rho_j \log(\sigma_{t-j}^2) + \sum_{j=1}^{q} \theta \left( \frac{\epsilon_{t-j}}{\sigma_{t-j}} - \frac{\epsilon_{t-j}}{\bar{\sigma}_{t-j}} \right) + \beta \left( \frac{\epsilon_{t-j}}{\sigma_{t-j}} - \frac{\epsilon_{t-j}}{\bar{\sigma}_{t-j}} \right) \] where $p=q=1$ for all indexes, except for S&P where $q=1$ and $p=2$.

\(^5\) The Riskmetrics volatility estimate is an exponential moving average $\sigma_t^2 = (1-\lambda) \sum_{j=0}^{N-1} \lambda^j (r_{t-j})^2$ with a parameter $\lambda = 0.94$ and a window size of 74 days. This size was selected by Riskmetrics as an optimal window size for daily investments.
Riskmetrics), GARCH(1, 1), EGARCH (assuming a Normal distribution for returns), and T-EGARCH (assuming a Student’s t distribution).

The **Historical simulation** method uses the empirical distribution of financial returns as an approximation for $F(r)$, so that in this method $\text{VaR}(\alpha)$ is the $\alpha$ quantile of the empirical distribution: $\text{VaR}(\alpha) = \hat{q}(\alpha)$. The empirical distribution of financial returns is simulated by considering different samples with size: N= 1250, 500, 250 and 125 daily observations.

With regard to **Monte Carlo simulation**, the underlying stochastic process that drives the dynamics of financial returns needs to be specified. To generate the future financial returns, we use autoregressive models ($r_t = \mu + \sum_{i=1}^{p} \phi_i r_{t-i} + \varepsilon_t$) which imply at time $t+1$:

$$r_{t+1} = \mu + \sum_{i=1}^{p} \phi_i r_{t+1-i} + \varepsilon_{t+1}$$

(4)

At time $t$, $\varepsilon_{t+1}$ is unknown and needs to be forecasted in order to have a forecast for $r_{t+1}$. To that end, we either assume that $\varepsilon_{t+1}$ follows a Normal distribution or else use Bootstrapping techniques.6

**Extreme value theory** approach focuses on the limiting distribution of extreme returns observed over a long time period, which is essentially independent of the distribution of the returns themselves. The two main models for Extreme value theory are: the block maxima models (McNeil, 1998) and the peaks-over-threshold (POT) model. We use the POT model because it is generally considered to be the most useful for practical applications, due to the more efficient use of the data on extreme values. We can distinguish between two types of analysis: the semi-parametric models built around Hill estimator and its relatives (Beirlant et al. 1996, Danielson, Hartman and

---

6 (1) If $\varepsilon_{t+1}$ follows a Normal distribution, then $\varepsilon_{t+1} = \sigma \delta$, where $\sigma$ is the unconditional standard deviation of $\varepsilon$ and $\delta$ is an observation of the Normal standard distribution which we have simulated using a statistical program (MATLAB). (2) When we use bootstrapping techniques, we use $H(\varepsilon)$ to denote the distribution function of $\varepsilon_{t+1}$, where $H(\varepsilon)$ follows a Uniform distribution [0,1]. We simulate the Uniform distribution and work out the value of $\varepsilon_{t+1}$ by $\varepsilon_{t+1} = H(\varepsilon)$. For each simulated $\varepsilon_{t+1}$ value, we obtain a simulated value of $r_{t+1}$. Repeating this 1000 times, we obtain 1000 simulated financial returns. The $\text{VaR}(\alpha)$ can then be calculated as $\text{VaR}(\alpha) = \hat{q}_{\text{MC}}(\alpha)$, where $\hat{q}_{\text{MC}}(\alpha)$ is the $\alpha$ quantile of the 1000 simulated financial returns.
Vries 1998), and the fully parametric models based on the generalized Pareto distribution (Embrechts, Resnic & Samorodnitsky 1998). We use the latter approach.

Among the random variables representing financial returns \( r_1, r_2, r_3, \ldots, r_n \), we choose a low threshold \( u \) and look at all values \( (y) \) exceeding \( u \): \( y_1, y_2, y_3, \ldots, y_{N_u} \), where \( y_i = r_i - u \) and \( N_u \) are the number of sample data over \( u \). The distribution of excess losses over the threshold \( u \) is defined as:

\[
F_u(y) = P(r - u < y / r > u)
\]

\[
F_u(y) = \frac{F(y + u) - F(u)}{1 - F(u)}
\]  

Assuming that, for a certain \( u \), the distribution of excess losses above the threshold is a Generalized Pareto Distribution, \( G_{k, \xi}(y) = 1 - \left[ 1 + \frac{k}{\xi} y \right]^{\frac{1}{k}} \), the distribution function of returns is given by:

\[
F(r) = F(y + u) = \left[ 1 - F(u) \right] G_{k, \alpha}(y) + F(u)
\]

To construct a tail estimator from (6), the only additional element we need is an estimate of \( F(u) \). For this purpose, we take the obvious empirical estimator \( (u - N_u)/u \). We then use the historical simulation method. Introducing the historical simulation estimate of \( F(u) \) and setting \( r = y + u \) in the equation, we arrive at the tail estimator

\[
F(r) = 1 - \frac{N_u}{n} \left[ 1 + \frac{k}{\xi} (r - u) \right]^{-\frac{1}{k}}, \quad r > u
\]  

For a given probability \( \alpha > F(u) \), the VaR estimate is calculated by inverting the tail estimation formula (7) to get

\[
VaR(\alpha) = u + \frac{\xi}{k} \left[ \frac{n}{N_u} (1 - \alpha) \right]^{-k} - 1
\]  

None of the previous Extreme value theory-based methods for quantile estimation yields VaR-estimates which reflect the current volatility background. These are called unconditional Extreme value theory methods. Given the conditional heteroscedasticity characteristic of most financial data, McNeil and Frey (2000) proposed a new methodology to estimate VaR which combines the Extreme value theory with volatility models. This is known as conditional Extreme value theory.
Let \((r_1, r_2, r_3, \ldots, r_T)\) be a strictly stationary time series representing financial returns. We assume that the dynamics of \(r\) is given by
\[
r_t = \mu_t + \sigma_t z_t
\]
where the innovations \(z_t\) are a strict white noise process with zero mean, variance equal to one and marginal distribution function \(F_z(z)\). Assuming that \(z_t\) follows a Generalized Pareto Distribution, denoted by \(G_{k,\sigma}(z)\), the conditional \(\alpha\) quantile of the returns can be estimated as
\[
VaR(\alpha) = \mu_t + \sigma_t G_{k,\sigma}^{-1}(\alpha)
\]
where \(\mu_t\) and \(\sigma_t^2\) are the conditional mean and variance of financial returns, respectively. Just as in parametric methods, \(\mu_t = \mu\) and \(\sigma_t^2\) are estimated using the same volatility models [EWMA, GARCH(1,1) and EGARCH under a (1) Normal distribution and (2) Student’s t-distribution]. \(G_{x}^{-1}(\alpha)\) is the \(\alpha\) quantile of the Generalized Pareto Distribution:
\[
G_{k,\sigma}^{-1}(\alpha) = u + \frac{\xi}{k} \left[ \frac{n}{N_u} (1 - \alpha) \right]^{-k} - 1
\]

3. Data

To study these VaR methodologies, we generate out-of-sample VaR forecasts for returns of 8 equity portfolios. We analyse four European indexes: the Spanish IBEX-35, the French CAC40, the German DAX and the British FTSE100. Furthermore, we include the American Dow Jones and S&P 500 indexes, the Japanese Nikkei 225 index and the Hong Kong Hang Seng index. These indexes were obtained from the Web of Yahoo Finance (Spain)\(^7\) for the period from January 2nd, 1994 to April 28th, 2006. Returns are calculated as \(r_t = \ln(I_t / I_{t-1}) \times 100\).

We select two samples to generate out-of-sample VaR forecasts for these 8 portfolios’ returns. These samples are quite different from each other. The first sample, called \(\text{volatile period}\), covers the period from 1 January 2001 to 31 December 2002. This period was really volatile in all stock markets because there was a financial crisis. The second sample, called \(\text{stable period}\), covers the period from 1 May 2004 to 30 April

\(^7\) http://es.finance.yahoo.com/
2006 and it was a non-volatile period. Both of them have approximately 500 data, leaving 500 trading days for the out-of-sample evaluation.  

To compare these VaR models, we work with out-of-sample one-step-ahead forecasts. First we study the volatile period sample. We have a sample from 2 January 1994 to 31 December 2002, and we split it into an in-sample part (from 2 January 1994 to 31 December 2000) and an out-of-sample part (volatile period). Then we use a rolling scheme to obtain 500 one-step-ahead forecasts. Second we study the stable period sample (from 2 January 1994 to 30 April 2006), and we split it into an in-sample part and an out-of-sample part (stable period).

4. Evaluation Framework

We compare the VaR methodologies using a two-stage selection approach. Since a minimum degree of reliability should be required, we remove in a first stage those methods that fail to pass a given number of statistical accuracy tests. The selected VaR models are then compared in a second stage on the basis of linear and squared loss functions. So while we rely on counting statistics in the first stage, we use a quantitative loss function in the second stage.

First, we test the accuracy of different models of VaR. We use the standard tests: unconditional and conditional coverage test, the Back-Testing criterion and the dynamic quantile test. We consider that a model is good if all tests indicate the model is accurate and then if it survives the first stage.

As usual, we define the exception to compare VaR(α) measures and the actual change in portfolio value on day t+1 (denoted as ΔV_{t+1}). If ΔV_{t+1} < VaR(α), then we have an exception. We define the exception indicator variable as:

\[ I_{t+1} = \begin{cases} 1 & \text{if } \Delta V_{t+1} < VaR(\alpha) \\ 0 & \text{if } \Delta V_{t+1} \geq VaR(\alpha) \end{cases} \]

Kupiec (1995) shows that if we assume the probability of an exception is constant, then the number of exceptions (\[ \sum I_{t+1} \]) follows a binomial distribution B(N, α), where N is the number of observations. An accurate VaR(α) measure should produce

---

8 The sample size depends on the stock market of each index, but all samples have approximately 500 data.

9 An open question in VaR methodology is whether a model with more, but small, exceptions might be preferable to another with less exceptions.
an unconditional coverage \((\hat{\alpha} = \sum I_{t+1} / N)\) equal to \(\alpha\) percent. The unconditional coverage test has as null hypothesis \(\hat{\alpha} = \alpha\), with a likelihood ratio statistic:

\[
LR_{uc} = 2 \left[ \log(\hat{\alpha}^\alpha (1-\hat{\alpha})^{N-\alpha}) - \log(\alpha^\alpha (1-\alpha)^{N-\alpha}) \right]
\]

which follows an asymptotic \(\chi^2(1)\) distribution.

Christoffersen (1998) developed a conditional coverage test. This jointly examines if the total number of exceptions is statistically equal to the expected one and the serial independence of \(I_{t+1}\). The likelihood ratio statistic of the conditional coverage test is \(LR_{cc} = LR_{uc} + LR_{ind}\), which is asymptotically distributed \(\chi^2(2)\), and the \(LR_{ind}\) statistic is the likelihood ratio statistic for the hypothesis of serial independence against first-order Markov dependence.\(^{10}\)

A similar test for the significance of the departure of \(\hat{\alpha}\) from \(\alpha\) is the back-testing criterion statistic:

\[
Z = (N\hat{\alpha} - N\alpha) / \sqrt{N\alpha(1-\alpha)}
\]

which follows an asymptotic \(N(0,1)\) distribution.

Finally, the Dynamic Quantile (DQ) test proposed by Engle and Manganelli (2004) examines if the exception indicator is uncorrelated with any variable that belongs to the information set \(\Omega_{t-1}\) available when the VaR was calculated. This is a Wald test of the hypothesis that all slopes in the regression model

\[
I_t = \beta_0 + \sum_{i=1}^p \beta_I I_{t-1} + \sum_{j=1}^q \mu_j X_j + \varepsilon_t
\]

are zero, where \(X_j\) are explanatory variables contained in \(\Omega_{t-1}\). In our implementation of the test we use \(p=5\) and \(X=\text{VaR}(\alpha)\). By doing this, we are testing for whether the probability of an exception depends on the level of the VaR.

In the second stage we evaluate the magnitude of the losses experienced when an exception occurs by the models that survive the first stage. Lopez (1999) developed a loss function that accommodates the specific concerns of risk managers and proposed to

\(^{10}\) The \(LR_{ind}\) statistic is \(LR_{ind} = 2 \left[ \log L_a - \log L_0 \right]\) and has an asymptotic \(\chi^2(1)\) distribution. The likelihood function under the alternative hypothesis is \(L_a = (1-\pi_{01})^{N_{01}} \pi_{01}^{N_{01}} (1-\pi_{11})^{N_{11}} \pi_{11}^{N_{11}}\) where \(N_{ij}\) denotes the number of observations in state \(j\) after having been in state \(i\) in the previous period, \(\pi_{01} = N_{01} / (N_{00} + N_{01})\) and \(\pi_{11} = N_{11} / (N_{10} + N_{11})\). And the likelihood function under the null hypothesis \((\pi_{01} = \pi_{11} = \pi = (N_{11} + N_{01}) / N)\) is \(L_0 = (1-\pi)^{N_{01}+N_{11}} \pi^{N_{01}+N_{11}}\).
examine the distance between the observed returns and the forecasted VaR(\(\alpha\)) values if an exception occurs. We measure the magnitude of the losses through this loss function:

\[
I_{t+1} = \begin{cases} 
\left(\Delta V_{t+1} - VaR(\alpha)\right)^2 & \text{if } \Delta V_{t+1} < VaR(\alpha) \\
0 & \text{if } \Delta V_{t+1} \geq VaR(\alpha) 
\end{cases}
\]

where the VaR measure is penalized with the square distance. So one VaR model is preferred over another if it yields a lower mean loss value, defined as the mean of the penalty scores: \(\sum_{t=1}^{N} I_{t+1}/N\).

