

Weber, Enzo

Working Paper

Macro wine in financial skins: The Oil-FX interdependence

SFB 649 Discussion Paper, No. 2008-048

Provided in Cooperation with:

Collaborative Research Center 649: Economic Risk, Humboldt University Berlin

Suggested Citation: Weber, Enzo (2008) : Macro wine in financial skins: The Oil-FX interdependence, SFB 649 Discussion Paper, No. 2008-048, Humboldt University of Berlin, Collaborative Research Center 649 - Economic Risk, Berlin

This Version is available at:

<https://hdl.handle.net/10419/25288>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Macro Wine in Financial Skins: The Oil-FX Interdependence

Enzo Weber*

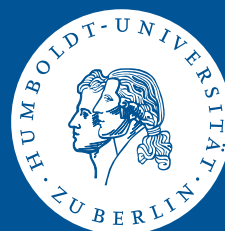


* Freie Universität Berlin, Germany

This research was supported by the Deutsche
Forschungsgemeinschaft through the SFB 649 "Economic Risk".

<http://sfb649.wiwi.hu-berlin.de>
ISSN 1860-5664

SFB 649, Humboldt-Universität zu Berlin
Spandauer Straße 1, D-10178 Berlin



Macro Wine in Financial Skins: The Oil-FX Interdependence¹

Enzo Weber

Universität Mannheim and Freie Universität Berlin

Boltzmannstr. 20, 14195 Berlin, Germany

eweber@wiwiss.fu-berlin.de

phone: +49 (0)30 838-55792 fax: +49 (0)30 838-54142

First version: 02/2008

This version: 03/2008

Abstract

This paper analyses mutual causalities between crude oil price and euro / US dollar exchange rate. Instead of focusing on long-run macroeconomic linkages like the bulk of the relevant literature, the present approach takes a financial markets perspective using daily data. The fast-running simultaneous impacts are identified through heteroscedasticity by specifying multivariate EGARCH processes for the structural variances. While for the decade after 1986 no significance is found, thereafter oil price changes cause inverse reactions of the dollar price and affect its volatility. Reversely, dollar appreciation asymmetrically increases the oil price.

Keywords: Crude Oil Price, Foreign Exchange, Identification

JEL classification: C32, F31, Q43

¹This research was supported by the Deutsche Forschungsgemeinschaft through the CRC 649 "Economic Risk". I am grateful to Jürgen Wolters and Cordelia Thielitz for their help. Of course, all remaining errors are my own.

1 Introduction

Oil price shocks have traditionally been seen as important factors influencing the global and national macroeconomy. Empirically, the econometric literature including Darby (1982), Hamilton (1983, 1988), Bohi (1989, 1991) and Ferderer (1996) has concentrated on the transmission of changes in oil prices to aggregate output and inflation. Concerning the connection of the oil and foreign exchange markets, academic interest focused on explaining long-run persistent fluctuations of the real exchange rate by stochastic trending in the oil price (e.g. Amano and van Norden 1998).

The present paper takes a financial markets perspective, which differs from conventional macroeconomic analyses in that causalities in very short time horizons are considered. For that purpose, I employ daily instead of monthly or quarterly data of crude oil prices and the euro / US dollar rate. Nonetheless, even here spillover effects largely appear contemporaneously, since adjustment of financial markets to economic information and capitalisation of investors' expectations typically take place within one trading day. Usual Granger-causality-type tests relying on serial cross-correlation are thus unlikely to capture the transmission structure appropriately, which is instead identified by an innovative method discussed below.

The above-mentioned literature well elaborated several channels through which oil prices may affect the macroeconomy, reviewed for instance in Barsky and Kilian (2004). To just mention a few, rising² oil prices might lower aggregate output by transferring income to oil-exporting countries, lowering production capacity in their role as input factors, invoking (sectoral and factor) adjustment costs or delaying (irreversible) investment decisions. Inflation is logically boosted by the input price increase, with potential repercussions on output through lowering real balances and evoking counterinflationary monetary policy reactions.

Resuming the discussion on the exchange rate, both real activity slowdown and accelerating inflation, or far more according expectations in financial markets, should lead to nominal devaluation. In addition, higher import prices and deterioration of the balance of trade have a direct effect in the same direction. On a bilateral exchange rate, the overall impact thus depends on the relative oil dependency and intensity of the involved economies. For the US compared to Euroland, one might expect dollar depreciation in response to rising oil prices. Even though the literature largely places oil prices at the

²As long as they are symmetric, for reasons of brevity, reverse effects are not