We select the best model among the surviving models. The best model is the one that minimizes the mean of the associated penalty scores. Nevertheless, we use several non-parametric statistics to test the superiority of the best model, that is, if the mean of this model is different from the mean of the other models. First, we use the Friedman test. This test is an alternative to the ANOVA test, when the assumption of Normality or that of equality of variance are not met. The null hypothesis of the Friedman test is that the penalty scores are the same for the alternative models versus the alternative hypothesis that the penalty scores from at least one model’s loss function are different from at least another one. The test statistic is a Chi-square with \(n-1\) degrees of freedom, where \(n\) is the number of the model’s loss functions. Friedman’s test compares all models to each other, and it could lead to rejection if two ill-performing models are significantly different from each other. To clarify that possible situation, we use Wilcoxon’s test. It tests whether the distribution of two paired loss functions is the same. This test takes into account the magnitude of the differences between two paired loss functions, as well as their signs. The null hypothesis is that the penalty scores from two models are identical. We use the asymptotic Normal approximation to the Wilcoxon statistic (correcting for both continuity and ties).

5. Empirical Results

5.1. First Stage: Comparing the Accuracy of VaR Models

Tables 1 to 4 show the forecast accuracy of the alternative VaR methods: Parametric, Monte Carlo simulation, Extreme Value Theory and Historical simulation, respectively. For each VaR model we show two panels: for the volatile period (high volatility sample) and the stable period (low volatility sample). We analyse the accuracy

\[\text{[11]}\] The ranking of the models is the same under a linear loss function as under a quadratic loss function and are not presented here. They are available on request.
of daily VaR estimates at 5% and 1% confidence levels. For each VaR method we show the percentage of exceptions and five statistics: the Unconditional coverage test, the Back-testing criterion, the Serial independence test, the Conditional coverage test and the Dynamic Quantile test. A shaded cell indicates a VaR estimate for which all tests suggest an accurate VaR estimate.

The results for the Parametric models (Table 1) indicate that, in the volatile period, this model achieves the highest accuracy when we use the asymmetric volatility method, and the innovations are supposed to follow a Normal or a Student’s t distribution (EGARCH and T-EGARCH, respectively). During the stable period, the results point to a high accuracy regardless of the volatility model used and the assumption about the probability distribution.

On the contrary, the tests indicate that Monte Carlo simulation VaR techniques are inaccurate in both periods, regardless of whether we assume a Normal distribution or we employ Bootstrapping techniques (Table 2). Therefore, at this stage we can drop the Monte Carlo simulation VaR technique as inaccurate.

Tables 3 and 4 show, respectively, the test statistics for models based on unconditional and conditional Extreme value theory. For the unconditional Extreme value Theory, VaR estimates are inaccurate in both samples (Table 3). VaR estimates get much better when we use the conditional Extreme value theory (Table 4). In the volatile period, the most accurate cases are observed in the conditional Extreme value theory when we use the asymmetric volatility model either under Normal or Student’s t distribution assumptions for the returns (EGARCH and T-EGARCH). Both of them achieve high accuracy in 11 cases, which include all indexes, except the Dow Jones. Just as in the case of the Parametric model, the conditional Extreme value theory approach is always accurate over the stable period. As a result, the most accurate methods are conditional Extreme value theory with the asymmetric volatility model regardless of whether we assume a Normal or Student’s t distribution (EGARCH and T-EGARCH) in both periods.

Historical simulation methods (Table 5) are inaccurate regardless of the size of the windows. And this result is robust to the period under consideration, although when we use the shortest window in a stable period the test indicates some accuracy.

Finally, we conclude from this first stage that the most accurate methods in accordance with the tests are Parametric-EGARCH, Parametric-T-EGARCH, EVT-EGARCH and EVT-T-EGARCH. Therefore, these four methods survive because all
tests indicate high accuracy of these models in more cases than the other models. It is important to note that the method used to measure the volatility is relevant in terms of accuracy. This result is in line with other papers such as González-Rivera et al. (2004), Hansen and Lunde (2004) and Ñiguez (2008), which find that the Riskmetrics EWMA model and GARCH(1,1) are clearly inferior. Moreover, these results show that, in general, all methods are more accurate in the stable period, as we had expected.

5.2. Second Stage: Evaluating Loss Functions for VaR Models

First, we analyze the loss functions of the four models which survived the first stage of our analysis (EVT-EGARCH, EVT-T-EGARCH, Parametric-EGARCH and Parametric-T-EGARCH). The left panel of Table 6 reports the average of the penalty scores from loss functions in the volatile period. These values indicate that Parametric-T-EGARCH produces lower losses than the other models, except Nikkei’s VaR(1%) where EVT-T-EGARCH produces lower losses. The left panel of Table 7 reports the same information in the stable period. We detect the same result: the Parametric-T-EGARCH model produces the lowest losses, except FTSE-100’s VaR(1%) where EVT-EGARCH produces lower losses. We also observe that the average of the penalty scores from loss functions of each index is lower in the stable period. This indicates that all models work better in the stable period in terms of losses, just as they do in terms of accuracy. Therefore, this study of the loss function indicates that Parametric-T-EGARCH produces the lowest average losses in both periods.

Second, we test if the losses show a statistically significant difference. On one hand, we use the Friedman test (central panel of Tables 6 and 7) and, on the other, the Wilcoxon test (right panel of Tables 6 and 7). In the volatile period (Table 6), the Friedman test statistic indicates that the null hypothesis that the penalty scores from the model’s loss function are identical is rejected, except in Nikkei’s VaR(1%) and VaR(5%), Hang Seng’s VaR(1%) and DAX’s VaR(1%). This result shows that there are differences in the loss functions from these four surviving models, except in the four aforementioned cases. When we test the hypothesis that the distribution of two paired loss functions is the same with the Wilcoxon test, we notice that some paired loss functions are similar. Some of these paired loss functions coincide with the cases where the Friedman test indicates that these functions are similar. It is important to note that the Friedman and Wilcoxon tests indicate that all surviving methods provide similar loss functions for the Nikkei’s VaR(1%), i.e., the case where we detect that the
Parametric-T-EGARCH does not provide the minimum average of the penalty scores, but the penalty scores of this function are similar to the EVT-T-EGARCH.

In the stable period (Table 7), the Wilcoxon test also indicates that the penalty scores from the surviving models’ loss function differ from one another in general. In these cases, the Wilcoxon test indicates that pairs of loss functions are similar to each other. It is important to note that the Wilcoxon test shows that the EVT-EGARCH and the Parametric-T-EGARCH models provide similar loss functions for the FTSE-100’s VaR(1%).

The final conclusion from our study of loss function is that the Parametric-T-EGARCH model usually provides the loss function with the minimum average value, but when other models provide the minimum value the tests indicate that both loss functions are similar. Therefore, the Parametric T-EGARCH is the model which provides the lowest losses for all indexes and both considered periods. These results provide evidence that GARCH models, combined with asymmetries and heavy-tailed distributions, do help to enhance the performance of GARCH models to forecast VaR. These results are in line with Hansen and Lunde (2005) and Ñiguez (2008).

6. Conclusions

We compare several VaR methodologies: (1) Historical simulation, (2) Monte Carlo simulation, (3) Parametric methods and (4) Extreme Value Theory methods. Parametric and Extreme Value Theory are implemented under alternative specifications for the conditional volatility and the probability distributions of returns. Historical simulation methods are carried out for different windows, while Monte Carlo simulation is performed under Normality as well as by Bootstrapping.

We start by using a variety of accuracy tests available in the literature to select a subset of the best performing models, which are then compared in terms of the values of a quadratic loss function.

Accuracy tests select the Parametric approach and the Extreme Value Theory model, in both cases under an asymmetric specification of conditional volatility. The choice of a Normal or Student’s t-distribution for the returns is inconsequential at this level.

A statistical comparison of loss functions indicates that among the selected methods, the Parametric approach under an asymmetric specification for conditional
volatility and Student’s t- innovations performs the best in VaR estimation, in stable as well as in volatile periods.

More general implications of our analysis are: i) selecting a proper specification for conditional variance is relevant for VaR estimation [contradicting the conclusions of some other authors], ii) the choice of probability distribution for estimation of the conditional variance model is also important, iii) all VaR methods tend to work better in stable than in volatile market periods, and iv) notwithstanding some criticism of the reliability of the Parametric approach in recent literature, it works at least as well as the Extreme Value Theory approach in VaR estimation.
References


Engle and Manganelli (2004)


Table 1(a). Parametric Method

<table>
<thead>
<tr>
<th></th>
<th>S&amp;P</th>
<th>Dow Jones</th>
<th>Nikkei</th>
<th>Hang Seng</th>
<th>IBEX-35</th>
<th>CAC-40</th>
<th>DAX</th>
<th>FTSE-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatile period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GARCH</td>
<td>7.6%</td>
<td>1.6%</td>
<td>10.8%</td>
<td>4.6%</td>
<td>7.1%</td>
<td>1.4%</td>
<td>6.3%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Lruc</td>
<td>2.684</td>
<td>0.668</td>
<td>11.717*</td>
<td>15.140*</td>
<td>1.807</td>
<td>0.345</td>
<td>0.718</td>
<td>0.099</td>
</tr>
<tr>
<td>BTC</td>
<td>2.668+</td>
<td>1.348</td>
<td>5.951+</td>
<td>8.090+</td>
<td>2.164+</td>
<td>0.948</td>
<td>1.336</td>
<td>0.494</td>
</tr>
<tr>
<td>Lrind</td>
<td>2.264</td>
<td>1.116</td>
<td>4.904~</td>
<td>7.905~</td>
<td>0.049</td>
<td>0.276</td>
<td>--</td>
<td>0.001</td>
</tr>
<tr>
<td>DQT</td>
<td>4.949</td>
<td>1.784</td>
<td>16.621#</td>
<td>23.045#</td>
<td>1.856</td>
<td>0.668</td>
<td>11.717*</td>
<td>15.140*</td>
</tr>
<tr>
<td>EWMA</td>
<td>4.0%</td>
<td>0.6%</td>
<td>7.4%</td>
<td>2.0%</td>
<td>3.1%</td>
<td>0.2%</td>
<td>3.9%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Lruc</td>
<td>0.489</td>
<td>0.410</td>
<td>2.309</td>
<td>1.700</td>
<td>1.961</td>
<td>2.028</td>
<td>0.620</td>
<td>0.975</td>
</tr>
<tr>
<td>BTC</td>
<td>-1.026-</td>
<td>-0.899</td>
<td>2.462+</td>
<td>2.247+</td>
<td>-1.977+</td>
<td>-1.773</td>
<td>-1.149</td>
<td>-1.320</td>
</tr>
<tr>
<td>Lrind</td>
<td>0.617</td>
<td>--</td>
<td>3.649</td>
<td>2.746</td>
<td>--</td>
<td>0.041</td>
<td>--</td>
<td>0.263</td>
</tr>
<tr>
<td>LRcc</td>
<td>1.107</td>
<td>--</td>
<td>5.958</td>
<td>4.446</td>
<td>--</td>
<td>0.661</td>
<td>--</td>
<td>0.888</td>
</tr>
<tr>
<td>DQT</td>
<td>2.047</td>
<td>0.466</td>
<td>1.722</td>
<td>0.38</td>
<td>0.956</td>
<td>0.026</td>
<td>2.744^</td>
<td>0.007</td>
</tr>
<tr>
<td>EGARCH</td>
<td>6.0%</td>
<td>2.6%</td>
<td>9.2%</td>
<td>3.2%</td>
<td>5.3%</td>
<td>0.6%</td>
<td>3.7%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Lruc</td>
<td>0.431</td>
<td>3.897*</td>
<td>6.532*</td>
<td>6.717*</td>
<td>0.038</td>
<td>0.378</td>
<td>0.877</td>
<td>0.975</td>
</tr>
<tr>
<td>BTC</td>
<td>1.026</td>
<td>3.596+</td>
<td>4.309+</td>
<td>4.944+</td>
<td>0.300</td>
<td>-0.866</td>
<td>-1.356</td>
<td>-1.320</td>
</tr>
<tr>
<td>Lrind</td>
<td>0.335</td>
<td>0.398</td>
<td>1.471</td>
<td>4.864~</td>
<td>--</td>
<td>--</td>
<td>0.091</td>
<td>0.922</td>
</tr>
<tr>
<td>LRcc</td>
<td>0.766</td>
<td>4.295</td>
<td>8.003#</td>
<td>11.581#</td>
<td>--</td>
<td>--</td>
<td>0.377</td>
<td>2.064</td>
</tr>
<tr>
<td>DQT</td>
<td>2.062</td>
<td>2.146</td>
<td>0.628</td>
<td>1.757</td>
<td>0.956</td>
<td>0.165</td>
<td>0.781</td>
<td>0.02</td>
</tr>
<tr>
<td>T-EGARCH</td>
<td>4.4%</td>
<td>1.2%</td>
<td>7.4%</td>
<td>2.0%</td>
<td>4.7%</td>
<td>0.6%</td>
<td>1.8%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Lruc</td>
<td>0.171</td>
<td>0.082</td>
<td>2.309</td>
<td>1.700</td>
<td>0.046</td>
<td>0.378</td>
<td>5.885*</td>
<td>0.975</td>
</tr>
<tr>
<td>BTC</td>
<td>0.066</td>
<td>0.449</td>
<td>2.462+</td>
<td>2.247+</td>
<td>-0.321</td>
<td>-0.866</td>
<td>-3.220</td>
<td>-1.320</td>
</tr>
<tr>
<td>Lrind</td>
<td>0</td>
<td>--</td>
<td>3.649</td>
<td>2.746</td>
<td>--</td>
<td>--</td>
<td>0.021</td>
<td>--</td>
</tr>
<tr>
<td>LRcc</td>
<td>0.172</td>
<td>--</td>
<td>5.958</td>
<td>4.446</td>
<td>--</td>
<td>--</td>
<td>0.502</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>1.679</td>
<td>1.216</td>
<td>1.722</td>
<td>0.38</td>
<td>0.73</td>
<td>0.142</td>
<td>0.251</td>
<td>0.021</td>
</tr>
</tbody>
</table>

Note: We use several models to estimate the indexes’ variance: GARCH is the GARCH(1,1) model. EWMA is the exponential moving averages model used by Riskmetrics. EGARCH is the best model for each index. This model is always the Exponential GARCH model as proposed by Nelson (1991), which was estimated assuming that residuals follow a conditional Normal distribution. All indexes are EGARCH(1,1) with one asymmetric term, except S&P which has two asymmetric terms. T-EGARCH is the best model for each index assuming that the residuals follow a conditional Student’s t-distribution. Percentage of VaR exceptions. LRuc is the unconditional coverage test. BTC is the back-testing criterion. LRind is the statistic for the serial independence. LRcc is the conditional coverage test. DQT is the Dynamic Quantile test. *, +, ~, #, ^ denote the rejection of the VaR estimate is accurate. The shaded cells indicate that the null hypothesis that the VaR estimate is accurate is not rejected by any test.
### Table 1(b). Parametric Method

<table>
<thead>
<tr>
<th>Index</th>
<th>S&amp;P</th>
<th>Dow Jones</th>
<th>Nikkei</th>
<th>Hang Seng</th>
<th>IBEX-35</th>
<th>CAC-40</th>
<th>DAX</th>
<th>FTSE-100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Stable period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GARCH</td>
<td>4.8%</td>
<td>1.6%</td>
<td>5.0%</td>
<td>1.8%</td>
<td>3.1%</td>
<td>1.2%</td>
<td>4.8%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Lruc</td>
<td>0.022</td>
<td>0.658</td>
<td>0.000</td>
<td>1.121</td>
<td>1.943</td>
<td>0.101</td>
<td>0.010</td>
<td>0.092</td>
</tr>
<tr>
<td>BTC</td>
<td>-0.225</td>
<td>1.337</td>
<td>-0.020</td>
<td>1.785</td>
<td>-1.969+</td>
<td>0.499</td>
<td>-0.155</td>
<td>0.474</td>
</tr>
<tr>
<td>Lrind</td>
<td>2.192</td>
<td>1.119</td>
<td>0.886</td>
<td>0.928</td>
<td>1.367</td>
<td>1.597</td>
<td>0.242</td>
<td>--</td>
</tr>
<tr>
<td>LRcc</td>
<td>2.214</td>
<td>1.777</td>
<td>0.886</td>
<td>2.049</td>
<td>3.310</td>
<td>1.698</td>
<td>0.252</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>2.78^</td>
<td>1.694</td>
<td>1.159</td>
<td>1.332</td>
<td>1.717</td>
<td>3.288^</td>
<td>0.377</td>
<td>0.248</td>
</tr>
<tr>
<td>EWMA</td>
<td>4.2%</td>
<td>0.8%</td>
<td>4.2%</td>
<td>1.4%</td>
<td>3.5%</td>
<td>1.0%</td>
<td>4.6%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Lruc</td>
<td>0.323</td>
<td>0.098</td>
<td>0.323</td>
<td>0.305</td>
<td>1.170</td>
<td>0.001</td>
<td>0.058</td>
<td>0.392</td>
</tr>
<tr>
<td>BTC</td>
<td>-0.840</td>
<td>-0.458</td>
<td>-0.840</td>
<td>0.888</td>
<td>-1.555</td>
<td>0.045</td>
<td>-0.361</td>
<td>-0.881</td>
</tr>
<tr>
<td>LRcc</td>
<td>0.512</td>
<td>--</td>
<td>0.512</td>
<td>--</td>
<td>1.007</td>
<td>--</td>
<td>0.315</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>1.909</td>
<td>0.541</td>
<td>0.729</td>
<td>0.591</td>
<td>1.085</td>
<td>0.39</td>
<td>0.925</td>
<td>0.063</td>
</tr>
<tr>
<td>EGARCH</td>
<td>3.6%</td>
<td>0.4%</td>
<td>4.6%</td>
<td>1.6%</td>
<td>2.9%</td>
<td>0.8%</td>
<td>4.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Lruc</td>
<td>1.014</td>
<td>1.032</td>
<td>0.083</td>
<td>0.658</td>
<td>2.417</td>
<td>0.077</td>
<td>0.445</td>
<td>0.000</td>
</tr>
<tr>
<td>BTC</td>
<td>-1.454</td>
<td>-1.355</td>
<td>-0.430</td>
<td>1.337</td>
<td>-2.176+</td>
<td>-0.409</td>
<td>-0.980</td>
<td>0.023</td>
</tr>
<tr>
<td>LRcc</td>
<td>0.079</td>
<td>--</td>
<td>0.328</td>
<td>--</td>
<td>1.579</td>
<td>--</td>
<td>0.606</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>1.093</td>
<td>--</td>
<td>0.835</td>
<td>--</td>
<td>2.177</td>
<td>--</td>
<td>0.373</td>
<td>--</td>
</tr>
<tr>
<td>T-EGARCH</td>
<td>2.6%</td>
<td>0.2%</td>
<td>3.4%</td>
<td>1.2%</td>
<td>2.4%</td>
<td>0.8%</td>
<td>2.6%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Lruc</td>
<td>3.213</td>
<td>2.104</td>
<td>1.341</td>
<td>0.079</td>
<td>3.562</td>
<td>0.077</td>
<td>3.062</td>
<td>2.056</td>
</tr>
<tr>
<td>BTC</td>
<td>-2.478+</td>
<td>-1.803</td>
<td>-1.659</td>
<td>0.440</td>
<td>-2.591+</td>
<td>-0.409</td>
<td>-2.423+</td>
<td>-1.784</td>
</tr>
<tr>
<td>LRcc</td>
<td>0.401</td>
<td>--</td>
<td>0.121</td>
<td>--</td>
<td>0.489</td>
<td>--</td>
<td>0.392</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>2.16</td>
<td>0.817</td>
<td>0.933</td>
<td>0.376</td>
<td>0.982</td>
<td>0.12</td>
<td>2.118</td>
<td>0.534</td>
</tr>
</tbody>
</table>

**Note:** We use several models to estimate the indexes’ variance: **GARCH** is the GARCH(1,1) model. **EWMA** is the exponential moving averages model used by Riskmetrics. **EGARCH** is the best model for each index. This model is always the Exponential GARCH model as proposed by Nelson (1991), which was estimated assuming that residuals follow a conditional Normal distribution. All indexes are EGARCH(1,1) with one asymmetric term, except S&P which has two asymmetric terms. **T-EGARCH** is the best model for each index assuming that the residuals follow a conditional Student’s t-distribution. Percentage of VaR exceptions. **LRuc** is the unconditional coverage test. **BTC** is the back-testing criterion. **LRind** is the statistic for the serial independence. **LRcc** is the conditional coverage test. **DQT** is the Dynamic Quantile test. *, +, ~, #, ^ denote the rejection of the Vuarch estimate is accurate. The shaded cells indicate that the null hypothesis that the VaR estimate is accurate is not rejected by any test.
Table 2. Monte Carlo Simulation

<table>
<thead>
<tr>
<th></th>
<th>S&amp;P</th>
<th>Dow Jones</th>
<th>Nikkei</th>
<th>Hang Seng</th>
<th>IBEX-35</th>
<th>CAC-40</th>
<th>DAX</th>
<th>FTSE-100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Volatile period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOOTS</td>
<td>12.8%</td>
<td>2.8%</td>
<td>16.0%</td>
<td>5.8%</td>
<td>8.1%</td>
<td>1.0%</td>
<td>1.8%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Lrind</td>
<td>2.773</td>
<td>1.609</td>
<td>1.206</td>
<td>2.225</td>
<td>0.284</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>LRcc</td>
<td>22.583 #</td>
<td>6.383 #</td>
<td>37.136 #</td>
<td>26.172 #</td>
<td>4.05</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>4.059 ^</td>
<td>3.446 ^</td>
<td>3.692 ^</td>
<td>4.432 ^</td>
<td>0.778</td>
<td>3.592 ^</td>
<td>1.719</td>
<td>0.118</td>
</tr>
<tr>
<td>NORMAL</td>
<td>13.4%</td>
<td>4.4%</td>
<td>16.0%</td>
<td>8.6%</td>
<td>6.9%</td>
<td>1.8%</td>
<td>1.6%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Lrind</td>
<td>1.459</td>
<td>1.363</td>
<td>1.206</td>
<td>4.137 ~</td>
<td>0.028</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>LRcc</td>
<td>24.01 #</td>
<td>15.165 #</td>
<td>37.136 #</td>
<td>52.798 #</td>
<td>1.521</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>0.016</td>
<td>--</td>
<td>3.029 ^</td>
<td>0.004</td>
<td>3.792 ^</td>
<td>0.055</td>
<td>9.898 ^</td>
<td>--</td>
</tr>
<tr>
<td><strong>Stable period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOOTS</td>
<td>0.2%</td>
<td>0.0%</td>
<td>4.0%</td>
<td>0.2%</td>
<td>2.2%</td>
<td>0.4%</td>
<td>0.6%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Lruc</td>
<td>18.654 *</td>
<td>--</td>
<td>0.508</td>
<td>2.104</td>
<td>4.243 *</td>
<td>0.97</td>
<td>13.823</td>
<td>--</td>
</tr>
<tr>
<td>Lrind</td>
<td>--</td>
<td>0.622</td>
<td>--</td>
<td>0.608</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>LRcc</td>
<td>--</td>
<td>1.13</td>
<td>--</td>
<td>4.852</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>2.906 ^</td>
<td>3.859 ^</td>
<td>3.312 ^</td>
<td>3.411 ^</td>
<td>0.785</td>
<td>2.132</td>
<td>2.474 ^</td>
<td>0.222</td>
</tr>
<tr>
<td>NORMAL</td>
<td>0.2%</td>
<td>0.0%</td>
<td>3.8%</td>
<td>1.0%</td>
<td>1.6%</td>
<td>0.6%</td>
<td>0.2%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Lruc</td>
<td>18.654 *</td>
<td>--</td>
<td>0.737</td>
<td>0</td>
<td>6.806 *</td>
<td>0.375</td>
<td>18.354 *</td>
<td>--</td>
</tr>
<tr>
<td>Lrind</td>
<td>--</td>
<td>--</td>
<td>0.746</td>
<td>--</td>
<td>1.1</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>LRcc</td>
<td>--</td>
<td>1.483</td>
<td>--</td>
<td>7.906 #</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>0.096</td>
<td>--</td>
<td>2.66 ^</td>
<td>3.151 ^</td>
<td>4.616 ^</td>
<td>15.746 ^</td>
<td>0.217</td>
<td>--</td>
</tr>
</tbody>
</table>

Note: We use two techniques to simulate: assuming that residuals follow a Normal distribution (NORMAL), and using Bootstrap techniques (BOOTS). Percentage of VaR exceptions. Lruc is the unconditional coverage test. BTC is the back-testing criterion. Lrind is the statistic for the serial independence. LRcc is the conditional coverage test. DQT is the Dynamic Quantile test. *, +, ~, #, ^ denote the rejection of the VaR estimate is accurate. The shaded cells indicate that the null hypothesis that the VaR estimate is accurate is not rejected by any test.
### Table 3. Unconditional Extreme Value Theory

<table>
<thead>
<tr>
<th></th>
<th>S&amp;P</th>
<th>Dow Jones</th>
<th>Nikkei</th>
<th>Hang Seng</th>
<th>IBEX-35</th>
<th>CAC-40</th>
<th>DAX</th>
<th>FTSE-100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Volatile period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unconditional</strong></td>
<td>11.8%</td>
<td>2.0%</td>
<td>15.8%</td>
<td>4.6%</td>
<td>7.7%</td>
<td>1.0%</td>
<td>2.2%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Lruc</td>
<td>15.555 *</td>
<td>1.700</td>
<td>34.820 *</td>
<td>15.140 *</td>
<td>2.907</td>
<td>0.001</td>
<td>4.268 *</td>
<td>2.028</td>
</tr>
<tr>
<td>Lrind</td>
<td>2.481</td>
<td>0.762</td>
<td>2.496</td>
<td>5.824 ~</td>
<td>0.170</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>2.432 ^</td>
<td>1.346</td>
<td>2.312 ^</td>
<td>6.038 ^</td>
<td>1.07</td>
<td>3.299 ^</td>
<td>0.928</td>
<td>0.778</td>
</tr>
<tr>
<td><strong>Stable period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unconditional</strong></td>
<td>0.2%</td>
<td>0.0%</td>
<td>3.8%</td>
<td>0.0%</td>
<td>2.0%</td>
<td>0.4%</td>
<td>0.4%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Lruc</td>
<td>18.654 *</td>
<td>--</td>
<td>0.737</td>
<td>--</td>
<td>5.005 *</td>
<td>0.970</td>
<td>15.861 *</td>
<td>--</td>
</tr>
<tr>
<td>Lrind</td>
<td>--</td>
<td>--</td>
<td>0.746</td>
<td>--</td>
<td>0.747</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>LCR</td>
<td>--</td>
<td>--</td>
<td>1.483</td>
<td>--</td>
<td>5.753</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>0.016</td>
<td>0 ^</td>
<td>2.554 ^</td>
<td>0 ^</td>
<td>2.721 ^</td>
<td>0.103</td>
<td>27.684 ^</td>
<td>0 ^</td>
</tr>
</tbody>
</table>

Note: **Unconditional**. Percentage of VaR exceptions. Lruc is the unconditional coverage test. BTC is the back-testing criterion. Lrind is the statistic for the serial independence. LRcc is the conditional coverage test. DQT is the Dynamic Quantile test. *, +, ~, #, ^ denote the rejection of the VaR estimate is accurate. The shaded cells indicate that the null hypothesis that the VaR estimate is accurate is not rejected by any test.
Table 4 (a). Conditional Extreme Value Theory

<table>
<thead>
<tr>
<th></th>
<th>S&amp;P</th>
<th>Dow Jones</th>
<th>Nikkei</th>
<th>Hang Seng</th>
<th>IBEX-35</th>
<th>CAC-40</th>
<th>DAX</th>
<th>FTSE-100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>GARCH</th>
<th>Volatile period</th>
<th>Lruc</th>
<th>BTC</th>
<th>Lrind</th>
<th>LCR</th>
<th>DQT</th>
<th>EWMA</th>
<th>T-EGARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.6%</td>
<td>0.8%</td>
<td>9.2%</td>
<td>2.6%</td>
<td>7.3%</td>
<td>0.4%</td>
<td>5.7%</td>
<td>0.6%</td>
<td>9.8%</td>
</tr>
<tr>
<td></td>
<td>5.7%</td>
<td>0.8%</td>
<td>9.2%</td>
<td>2.6%</td>
<td>7.3%</td>
<td>0.4%</td>
<td>5.7%</td>
<td>0.6%</td>
<td>9.8%</td>
</tr>
<tr>
<td></td>
<td>5.6%</td>
<td>0.8%</td>
<td>9.2%</td>
<td>2.6%</td>
<td>7.3%</td>
<td>0.4%</td>
<td>5.7%</td>
<td>0.6%</td>
<td>9.8%</td>
</tr>
<tr>
<td></td>
<td>0.4%</td>
<td>4.3%</td>
<td>5.8%</td>
<td>1.8%</td>
<td>5.9%</td>
<td>0.4%</td>
<td>5.5%</td>
<td>0.4%</td>
<td>8.3%</td>
</tr>
</tbody>
</table>

See Note table 2.
<table>
<thead>
<tr>
<th>GARCH</th>
<th>4.2%</th>
<th>0.4%</th>
<th>4.2%</th>
<th>1.2%</th>
<th>3.1%</th>
<th>0.6%</th>
<th>4.8%</th>
<th>0.6%</th>
<th>1.4%</th>
<th>0.0%</th>
<th>3.3%</th>
<th>0.8%</th>
<th>3.7%</th>
<th>1.2%</th>
<th>3.8%</th>
<th>0.8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luc</td>
<td>0.323</td>
<td>1.032</td>
<td>0.323</td>
<td>0.079</td>
<td>1.943</td>
<td>0.375</td>
<td>0.010</td>
<td>0.392</td>
<td>8.414</td>
<td>*</td>
<td>--</td>
<td>1.537</td>
<td>0.122</td>
<td>0.863</td>
<td>0.061</td>
<td>0.759</td>
</tr>
<tr>
<td>BTC</td>
<td>-0.840</td>
<td>-1.355</td>
<td>-0.840</td>
<td>0.440</td>
<td>-1.969</td>
<td>*</td>
<td>-0.863</td>
<td>-0.155</td>
<td>-0.881</td>
<td>-3.739</td>
<td>*</td>
<td>-2.263</td>
<td>-1.769</td>
<td>-0.509</td>
<td>-1.347</td>
<td>0.386</td>
</tr>
<tr>
<td>Lrind</td>
<td>0.512</td>
<td>--</td>
<td>0.008</td>
<td>--</td>
<td>1.367</td>
<td>--</td>
<td>0.242</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.13</td>
<td>2.397</td>
<td>0.052</td>
<td>1.633</td>
<td>0.047</td>
<td>--</td>
</tr>
<tr>
<td>LCR</td>
<td>0.835</td>
<td>--</td>
<td>0.331</td>
<td>--</td>
<td>3.310</td>
<td>--</td>
<td>0.252</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.667</td>
<td>2.52</td>
<td>0.914</td>
<td>1.694</td>
<td>0.806</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>2.218</td>
<td>0.187</td>
<td>0.503</td>
<td>0.312</td>
<td>1.63</td>
<td>0.096</td>
<td>0.46</td>
<td>0.03</td>
<td>0.212</td>
<td>0.0</td>
<td>0.727</td>
<td>5.806</td>
<td>1.005</td>
<td>4.279</td>
<td>0.913</td>
<td>0.025</td>
</tr>
<tr>
<td>EWMA</td>
<td>5.2%</td>
<td>1.4%</td>
<td>5.8%</td>
<td>1.6%</td>
<td>5.1%</td>
<td>1.6%</td>
<td>6.7%</td>
<td>1.8%</td>
<td>5.3%</td>
<td>2.0%</td>
<td>5.0%</td>
<td>2.5%</td>
<td>6.2%</td>
<td>2.3%</td>
<td>5.2%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Luc</td>
<td>0.015</td>
<td>0.305</td>
<td>0.264</td>
<td>0.658</td>
<td>0.005</td>
<td>0.722</td>
<td>1.143</td>
<td>1.170</td>
<td>0.048</td>
<td>1.639</td>
<td>0.001</td>
<td>3.69</td>
<td>0.669</td>
<td>2.931</td>
<td>0.011</td>
<td>2.311</td>
</tr>
<tr>
<td>BTC</td>
<td>0.184</td>
<td>0.888</td>
<td>0.799</td>
<td>1.337</td>
<td>0.104</td>
<td>1.407</td>
<td>1.701</td>
<td>1.830</td>
<td>0.336</td>
<td>2.201</td>
<td>0.051</td>
<td>3.477</td>
<td>1.286</td>
<td>3.048</td>
<td>0.164</td>
<td>2.668</td>
</tr>
<tr>
<td>Lrind</td>
<td>0.135</td>
<td>--</td>
<td>2.238</td>
<td>--</td>
<td>0.845</td>
<td>1.100</td>
<td>0.132</td>
<td>--</td>
<td>--</td>
<td>0.644</td>
<td>--</td>
<td>0.15</td>
<td>0.415</td>
<td>0.793</td>
<td>0.517</td>
<td>0.137</td>
</tr>
<tr>
<td>LCR</td>
<td>0.150</td>
<td>--</td>
<td>2.503</td>
<td>--</td>
<td>0.850</td>
<td>1.823</td>
<td>1.275</td>
<td>--</td>
<td>0.692</td>
<td>--</td>
<td>0.152</td>
<td>4.105</td>
<td>1.462</td>
<td>3.448</td>
<td>0.148</td>
<td>2.938</td>
</tr>
<tr>
<td>DQT</td>
<td>2.17</td>
<td>0.638</td>
<td>0.608</td>
<td>1.047</td>
<td>1.365</td>
<td>1.77</td>
<td>2.163</td>
<td>0.543</td>
<td>1.694</td>
<td>0.229</td>
<td>1.266</td>
<td>0.841</td>
<td>2.935</td>
<td>0.98</td>
<td>1.513</td>
<td>1.681</td>
</tr>
<tr>
<td>EGARCH</td>
<td>4.2%</td>
<td>0.2%</td>
<td>4.6%</td>
<td>1.2%</td>
<td>3.3%</td>
<td>0.8%</td>
<td>4.6%</td>
<td>0.8%</td>
<td>3.0%</td>
<td>0.6%</td>
<td>3.9%</td>
<td>0.8%</td>
<td>4.7%</td>
<td>1.0%</td>
<td>4.0%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Luc</td>
<td>0.323</td>
<td>2.104</td>
<td>0.083</td>
<td>0.079</td>
<td>1.529</td>
<td>0.077</td>
<td>0.058</td>
<td>0.086</td>
<td>2.249</td>
<td>0.434</td>
<td>0.634</td>
<td>0.122</td>
<td>0.05</td>
<td>0.001</td>
<td>0.526</td>
<td>0.101</td>
</tr>
<tr>
<td>BTC</td>
<td>-0.840</td>
<td>-1.803</td>
<td>-0.430</td>
<td>0.440</td>
<td>-1.762</td>
<td>-0.409</td>
<td>-0.361</td>
<td>-0.429</td>
<td>-2.109</td>
<td>-0.924</td>
<td>-1.163</td>
<td>-0.509</td>
<td>-0.334</td>
<td>-0.058</td>
<td>-1.063</td>
<td>-0.466</td>
</tr>
<tr>
<td>Lrind</td>
<td>0.008</td>
<td>--</td>
<td>0.328</td>
<td>--</td>
<td>1.177</td>
<td>--</td>
<td>0.315</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.027</td>
<td>2.397</td>
<td>0.007</td>
<td>1.967</td>
<td>0.624</td>
<td>--</td>
</tr>
<tr>
<td>LCR</td>
<td>0.331</td>
<td>--</td>
<td>0.411</td>
<td>--</td>
<td>2.706</td>
<td>--</td>
<td>0.373</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.661</td>
<td>2.52</td>
<td>0.056</td>
<td>1.969</td>
<td>1.15</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>2.614</td>
<td>0.842</td>
<td>0.735</td>
<td>0.403</td>
<td>1.305</td>
<td>0.144</td>
<td>0.617</td>
<td>0.099</td>
<td>0.609</td>
<td>0.128</td>
<td>0.563</td>
<td>5.84</td>
<td>0.908</td>
<td>4.182</td>
<td>1.097</td>
<td>0.53</td>
</tr>
</tbody>
</table>

T-EGARCH

| Luc   | 0.323 | 2.104 | 0.083 | 0.079 | 0.610 | 0.077 | 0.001 | 0.086 | 1.415 | 0.434 | 0.634 | 0.122 | 0.008 | 0.001 | 0.526 | 0.101 |
| BTC   | -0.84 | -1.803 | -0.430 | 0.440 | -1.140 | -0.409 | 0.052 | -0.429 | -1.702 | -0.924 | -1.163 | -0.509 | -0.132 | -0.058 | -1.063 | -0.466 |
| Lrind | 0.008 | --   | 0.328 | --   | 0.717 | --   | 0.179 | --   | 0.124 | --   | 0.027 | 2.397 | 0.02 | 1.967 | 0.624 | --   |
| LCR   | 0.331 | --   | 0.411 | --   | 1.327 | --   | 0.180 | --   | 1.539 | --   | 0.661 | 2.52 | 0.028 | 1.969 | 1.15 | --   |
| DQT   | 2.614 | 0.842 | 0.724 | 0.414 | 0.98 | 0.155 | 0.603 | 0.096 | 0.86 | 0.139 | 0.558 | 5.838 | 0.947 | 4.155 | 1.054 | 0.538 |

See Note table 2.
Table 5(a). Historical Simulation

<table>
<thead>
<tr>
<th></th>
<th>S&amp;P</th>
<th>Dow Jones</th>
<th>Nikkel</th>
<th>Hang Seng</th>
<th>IBEX-35</th>
<th>CAC-40</th>
<th>DAX</th>
<th>FTSE-100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>0%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Volatile period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>N=1250</strong></td>
<td>8.6%</td>
<td>1.8%</td>
<td>12.4%</td>
<td>3.4%</td>
<td>5.9%</td>
<td>0.8%</td>
<td>1.4%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Lruc</td>
<td>4.921</td>
<td>1.135</td>
<td>18.060</td>
<td>7.775</td>
<td>0.349</td>
<td>0.079</td>
<td>7.898</td>
<td>2.028</td>
</tr>
<tr>
<td>BTC</td>
<td>3.694</td>
<td>1.798</td>
<td>7.592</td>
<td>5.394</td>
<td>0.921</td>
<td>-0.413</td>
<td>-3.634</td>
<td>-1.773</td>
</tr>
<tr>
<td>Lrind</td>
<td>2.069</td>
<td>0.925</td>
<td>1.816</td>
<td>2.520</td>
<td>0.168</td>
<td>--</td>
<td>--</td>
<td>0.36</td>
</tr>
<tr>
<td>LRcc</td>
<td>6.990</td>
<td>2.060</td>
<td>19.876</td>
<td>10.294</td>
<td>0.518</td>
<td>--</td>
<td>--</td>
<td>4.346</td>
</tr>
<tr>
<td>DQT</td>
<td>2.874</td>
<td>1.798</td>
<td>2.787</td>
<td>6.432</td>
<td>1.089</td>
<td>5.496</td>
<td>2.943</td>
<td>0.074</td>
</tr>
<tr>
<td><strong>N=500</strong></td>
<td>6.4%</td>
<td>1.4%</td>
<td>12.4%</td>
<td>3.4%</td>
<td>6.5%</td>
<td>1.2%</td>
<td>2.4%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Lruc</td>
<td>0.826</td>
<td>0.312</td>
<td>18.060</td>
<td>7.775</td>
<td>0.947</td>
<td>0.999</td>
<td>3.858</td>
<td>2.028</td>
</tr>
<tr>
<td>BTC</td>
<td>1.436</td>
<td>0.899</td>
<td>7.592</td>
<td>5.394</td>
<td>1.543</td>
<td>0.494</td>
<td>-2.599</td>
<td>-1.773</td>
</tr>
<tr>
<td>Lrind</td>
<td>2.659</td>
<td>1.816</td>
<td>2.520</td>
<td>0.339</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.739</td>
</tr>
<tr>
<td>DQT</td>
<td>2.624</td>
<td>0.197</td>
<td>2.787</td>
<td>6.432</td>
<td>1.541</td>
<td>2.877</td>
<td>1.02</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>N=250</strong></td>
<td>6.0%</td>
<td>1.0%</td>
<td>7.0%</td>
<td>1.4%</td>
<td>5.1%</td>
<td>0.8%</td>
<td>3.1%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Lruc</td>
<td>0.431</td>
<td>0.000</td>
<td>1.635</td>
<td>0.312</td>
<td>0.004</td>
<td>0.079</td>
<td>1.961</td>
<td>2.028</td>
</tr>
<tr>
<td>BTC</td>
<td>1.026</td>
<td>0.000</td>
<td>2.052</td>
<td>0.899</td>
<td>0.093</td>
<td>-0.413</td>
<td>-1.977</td>
<td>-1.773</td>
</tr>
<tr>
<td>Lrind</td>
<td>3.216</td>
<td>4.306</td>
<td>4.094</td>
<td>0.030</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.184</td>
</tr>
<tr>
<td>LRcc</td>
<td>3.647</td>
<td>5.941</td>
<td>4.407</td>
<td>0.034</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.184</td>
</tr>
<tr>
<td>DQT</td>
<td>4.424</td>
<td>0.475</td>
<td>4.708</td>
<td>6.122</td>
<td>1.734</td>
<td>5.447</td>
<td>1.335</td>
<td>0.014</td>
</tr>
<tr>
<td><strong>N=125</strong></td>
<td>5.6%</td>
<td>1.0%</td>
<td>6.2%</td>
<td>1.4%</td>
<td>5.3%</td>
<td>0.8%</td>
<td>4.3%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Lruc</td>
<td>0.159</td>
<td>0.000</td>
<td>0.614</td>
<td>0.312</td>
<td>0.038</td>
<td>0.079</td>
<td>0.246</td>
<td>0.378</td>
</tr>
<tr>
<td>BTC</td>
<td>0.616</td>
<td>1.231</td>
<td>0.899</td>
<td>0.300</td>
<td>-0.413</td>
<td>-0.735</td>
<td>-0.866</td>
<td>-0.401</td>
</tr>
<tr>
<td>Lrind</td>
<td>3.848</td>
<td>2.929</td>
<td>1.342</td>
<td>0.055</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.321</td>
</tr>
<tr>
<td>LRcc</td>
<td>4.007</td>
<td>3.542</td>
<td>1.654</td>
<td>0.933</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.392</td>
</tr>
<tr>
<td>DQT</td>
<td>4.261</td>
<td>0.899</td>
<td>7.283</td>
<td>2.448</td>
<td>3.545</td>
<td>0.416</td>
<td>1.81</td>
<td>0.246</td>
</tr>
</tbody>
</table>

Note: We consider different sizes of samples: N= 1250, 500, 250 and 125 daily observations. Percentage of VaR exceptions. Lruc is the unconditional coverage test. BTC is the back-testing criterion. Lrind is the statistic for the serial independence. LRcc is the conditional coverage test. DQT is the Dynamic Quantile test. *, +, ~, #, ^ denote the rejection of the VaR estimate is accurate. The shaded cells indicate that the null hypothesis that the VaR estimate is accurate is not rejected by any test.
### Table 5(b). Historical Simulation

<table>
<thead>
<tr>
<th></th>
<th>S&amp;P</th>
<th>Dow Jones</th>
<th>Nikkei</th>
<th>Hang Seng</th>
<th>IBEX-35</th>
<th>CAC-40</th>
<th>DAX</th>
<th>FTSE-100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Stable period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=1250</td>
<td>0.2%</td>
<td>0.0%</td>
<td>1.4%</td>
<td>0.0%</td>
<td>1.8%</td>
<td>0.4%</td>
<td>1.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Lruc</td>
<td>18.654*</td>
<td>--</td>
<td>8.252*</td>
<td>--</td>
<td>5.856</td>
<td>0.970</td>
<td>10.564*</td>
<td>--</td>
</tr>
<tr>
<td>Lrind</td>
<td>--</td>
<td>--</td>
<td>0.910</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>LRcc</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>6.766#</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>0.208</td>
<td>0^</td>
<td>2.419^</td>
<td>0^</td>
<td>3.712^</td>
<td>0.108</td>
<td>6.757^</td>
<td>0^</td>
</tr>
<tr>
<td>N=500</td>
<td>1.4%</td>
<td>0.4%</td>
<td>5.4%</td>
<td>2.2%</td>
<td>3.5%</td>
<td>0.8%</td>
<td>3.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Lruc</td>
<td>8.252</td>
<td>1.032</td>
<td>0.064</td>
<td>2.332</td>
<td>1.170</td>
<td>0.077</td>
<td>2.031</td>
<td>0.996</td>
</tr>
<tr>
<td>Lrind</td>
<td>--</td>
<td>--</td>
<td>1.542</td>
<td>0.625</td>
<td>1.007</td>
<td>2.357</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>LRcc</td>
<td>--</td>
<td>--</td>
<td>1.606</td>
<td>2.957</td>
<td>2.177</td>
<td>2.434</td>
<td>--</td>
<td>7.279#</td>
</tr>
<tr>
<td>DQT</td>
<td>1.758</td>
<td>0.191</td>
<td>4.909^</td>
<td>3.727^</td>
<td>6.429^</td>
<td>12.951^</td>
<td>2.175^</td>
<td>26.665^</td>
</tr>
<tr>
<td>N=250</td>
<td>2.8%</td>
<td>1.0%</td>
<td>5.6%</td>
<td>1.4%</td>
<td>4.5%</td>
<td>1.0%</td>
<td>3.4%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Lruc</td>
<td>2.653</td>
<td>0.000</td>
<td>0.148</td>
<td>0.305</td>
<td>0.121</td>
<td>0.001</td>
<td>1.240</td>
<td>0.392</td>
</tr>
<tr>
<td>BTC</td>
<td>-2.273+</td>
<td>-0.009</td>
<td>0.594</td>
<td>0.888</td>
<td>-0.518</td>
<td>0.045</td>
<td>-1.598</td>
<td>-0.881</td>
</tr>
<tr>
<td>Lrind</td>
<td>0.312</td>
<td>--</td>
<td>3.865</td>
<td>--</td>
<td>4.286</td>
<td>1.930</td>
<td>0.115</td>
<td>--</td>
</tr>
<tr>
<td>LRcc</td>
<td>2.965</td>
<td>--</td>
<td>4.013</td>
<td>--</td>
<td>4.407</td>
<td>1.931</td>
<td>1.356</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>0.828</td>
<td>0.691</td>
<td>2.932^</td>
<td>1.836</td>
<td>9.045^</td>
<td>5.819^</td>
<td>1.853</td>
<td>9.984^</td>
</tr>
<tr>
<td>N=125</td>
<td>4.0%</td>
<td>1.0%</td>
<td>5.6%</td>
<td>1.4%</td>
<td>4.5%</td>
<td>0.8%</td>
<td>4.2%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Lruc</td>
<td>0.508</td>
<td>0.000</td>
<td>0.148</td>
<td>0.417</td>
<td>0.121</td>
<td>0.077</td>
<td>0.273</td>
<td>0.000</td>
</tr>
<tr>
<td>BTC</td>
<td>-1.044+</td>
<td>-0.009</td>
<td>0.594</td>
<td>-0.906</td>
<td>-0.518</td>
<td>-0.409</td>
<td>-0.773</td>
<td>0.023</td>
</tr>
<tr>
<td>Lrind</td>
<td>0.023</td>
<td>--</td>
<td>5.472</td>
<td>--</td>
<td>1.324</td>
<td>2.357</td>
<td>0.497</td>
<td>--</td>
</tr>
<tr>
<td>LRcc</td>
<td>0.530</td>
<td>--</td>
<td>5.620</td>
<td>--</td>
<td>1.445</td>
<td>2.434</td>
<td>0.770</td>
<td>--</td>
</tr>
<tr>
<td>DQT</td>
<td>1.24</td>
<td>1.438</td>
<td>4.731^</td>
<td>0.717</td>
<td>2.952^</td>
<td>11.915^</td>
<td>1.258</td>
<td>3.341^</td>
</tr>
</tbody>
</table>

Note: We consider different sizes of samples: N= 1250, 500, 250 and 125 daily observations. Percentage of VaR exceptions. LLuc is the unconditional coverage test. BTC is the back-testing criterion. Lrind is the statistic for the serial independence. LRcc is the conditional coverage test. DQT is the Dynamic Quantile test. *, +, ~, #, ^ denote the rejection of the VaR estimate is accurate. The shaded cells indicate that the null hypothesis that the VaR estimate is accurate is not rejected by any test.
Table 6. Magnitude of the losses experienced: High volatility

<table>
<thead>
<tr>
<th></th>
<th>Extreme theory value</th>
<th>Parametric method</th>
<th>Friedman</th>
<th>Wilcoxon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) EGARCH (2) T-GARCH (3) EGARCH (4) T-EGARCH</td>
<td></td>
<td>(4) vs. (1)</td>
<td>(4) vs. (2)</td>
</tr>
<tr>
<td>S&amp;P VaR(1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0005 0.0005 0.0012 0.0003</td>
<td></td>
<td>35.91* (0.00)</td>
<td>-2.67* (0.01)</td>
</tr>
<tr>
<td>S&amp;P VaR(5%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0046 0.0046 0.0050 0.0033</td>
<td></td>
<td>59.54* (0.00)</td>
<td>-4.62* (0.00)</td>
</tr>
<tr>
<td>Dow Jones VaR(1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0028 0.0037 0.0055 0.0019</td>
<td></td>
<td>36.62* (0.00)</td>
<td>-2.20* (0.03)</td>
</tr>
<tr>
<td>Dow Jones VaR(5%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0185 0.0201 0.0192 0.0141</td>
<td></td>
<td>75.41* (0.00)</td>
<td>-4.92* (0.00)</td>
</tr>
<tr>
<td>Nikkei VaR(1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0003 0.0003 0.0006 0.0006</td>
<td></td>
<td>0.60 (0.90)</td>
<td>-0.45 (0.65)</td>
</tr>
<tr>
<td>Nikkei VaR(5%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0050 0.0048 0.0043 0.0040</td>
<td></td>
<td>4.79 (0.19)</td>
<td>-0.69 (0.49)</td>
</tr>
<tr>
<td>Hang Seng VaR(1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0025 0.0025 0.0034 0.0016</td>
<td></td>
<td>5.40 (0.14)</td>
<td>-1.34 (0.18)</td>
</tr>
<tr>
<td>Hang Seng VaR(5%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0078 0.0078 0.0073 0.0056</td>
<td></td>
<td>37.11* (0.00)</td>
<td>-4.01* (0.00)</td>
</tr>
<tr>
<td>IBEX-35 VaR(1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0001 0.0001 0.0004 0.0000</td>
<td></td>
<td>22.82* (0.00)</td>
<td>-0.53 (0.59)</td>
</tr>
<tr>
<td>IBEX-35 VaR(5%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0053 0.0050 0.0048 0.0028</td>
<td></td>
<td>49.00* (0.00)</td>
<td>-4.00* (0.00)</td>
</tr>
<tr>
<td>CAC-40 VaR(1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0022 0.0021 0.0027 0.0021</td>
<td></td>
<td>12.79* (0.01)</td>
<td>-1.34 (0.18)</td>
</tr>
<tr>
<td>CAC-40 VaR(5%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0071 0.0070 0.0076 0.0064</td>
<td></td>
<td>76.81* (0.00)</td>
<td>-4.54* (0.00)</td>
</tr>
<tr>
<td>DAX VaR(1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0001 0.0001 0.0002 0.0000</td>
<td></td>
<td>5.25 (0.15)</td>
<td>-1.00 (0.32)</td>
</tr>
<tr>
<td>DAX VaR(5%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0050 0.0044 0.0048 0.0026</td>
<td></td>
<td>98.35* (0.00)</td>
<td>-5.84* (0.00)</td>
</tr>
<tr>
<td>FTSE-100 VaR(1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0001 0.0001 0.0002 0.0001</td>
<td></td>
<td>15.55* (0.00)</td>
<td>-1.34 (0.18)</td>
</tr>
<tr>
<td>FTSE-100 VaR(5%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.0039 0.0036 0.0040 0.0029</td>
<td></td>
<td>82.33* (0.00)</td>
<td>-5.23* (0.00)</td>
</tr>
</tbody>
</table>

Note: The first four columns report the Average of the loss function of each VaR model in the volatility period. The average was multiplied by 1000. Boldface figures denote the minimum value for the average of the loss function for each index. Friedman denotes Friedman test statistic. Wilcoxon denotes the Wilcoxon test statistic for making a comparison between Parametric T-EGARCH model (4) and each of the other VaR models. For VaR (1%) Nikkei we make a comparison between ETV T-EGARCH model (2) and (1), (3) and (4), respectively. * indicates significance of at least 10%. p-value is in parentheses.
Table 7. Magnitude of the losses experienced: Low volatility

<table>
<thead>
<tr>
<th>Index</th>
<th>Extreme theory value</th>
<th>Parametric method</th>
<th>Friedman</th>
<th>Wilcoxon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) E-VGARCH (2) T-GARCH (3) E-VGARCH (4) T-EGARCH</td>
<td>(4) vs. (1)</td>
<td>(4) vs. (2)</td>
<td>(4) vs. (3)</td>
</tr>
<tr>
<td>S&amp;P VaR(1%) Average</td>
<td>0.00001</td>
<td>0.00001</td>
<td>0.00001</td>
<td>0.00000</td>
</tr>
<tr>
<td>S&amp;P VaR(5%) Average</td>
<td>0.00028</td>
<td>0.00028</td>
<td>0.00024</td>
<td>0.00017</td>
</tr>
<tr>
<td>Dow Jones VaR(1%) Average</td>
<td>0.00045</td>
<td>0.00047</td>
<td>0.00075</td>
<td>0.00027</td>
</tr>
<tr>
<td>Dow Jones VaR(5%) Average</td>
<td>0.00223</td>
<td>0.00229</td>
<td>0.00232</td>
<td>0.00181</td>
</tr>
<tr>
<td>Nikkei VaR(1%) Average</td>
<td>0.00079</td>
<td>0.00091</td>
<td>0.00084</td>
<td>0.00032</td>
</tr>
<tr>
<td>Nikkei VaR(5%) Average</td>
<td>0.00341</td>
<td>0.00368</td>
<td>0.00291</td>
<td>0.00239</td>
</tr>
<tr>
<td>Hang Seng VaR(1%) Average</td>
<td>0.00009</td>
<td>0.00010</td>
<td>0.00015</td>
<td>0.00003</td>
</tr>
<tr>
<td>Hang Seng VaR(5%) Average</td>
<td>0.00154</td>
<td>0.00161</td>
<td>0.00115</td>
<td>0.00064</td>
</tr>
<tr>
<td>IBEX-35 VaR(1%) Average</td>
<td>0.00005</td>
<td>0.00008</td>
<td>0.00010</td>
<td>0.00004</td>
</tr>
<tr>
<td>IBEX-35 VaR(5%) Average</td>
<td>0.00068</td>
<td>0.00085</td>
<td>0.00064</td>
<td>0.00056</td>
</tr>
<tr>
<td>CAC-40 VaR(1%) Average</td>
<td>0.00004</td>
<td>0.00004</td>
<td>0.00009</td>
<td>0.00004</td>
</tr>
<tr>
<td>CAC-40 VaR(5%) Average</td>
<td>0.00101</td>
<td>0.00103</td>
<td>0.00105</td>
<td>0.00088</td>
</tr>
<tr>
<td>DAX VaR(1%) Average</td>
<td>0.00015</td>
<td>0.00019</td>
<td>0.00021</td>
<td>0.00013</td>
</tr>
<tr>
<td>DAX VaR(5%) Average</td>
<td>0.00143</td>
<td>0.00156</td>
<td>0.00142</td>
<td>0.00125</td>
</tr>
<tr>
<td>FTSE-100 VaR(1%) Average</td>
<td>0.00002</td>
<td>0.00002</td>
<td>0.00006</td>
<td>0.00003</td>
</tr>
<tr>
<td>FTSE-100 VaR(5%) Average</td>
<td>0.00058</td>
<td>0.00059</td>
<td>0.00060</td>
<td>0.00053</td>
</tr>
</tbody>
</table>

Note: The first four columns report the Average of the loss function of each VaR model in the stable period. The average was multiplied by 1000. Boldface figures denote the minimum value for the average of the loss function for each index. Friedman denotes Friedman test statistic. Wilcoxon denotes the Wilcoxon test statistic for making a comparison between Parametric T-EGARCH model (4) and each of the other VaR models. For VaR (1%) FTSE-100 we make a comparison between ETV EGARCH model (1) and (2), (3) and (4), respectively. * indicates significance of at least 10%. p-value is in parentheses.
<table>
<thead>
<tr>
<th>Número</th>
<th>Título</th>
<th>Autor(es)</th>
</tr>
</thead>
<tbody>
<tr>
<td>159/2000</td>
<td>Participación privada en la construcción y explotación de carreteras de peaje</td>
<td>Ginés de Rus, Manuel Romero y Lourdes Trujillo</td>
</tr>
<tr>
<td>160/2000</td>
<td>Errores y posibles soluciones en la aplicación del Value at Risk</td>
<td>Mariano González Sánchez</td>
</tr>
<tr>
<td>161/2000</td>
<td>Tax neutrality on saving assets. The spahish case before and after the tax reform</td>
<td>Cristina Ruza y de Paz-Curbera</td>
</tr>
<tr>
<td>163/2000</td>
<td>El control interno del riesgo. Una propuesta de sistema de límites riesgo neutral</td>
<td>Mariano González Sánchez</td>
</tr>
<tr>
<td>164/2001</td>
<td>La evolución de las políticas de gasto de las Administraciones Públicas en los años 90</td>
<td>Alfonso Utrilla de la Hoz y Carmen Pérez Esparrells</td>
</tr>
<tr>
<td>165/2001</td>
<td>Bank cost efficiency and output specification</td>
<td>Emili Tortosa-Ausina</td>
</tr>
<tr>
<td>166/2001</td>
<td>Recent trends in Spanish income distribution: A robust picture of falling income inequality</td>
<td>Josep Oliver-Alonso, Xavier Ramos y José Luis Raymond-Bara</td>
</tr>
<tr>
<td>167/2001</td>
<td>Efectos redistributivos y sobre el bienestar social del tratamiento de las cargas familiares en el nuevo IRPF</td>
<td>Nuria Badenes Plá, Julio López Laborda, Jorge Onrubia Fernández</td>
</tr>
<tr>
<td>168/2001</td>
<td>The Effects of Bank Debt on Financial Structure of Small and Medium Firms in some European Countries</td>
<td>Mónica Melle-Hernández</td>
</tr>
<tr>
<td>169/2001</td>
<td>La política de cohesión de la UE ampliada: la perspectiva de España</td>
<td>Ismael Sanz Labrador</td>
</tr>
<tr>
<td>170/2002</td>
<td>Riesgo de liquidez de Mercado</td>
<td>Mariano González Sánchez</td>
</tr>
<tr>
<td>171/2002</td>
<td>Los costes de administración para el afiliado en los sistemas de pensiones basados en cuentas de capitalización individual: medida y comparación internacional.</td>
<td>José Enrique Devesa Carpio, Rosa Rodriguez Barrera, Carlos Vidal Meliá</td>
</tr>
<tr>
<td>172/2002</td>
<td>La encuesta continua de presupuestos familiares (1985-1996): descripción, representatividad y propuestas de metodología para la explotación de la información de los ingresos y el gasto.</td>
<td>Llorec Pou, Joaquín Alegre</td>
</tr>
<tr>
<td>173/2002</td>
<td>Modelos paramétricos y no paramétricos en problemas de concesión de tarjetas de crédito.</td>
<td>Rosa Puertas, María Bonilla, Ignacio Olmeda</td>
</tr>
</tbody>
</table>
174/2002 Mercado único, comercio intra-industrial y costes de ajuste en las manufacturas españolas.
José Vicente Blanes Cristóbal

175/2003 La Administración tributaria en España. Un análisis de la gestión a través de los ingresos y de los gastos.
Juan de Dios Jiménez Aguilera, Pedro Enrique Barrilao González

Santiago Carbó Valverde, Rafael López del Paso, David B. Humphrey

177/2003 Effects of ATMs and Electronic Payments on Banking Costs: The Spanish Case.
Santiago Carbó Valverde, Rafael López del Paso, David B. Humphrey

178/2003 Factors explaining the interest margin in the banking sectors of the European Union.
Joaquín Maudos y Juan Fernández Guevara

179/2003 Los planes de stock options para directivos y consejeros y su valoración por el mercado de valores en España.
Mónica Melle Hernández

Yener Altunbas, Santiago Carbó y Phil Molyneux

181/2003 The Euro effect on the integration of the European stock markets.
Mónica Melle Hernández

182/2004 In search of complementarity in the innovation strategy: international R&D and external knowledge acquisition.
Bruno Cassiman, Reinhilde Veugelers

183/2004 Fijación de precios en el sector público: una aplicación para el servicio municipal de suministro de agua.
Mª Ángeles García Valiñas

184/2004 Estimación de la economía sumergida en España: un modelo estructural de variables latentes.
Ángel Alañón Pardo, Miguel Gómez de Antonio

185/2004 Causas políticas y consecuencias sociales de la corrupción.
Joan Oriol Prats Cabrera

186/2004 Loan bankers’ decisions and sensitivity to the audit report using the belief revision model.
Andrés Guiral Contreras and José A. Gonzalo Angulo

Marta Tolentino García-Abadillo y Antonio Díaz Pérez

188/2004 Does market competition make banks perform well?.
Mónica Melle

189/2004 Efficiency differences among banks: external, technical, internal, and managerial.
Santiago Carbó Valverde, David B. Humphrey y Rafael López del Paso
190/2004 Una aproximación al análisis de los costes de la esquizofrenia en España: los modelos jerárquicos bayesianos
F. J. Vázquez-Polo, M. A. Negrín, J. M. Cavasés, E. Sánchez y grupo RIRAG

191/2004 Environmental proactivity and business performance: an empirical analysis
Javier González-Benito y Óscar González-Benito

192/2004 Economic risk to beneficiaries in national defined contribution accounts (NDCs)
Carlos Vidal-Meliá, Inmaculada Domínguez-Fabian y José Enrique Devesa-Carpio

193/2004 Sources of efficiency gains in port reform: non parametric malmquist decomposition tfp index for Mexico
Antonio Estache, Beatriz Tovar de la Fé y Lourdes Trujillo

194/2004 Persistencia de resultados en los fondos de inversión españoles
Alfredo Ciriaco Fernández y Rafael Santamaría Aquilué

195/2005 El modelo de revisión de creencias como aproximación psicológica a la formación del juicio del auditor sobre la gestión continuada
Andrés Guiral Contreras y Francisco Esteso Sánchez

196/2005 La nueva financiación sanitaria en España: descentralización y prospectiva
David Cantarero Prieto

197/2005 A cointegration analysis of the Long-Run supply response of Spanish agriculture to the common agricultural policy
José A. Mendez, Ricardo Mora y Carlos San Juan

198/2005 ¿Refleja la estructura temporal de los tipos de interés del mercado español preferencia por la liquidez?
Magdalena Massot Perelló y Juan M. Nave

199/2005 Análisis de impacto de los Fondos Estructurales Europeos recibidos por una economía regional: Un enfoque a través de Matrices de Contabilidad Social
M. Carmen Lima y M. Alejandro Cardenete

200/2005 Does the development of non-cash payments affect monetary policy transmission?
Santiago Carbó Valverde y Rafael López del Paso

201/2005 Firm and time varying technical and allocative efficiency: an application for port cargo handling firms
Ana Rodríguez-Álvarez, Beatriz Tovar de la Fé y Lourdes Trujillo

202/2005 Contractual complexity in strategic alliances
Jeffrey J. Reuer y Africa Ariño

203/2005 Factores determinantes de la evolución del empleo en las empresas adquiridas por opa
Nuria Alcalde Fradejas y Inés Pérez-Soba Aguilar

Elena Olmedo, Juan M. Valderas, Ricardo Gimeno and Lorenzo Escot
205/2005 Precio de la tierra con presión urbana: un modelo para España
Esther Decimavilla, Carlos San Juan y Stefan Sperlich

206/2005 Interregional migration in Spain: a semiparametric analysis
Adolfo Maza y José Villaverde

207/2005 Productivity growth in European banking
Carmen Murillo-Melchor, José Manuel Pastor y Emili Tortosa-Ausina

Santiago Carbó Valverde, David B. Humphrey y Rafael López del Paso

209/2005 La elasticidad de sustitución intertemporal con preferencias no separables intratemporalmente: los casos de Alemania, España y Francia.
Elena Márquez de la Cruz, Ana R. Martínez Cañete y Inés Pérez-Soba Aguilar

210/2005 Contribución de los efectos tamaño, book-to-market y momentum a la valoración de activos: el caso español.
Begoña Font-Belaire y Alfredo Juan Grau-Grau

211/2005 Permanent income, convergence and inequality among countries
José M. Pastor and Lorenzo Serrano

212/2005 The Latin Model of Welfare: Do 'Insertion Contracts' Reduce Long-Term Dependence?
Luis Ayala and Magdalena Rodríguez

213/2005 The effect of geographic expansion on the productivity of Spanish savings banks
Manuel Illueca, José M. Pastor and Emili Tortosa-Ausina

214/2005 Dynamic network interconnection under consumer switching costs
Ángel Luis López Rodriguez

215/2005 La influencia del entorno socioeconómico en la realización de estudios universitarios: una aproximación al caso español en la década de los noventa
Marta Rahona López

216/2005 The valuation of spanish ipos: efficiency analysis
Susana Álvarez Otero

217/2005 On the generation of a regular multi-input multi-output technology using parametric output distance functions
Sergio Perelman and Daniel Santín

218/2005 La gobernanza de los procesos parlamentarios: la organización industrial del congreso de los diputados en España
Gonzalo Caballero Miguez

219/2005 Determinants of bank market structure: Efficiency and political economy variables
Francisco González

220/2005 Agresividad de las órdenes introducidas en el mercado español: estrategias, determinantes y medidas de performance
David Abad Díaz
221/2005 Tendencia post-anuncio de resultados contables: evidencia para el mercado español
Carlos Forner Rodríguez, Joaquín Marhuenda Fructuoso y Sonia Sanabria García

222/2005 Human capital accumulation and geography: empirical evidence in the European Union
Jesús López-Rodriguez, J. Andrés Faíña y Jose Lopez Rodriguez

223/2005 Auditors' Forecasting in Going Concern Decisions: Framing, Confidence and Information Processing
Waymond Rodgers and Andrés Guiral

José Ramón Cancelo de la Torre, J. Andrés Faíña and Jesús López-Rodriguez

225/2005 The effects of ownership structure and board composition on the audit committee activity: Spanish evidence
Carlos Fernández Méndez and Rubén Arrondo García

226/2005 Cross-country determinants of bank income smoothing by managing loan loss provisions
Ana Rosa Fonseca and Francisco González

Alejandro Estellér Moré

228/2005 Region versus Industry effects: volatility transmission
Pilar Soriano Felipe and Francisco J. Climent Diranzo

Daniel Vázquez-Bustelo and Sandra Valle

Alfonso Palacio-Vera

231/2005 Reconciling Sustainability and Discounting in Cost Benefit Analysis: a methodological proposal
M. Carmen Almansa Sáez and Javier Calatrava Requena

232/2005 Can The Excess Of Liquidity Affect The Effectiveness Of The European Monetary Policy?
Santiago Carbó Valverde and Rafael López del Paso

Miguel Angel Barberán Lahuerta

Víctor M. González

Waymond Rodgers, Paul Pavlou and Andres Guiral.

Francisco J. André, M. Alejandro Cardenete y Carlos Romero.
Santiago Carbó-Valverde, Francisco Rodríguez-Fernández y Gregory F. Udell.

238/2006 Trade Effects Of Monetary Agreements: Evidence For Oecd Countries.
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano.

Marcos Álvarez-Díaz y Gonzalo Caballero Miguez.

240/2006 La interacción entre el éxito competitivo y las condiciones del mercado doméstico como deter-
minantes de la decisión de exportación en las Pymes.
Francisco García Pérez.

241/2006 Una estimación de la depreciación del capital humano por sectores, por ocupación y en el
tiempo.
Inés P. Murillo.

Manuel A. Gómez.

243/2006 Measuring efficiency in education: an analysis of different approaches for incorporating
non-discretionary inputs.
Jose Manuel Cordero-Ferrera, Francisco Pedraja-Chaparro y Javier Salinas-Jiménez

244/2006 Did The European Exchange-Rate Mechanism Contribute To The Integration Of Peripheral
Countries?.
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano

Marta Pascual and David Cantarero

246/2006 Measurement and analysis of the Spanish Stock Exchange using the Lyapunov exponent with
digital technology.
Salvador Rojí Ferrari and Ana Gonzalez Marcos

247/2006 Testing For Structural Breaks In Variance Withadditive Outliers And Measurement Errors.
Paulo M.M. Rodrigues and Antonio Rubia

Joaquín Maudos and Juan Fernández de Guevara

Desiderio Romero Jordán, José Félix Sanz Sanz y César Pérez López

250/2006 Regional Income Disparities in Europe: What role for location?.
Jesús López-Rodriguez and J. Andrés Faíña

251/2006 Funciones abreviadas de bienestar social: Una forma sencilla de simultanear la medición de la
eficiencia y la equidad de las políticas de gasto público.
Nuria Badenes Plá y Daniel Santín González

252/2006 “The momentum effect in the Spanish stock market: Omitted risk factors or investor behaviour?”.
Luis Muga and Rafael Santamaria

253/2006 Dinámica de precios en el mercado español de gasolina: un equilibrio de colusión tácita.
Jordi Perdigueró García
José M. Pastor, Empar Pons y Lorenzo Serrano

255/2006 Environmental implications of organic food preferences: an application of the impure public goods model.
Ana María Aldanondo-Ochoa y Carmen Almansa-Sáez

José Félix Sanz-Sanz, Desiderio Romero-Jordán y Santiago Álvarez-García

257/2006 La internacionalización de la empresa manufacturera española: efectos del capital humano genérico y específico.
José López Rodríguez

María Martínez Torres

259/2006 Efficiency and market power in Spanish banking.
Rolf Färe, Shawna Grosskopf y Emili Tortosa-Ausina.

Helena Chuliá y Hipòlit Torró.

José Antonio Ortega.

262/2006 Accidentes de tráfico, víctimas mortales y consumo de alcohol.
José Mª Arranz y Ana I. Gil.

263/2006 Análisis de la Presencia de la Mujer en los Consejos de Administración de las Mil Mayores Empresas Españolas.
Ruth Mateos de Cabo, Lorenzo Escot Mangas y Ricardo Gimeno Nogués.

Ignacio Álvarez Peralta.

Jaime Vallés-Giménez y Anabel Zárate-Marco.

266/2006 Health Human Capital And The Shift From Foraging To Farming.
Paolo Rungo.

Juan Luis Jiménez y Jordi Perdiguer.

Desiderio Romero-Jordán y José Félix Sanz-Sanz.

269/2006 Banking competition, financial dependence and economic growth.
Joaquín Maudos y Juan Fernández de Guevara

270/2006 Efficiency, subsidies and environmental adaptation of animal farming under CAP.
Werner Kleinhanß, Carmen Murillo, Carlos San Juan y Stefan Sperlich
A. García-Lorenzo y Jesús López-Rodríguez

272/2006 Riesgo asimétrico y estrategias de momentum en el mercado de valores español
Luis Muga y Rafael Santamaria

273/2006 Valoración de capital-riesgo en proyectos de base tecnológica e innovadora a través de la teoría de opciones reales
Gracia Rubio Martín

274/2006 Capital stock and unemployment: searching for the missing link
Ana Rosa Martínez-Cañete, Elena Márquez de la Cruz, Alfonso Palacio-Vera and Inés Pérez-Soba Aguilar

275/2006 Study of the influence of the voters’ political culture on vote decision through the simulation of a political competition problem in Spain
Sagrario Lantarón, Isabel Lillo, Mª Dolores López and Javier Rodrigo

276/2006 Investment and growth in Europe during the Golden Age
Antonio Cubel and Mª Teresa Sanchis

277/2006 Efectos de vincular la pensión pública a la inversión en cantidad y calidad de hijos en un modelo de equilibrio general
Robert Meneu Gaya

278/2006 El consumo y la valoración de activos
Elena Márquez y Belén Nieto

279/2006 Economic growth and currency crisis: A real exchange rate entropic approach
David Matesanz Gómez y Guillermo J. Ortega

280/2006 Three measures of returns to education: An illustration for the case of Spain
María Arrazola y José de Hevia

281/2006 Composition of Firms versus Composition of Jobs
Antoni Cunyat

282/2006 La vocación internacional de un holding tranviario belga: la Compagnie Mutuelle de Tramways, 1895-1918
Alberte Martínez López

283/2006 Una visión panorámica de las entidades de crédito en España en la última década.
Constantino García Ramos

Alberte Martínez López

285/2006 Los intereses belgas en la red ferroviaria catalana, 1890-1936
Alberte Martínez López

286/2006 The Governance of Quality: The Case of the Agrifood Brand Names
Marta Fernández Barcala, Manuel González-Díaz y Emmanuel Raynaud

287/2006 Modelling the role of health status in the transition out of malthusian equilibrium
Paolo Rungo, Luis Currais and Berta Rivera

288/2006 Industrial Effects of Climate Change Policies through the EU Emissions Trading Scheme
Xavier Labandeira and Miguel Rodríguez
Globalisation and the Composition of Government Spending: An analysis for OECD countries
Norman Gemmell, Richard Kneller and Ismael Sanz

La producción de energía eléctrica en España: Análisis económico de la actividad tras la liberalización del Sector Eléctrico
Fernando Hernández Martínez

Further considerations on the link between adjustment costs and the productivity of R&D investment: evidence for Spain
Desiderio Romero-Jordán, José Félix Sanz-Sanz and Inmaculada Álvarez-Ayuso

Una teoría sobre la contribución de la función de compras al rendimiento empresarial
Javier González Benito

Agility drivers, enablers and outcomes: empirical test of an integrated agile manufacturing model
Daniel Vázquez-Bustelo, Lucía Avella and Esteban Fernández

Testing the parametric vs the semiparametric generalized mixed effects models
Maria José Lombardía and Stefan Sperlich

Nonlinear dynamics in energy futures
Mariano Matilla-García

Estimating Spatial Models By Generalized Maximum Entropy Or How To Get Rid Of W
Esteban Fernández Vázquez, Matías Mayor Fernández and Jorge Rodríguez-Valez

Optimización fiscal en las transmisiones lucrativas: análisis metodológico
Félix Domínguez Barrero

La situación actual de la banca online en España
Francisco José Climent Diranzo y Alexandre Momparler Pechuán

Estrategia competitiva y rendimiento del negocio: el papel mediador de la estrategia y las capacidades productivas
Javier González Benito y Isabel Suárez González

A Parametric Model to Estimate Risk in a Fixed Income Portfolio
Pilar Abad and Sonia Benito

Análisis Empírico de las Preferencias Sociales Respecto del Gasto en Obra Social de las Cajas de Ahorros
Alejandro Esteller-Moré, Jonathan Jorba Jiménez y Albert Solé-Ollé

Assessing the enlargement and deepening of regional trading blocs: The European Union case
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano

¿Es la Franquicia un Medio de Financiación?: Evidencia para el Caso Español
Vanesa Solís Rodríguez y Manuel González Díaz

On the Finite-Sample Biases in Nonparametric Testing for Variance Constancy
Paulo M.M. Rodrigues and Antonio Rubia

Spain is Different: Relative Wages 1989-98
José Antonio Carrasco Gallego
Wood and industrialization. evidence and hypotheses from the case of Spain, 1860-1935. Iñaki Iriarte-Goñi and María Isabel Ayuda Bosque

New evidence on long-run monetary neutrality. J. Cunado, L.A. Gil-Alana and F. Perez de Gracia

Monetary policy and structural changes in the volatility of us interest rates. Juncal Cuñado, Javier Gomez Biscarri and Fernando Perez de Gracia

The productivity effects of intrafirm diffusion. Lucio Fuentelsaz, Jaime Gómez and Sergio Palomas

Unemployment duration, layoffs and competing risks. J.M. Arranz, C. García-Serrano and L. Toharia

El grado de cobertura del gasto público en España respecto a la UE-15 Nuria Rueda, Begoña Barruso, Carmen Calderón y Mª del Mar Herrador

The Impact of Direct Subsidies in Spain before and after the CAP’92 Reform Carmen Murillo, Carlos San Juan and Stefan Sperlich

Determinants of post-privatisation performance of Spanish divested firms Laura Cabeza García and Silvia Gómez Ansón

¿Por qué deciden diversificar las empresas españolas? Razones oportunistas versus razones económicas Almudena Martínez Campillo

Dynamical Hierarchical Tree in Currency Markets Juan Gabriel Brida, David Matesanz Gómez and Wiston Adrián Risso

Los determinantes sociodemográficos del gasto sanitario. Análisis con microdatos individuales Ana María Angulo, Ramón Barberán, Pilar Egea y Jesús Mur

Why do companies go private? The Spanish case Inés Pérez-Soba Aguilar

The use of gis to study transport for disabled people Verónica Cañal Fernández

The long run consequences of M&A: An empirical application Cristina Bernad, Lucio Fuentelsaz and Jaime Gómez

Las clasificaciones de materias en economía: principios para el desarrollo de una nueva clasificación Valentín Edo Hernández

Reforming Taxes and Improving Health: A Revenue-Neutral Tax Reform to Eliminate Medical and Pharmaceutical VAT Santiago Álvarez-García, Carlos Pestana Barros y Juan Prieto-Rodriguez

Impacts of an iron and steel plant on residential property values Celia Bilbao-Terol

Firm size and capital structure: Evidence using dynamic panel data Víctor M. González and Francisco González
¿Cómo organizar una cadena hotelera? La elección de la forma de gobierno
Marta Fernández Barcala y Manuel González Díaz

Análisis de los efectos de la decisión de diversificar: un contraste del marco teórico “Agencia-Stewardship”
Almudena Martínez Campillo y Roberto Fernández Gago

Selecting portfolios given multiple eurostoxx-based uncertainty scenarios: a stochastic goal programming approach from fuzzy betas
Enrique Ballestero, Blanca Pérez-Gladish, Mar Arenas-Parra and Amelia Bilbao-Terol

“El bienestar de los inmigrantes y los factores implicados en la decisión de emigrar”
Anastasia Hernández Alemán y Carmelo J. León

Andrea Martínez-Noya and Esteban García-Canal

Diferencias salariales entre empresas públicas y privadas. El caso español
Begoña Cueto y Nuria Sánchez- Sánchez

Effects of Fiscal Treatments of Second Home Ownership on Renting Supply
Celia Bilbao Terol and Juan Prieto Rodríguez

Auditors’ ethical dilemmas in the going concern evaluation
Andres Guiral, Waymond Rodgers, Emiliano Ruiz and Jose A. Gonzalo

Convergencia en capital humano en España. Un análisis regional para el periodo 1970-2004
Susana Morales Sequera y Carmen Pérez Esparrells

Socially responsible investment: mutual funds portfolio selection using fuzzy multiobjective programming
Blanca Mª Pérez-Gladish, Mar Arenas-Parra, Amelia Bilbao-Terol and Mª Victoria Rodriguez-Uria

Persistencia del resultado contable y sus componentes: implicaciones de la medida de ajustes por devengo
Raúl Iñiguez Sánchez y Francisco Poveda Fuentes

Wage Inequality and Globalisation: What can we Learn from the Past? A General Equilibrium Approach
Concha Betrán, Javier Ferri and Maria A. Pons

Eficacia de los incentivos fiscales a la inversión en I+D en España en los años noventa
Desiderio Romero Jordán y José Félix Sanz Sanz

Convergencia regional en renta y bienestar en España
Robert Meneu Gaya

Tributación ambiental: Estado de la Cuestión y Experiencia en España
Ana Carrera Poncela

Salient features of dependence in daily us stock market indices
Luis A. Gil-Alana, Juncal Cuñado and Fernando Pérez de Gracia

La educación superior: ¿un gasto o una inversión rentable para el sector público?
Inés P. Murillo y Francisco Pedraja
358/2007 Effects of a reduction of working hours on a model with job creation and job destruction
Emilio Domínguez, Miren Ullibarri y Idoya Zabaleta

359/2007 Stock split size, signaling and earnings management: Evidence from the Spanish market
José Yagüe, J. Carlos Gómez-Sala and Francisco Poveda-Fuentes

360/2007 Modelización de las expectativas y estrategias de inversión en mercados de derivados
Begoña Font-Belaire

361/2008 Trade in capital goods during the golden age, 1953-1973
Mª Teresa Sanchis and Antonio Cubel

362/2008 El capital económico por riesgo operacional: una aplicación del modelo de distribución de pérdidas
Enrique José Jiménez Rodríguez y José Manuel Feria Domínguez

363/2008 The drivers of effectiveness in competition policy
Joan-Ramon Borrell and Juan-Luis Jiménez

364/2008 Corporate governance structure and board of directors remuneration policies: evidence from Spain
Carlos Fernández Méndez, Rubén Arrondo García and Enrique Fernández Rodríguez

365/2008 Beyond the disciplinary role of governance: how boards and donors add value to Spanish foundations
Pablo De Andrés Alonso, Valentin Azofra Palenzuela y M. Elena Romero Merino

366/2008 Complejidad y perfeccionamiento contractual para la contención del oportunismo en los acuerdos de franquicia
Vanessa Solís Rodríguez y Manuel González Díaz

367/2008 Inestabilidad y convergencia entre las regiones europeas
Jesús Mur, Fernando López y Ana Angulo

368/2008 Análisis espacial del cierre de explotaciones agrarias
Ana Aldanondo Ochoa, Carmen Almansa Sáez y Valero Casanovas Oliva

369/2008 Cross-Country Efficiency Comparison between Italian and Spanish Public Universities in the period 2000-2005
Tommaso Agasisti and Carmen Pérez Esparrells

370/2008 El desarrollo de la sociedad de la información en España: un análisis por comunidades autónomas
María Concepción García Jiménez y José Luis Gómez Barroso

371/2008 El medioambiente y los objetivos de fabricación: un análisis de los modelos estratégicos para su consecución
Lucía Avella Camarero, Esteban Fernández Sánchez y Daniel Vázquez-Bustelo

372/2008 Influence of bank concentration and institutions on capital structure: New international evidence
Víctor M. González and Francisco González

373/2008 Generalización del concepto de equilibrio en juegos de competición política
Mª Dolores López González y Javier Rodrigo Hitos

374/2008 Smooth Transition from Fixed Effects to Mixed Effects Models in Multi-level regression Models
Maria José Lombardía and Stefan Sperlich
<table>
<thead>
<tr>
<th>Year</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>A Revenue-Neutral Tax Reform to Increase Demand for Public Transport Services</td>
<td>Carlos Pestana Barros and Juan Prieto-Rodriguez</td>
</tr>
<tr>
<td>2008</td>
<td>Measurement of intra-distribution dynamics: An application of different approaches to the European regions</td>
<td>Adolfo Maza, María Hierro and José Villaverde</td>
</tr>
<tr>
<td>2008</td>
<td>Migración interna de extranjeros y ¿nueva fase en la convergencia?</td>
<td>María Hierro y Adolfo Maza</td>
</tr>
<tr>
<td>2008</td>
<td>Efectos de la Reforma del Sector Eléctrico: Modelización Teórica y Experiencia Internacional</td>
<td>Ciro Eduardo Bazán Navarro</td>
</tr>
<tr>
<td>2008</td>
<td>A Non-Parametric Independence Test Using Permutation Entropy</td>
<td>Mariano Matilla-García and Manuel Ruiz Marín</td>
</tr>
<tr>
<td>2008</td>
<td>Testing for the General Fractional Unit Root Hypothesis in the Time Domain</td>
<td>Uwe Hassler, Paulo M.M. Rodrigues and Antonio Rubia</td>
</tr>
<tr>
<td>2008</td>
<td>Multivariate gram-charlier densities</td>
<td>Esther B. Del Brio, Trino-Manuel Ñíguez and Javier Perote</td>
</tr>
<tr>
<td>2008</td>
<td>Analyzing Semiparametrically the Trends in the Gender Pay Gap - The Example of Spain</td>
<td>Ignacio Moral-Arce, Stefan Sperlich, Ana I. Fernández-Sainz and Maria J. Roca</td>
</tr>
<tr>
<td>2008</td>
<td>A Cost-Benefit Analysis of a Two-Sided Card Market</td>
<td>Santiago Carbó Valverde, David B. Humphrey, José Manuel Liñares Zegarra and Francisco Rodríguez Fernandez</td>
</tr>
<tr>
<td>2008</td>
<td>A Fuzzy Bicriteria Approach for Journal Deselection in a Hospital Library</td>
<td>M. L. López-Avello, M. V. Rodríguez-Uría, B. Pérez-Gladish, A. Bilbao-Terol, M. Arenas-Parra</td>
</tr>
<tr>
<td>2008</td>
<td>Valoración de las grandes corporaciones farmacéuticas, a través del análisis de sus principales intangibles, con el método de opciones reales</td>
<td>Gracia Rubio Martín y Prosper Lamothe Fernández</td>
</tr>
<tr>
<td>2008</td>
<td>El marketing interno como impulsor de las habilidades comerciales de las pymes españolas: efectos en los resultados empresariales</td>
<td>Mª Leticia Santos Vijande, Mª José Sanzo Pérez, Nuria García Rodríguez y Juan A. Trespalacios Gutiérrez</td>
</tr>
<tr>
<td>2008</td>
<td>Understanding Warrants Pricing: A case study of the financial market in Spain</td>
<td>David Abad and Belén Nieto</td>
</tr>
<tr>
<td>2008</td>
<td>Aglomeración espacial, Potencial de Mercado y Geografía Económica: Una revisión de la literatura</td>
<td>Jesús López-Rodríguez y J. Andrés Faiña</td>
</tr>
<tr>
<td>2008</td>
<td>An empirical assessment of the impact of switching costs and first mover advantages on firm performance</td>
<td>Jaime Gómez, Juan Pablo Maicas</td>
</tr>
<tr>
<td>2008</td>
<td>Tender offers in Spain: testing the wave</td>
<td>Ana R. Martínez-Cañete y Inés Pérez-Soba Aguilar</td>
</tr>
</tbody>
</table>
391/2008 La integración del mercado español a finales del siglo XIX: los precios del trigo entre 1891 y 1905
Mariano Matilla García, Pedro Pérez Pascual y Basilio Sanz Carnero

392/2008 Cuando el tamaño importa: estudio sobre la influencia de los sujetos políticos en la balanza de bienes y servicios
Alfonso Echazarra de Gregorio

393/2008 Una visión cooperativa de las medidas ante el posible daño ambiental de la desalación
Borja Montañón Sanz

394/2008 Efectos externos del endeudamiento sobre la calificación crediticia de las Comunidades Autónomas
Andrés Leal Marcos y Julio López Laborda

395/2008 Technical efficiency and productivity changes in Spanish airports: A parametric distance functions approach
Beatriz Tovar & Roberto Rendeiro Martín-Cejas

396/2008 Network analysis of exchange data: Interdependence drives crisis contagion
David Matesanz Gómez & Guillermo J. Ortega

397/2008 Explaining the performance of Spanish privatised firms: a panel data approach
Laura Cabeza García and Silvia Gomez Anson

398/2008 Technological capabilities and the decision to outsource R&D services
Andrea Martínez-Noya and Esteban García-Canal

399/2008 Hybrid Risk Adjustment for Pharmaceutical Benefits
Manuel García-Goñi, Pere Ibern & José María Inoriza

400/2008 The Team Consensus–Performance Relationship and the Moderating Role of Team Diversity
José Henrique Dieguez, Javier González-Benito and Jesús Galende

401/2008 The institutional determinants of CO₂ emissions: A computational modelling approach using Artificial Neural Networks and Genetic Programming
Marcos Álvarez-Díaz, Gonzalo Caballero Miguez and Mario Soliño

402/2008 Alternative Approaches to Include Exogenous Variables in DEA Measures: A Comparison Using Monte Carlo
José Manuel Cordero-Ferrera, Francisco Pedraja-Chaparro and Daniel Santín-González

403/2008 Efecto diferencial del capital humano en el crecimiento económico andaluz entre 1985 y 2004: comparación con el resto de España
Mª del Pópulo Pablo-Romero Gil-Delgado y Mª de la Palma Gómez-Calero Valdés

404/2008 Análisis de fusiones, variaciones conjeturales y la falacia del estimador en diferencias
Juan Luis Jiménez y Jordi Perdiguerro

405/2008 Política fiscal en la uem: ¿basta con los estabilizadores automáticos?
Jorge Uxó González y Mª Jesús Arroyo Fernández

406/2008 Papel de la orientación emprendedora y la orientación al mercado en el éxito de las empresas
Óscar González-Benito, Javier González-Benito y Pablo A. Muñoz-Gallego

407/2008 La presión fiscal por impuesto sobre sociedades en la unión europea
Elena Fernández Rodríguez, Antonio Martínez Arias y Santiago Álvarez García
408/2008 The environment as a determinant factor of the purchasing and supply strategy: an empirical analysis
Dr. Javier González-Benito y MS Duilio Reis da Rocha

409/2008 Cooperation for innovation: the impact on innovatory effort
Gloria Sánchez González and Liliana Herrera

410/2008 Spanish post-earnings announcement drift and behavioral finance models
Carlos Forner and Sonia Sanabria

411/2008 Decision taking with external pressure: evidence on football manager dismissals in argentina and their consequences
Ramón Flores, David Forrest and Juan de Dios Tena

Raúl Serrano y Vicente Pinilla

413/2008 Voter heuristics in Spain: a descriptive approach elector decision
José Luis Sáez Lozano and Antonio M. Jaime Castillo

414/2008 Análisis del efecto área de salud de residencia sobre la utilización y acceso a los servicios sanitarios en la Comunidad Autónoma Canaria
Ignacio Abásolo Alessón, Lidia García Pérez, Raquel Aguiar Ibáñez y Asier Amador Robayna

415/2008 Impact on competitive balance from allowing foreign players in a sports league: an analytical model and an empirical test
Ramón Flores, David Forrest & Juan de Dios Tena

416/2008 Organizational innovation and productivity growth: Assessing the impact of outsourcing on firm performance
Alberto López

417/2008 Value Efficiency Analysis of Health Systems
Eduardo González, Ana Cárcaba & Juan Ventura

418/2008 Equidad en la utilización de servicios sanitarios públicos por comunidades autónomas en España: un análisis multinivel
Ignacio Abásolo, Jaime Pinilla, Miguel Negrín, Raquel Aguiar y Lidia García

419/2008 Piedras en el camino hacia Bolonia: efectos de la implantación del EEES sobre los resultados académicos
Carmen Florido, Juan Luis Jiménez e Isabel Santana

420/2008 The welfare effects of the allocation of airlines to different terminals
M. Pilar Socorro and Ofelia Betancor

421/2008 How bank capital buffers vary across countries. The influence of cost of deposits, market power and bank regulation
Ana Rosa Fonseca and Francisco González

422/2008 Analysing health limitations in spain: an empirical approach based on the european community household panel
Marta Pascual and David Cantarero
Regional productivity variation and the impact of public capital stock: an analysis with spatial interaction, with reference to Spain
Miguel Gómez-Antonio and Bernard Fingleton

Average effect of training programs on the time needed to find a job. The case of the training schools program in the south of Spain (Seville, 1997-1999).
José Manuel Cansino Muñoz-Repiso and Antonio Sánchez Braza

Medición de la eficiencia y cambio en la productividad de las empresas distribuidoras de electricidad en Perú después de las reformas
Raúl Pérez-Reyes y Beatriz Tovar

Acercando posturas sobre el descuento ambiental: sondeo Delphi a expertos en el ámbito internacional
Carmen Almansa Sáez y José Miguel Martínez Paz

Determinants of abnormal liquidity after rating actions in the Corporate Debt Market
Pilar Abad, Antonio Díaz and M. Dolores Robles

Export led-growth and balance of payments constrained. New formalization applied to Cuban commercial regimes since 1960
David Matesanz Gómez, Guadalupe Fugarolas Álvarez-Ude and Isís Mañalich Gálvez

La deuda implícita y el desequilibrio financiero-actuarial de un sistema de pensiones. El caso del régimen general de la seguridad social en España
José Enrique Devesa Carpio y Mar Devesa Carpio

Efectos de la descentralización fiscal sobre el precio de los carburantes en España
Desiderio Romero Jordán, Marta Jorge García-Inés y Santiago Álvarez García

Euro, firm size and export behavior
Silviano Esteve-Pérez, Salvador Gil-Pareja, Rafael Llorca-Vivero and José Antonio Martínez-Serrano

Does social spending increase support for free trade in advanced democracies?
Ismael Sanz, Ferran Martínez i Coma and Federico Steinberg

Potencial de Mercado y Estructura Espacial de Salarios: El Caso de Colombia
Jesús López-Rodriguez y Maria Cecilia Acevedo

Persistence in Some Energy Futures Markets
Juncal Cunado, Luis A. Gil-Alana and Fernando Pérez de Gracia

La inserción financiera externa de la economía francesa: inversores institucionales y nueva gestión empresarial
Ignacio Álvarez Peralta

¿Flexibilidad o rigidez salarial en España?: un análisis a escala regional
Ignacio Moral Arce y Adolfo Maza Fernández

Intangible relationship-specific investments and the performance of r&d outsourcing agreements
Andrea Martínez-Noya, Esteban García-Canal & Mauro F. Guillén

Friendly or Controlling Boards?
Pablo de Andrés Alonso & Juan Antonio Rodríguez Sanz
La sociedad Trenor y Cía. (1838-1926): un modelo de negocio industrial en la España del siglo XIX
Amparo Ruiz Llopis

Continental bias in trade
Salvador Gil-Pareja, Rafael Llorca-Vivero & José Antonio Martínez Serrano

Determining operational capital at risk: an empirical application to the retail banking
Enrique José Jiménez-Rodríguez, José Manuel Feria-Dominguez & José Luis Martín-Marín

Costes de mitigación y escenarios post-kyoto en España: un análisis de equilibrio general para España
Mikel González Ruiz de Eguino

Las revistas españolas de economía en las bibliotecas universitarias: ranking, valoración del indicador y del sistema
Valentín Edo Hernández

Convergencia económica en España y coordinación de políticas económicas. un estudio basado en la estructura productiva de las CC.AA.
Ana Cristina Mingorance Arnáiz

Instrumentos de mercado para reducir emisiones de co2: un análisis de equilibrio general para España
Mikel González Ruiz de Eguino

El comercio intra e inter-regional del sector Turismo en España
Carlos Llano y Tamara de la Mata

Efectos del incremento del precio del petróleo en la economía española: Análisis de cointegración y de la política monetaria mediante reglas de Taylor
Fernando Hernández Martínez

Bologna Process and Expenditure on Higher Education: A Convergence Analysis of the EU-15
T. Agasisti, C. Pérez Esparrells, G. Catalano & S. Morales

Global Economy Dynamics? Panel Data Approach to Spillover Effects
Gregory Daco, Fernando Hernández Martínez & Li-Wu Hsu

Pricing levered warrants with dilution using observable variables
Isabel Abínzano & Javier F. Navas

Information technologies and financial performance: The effect of technology diffusion among competitors
Lucio Fuentelsaz, Jaime Gómez & Sergio Palomas

A Detailed Comparison of Value at Risk in International Stock Exchanges
Pilar Abad & Sonia Benito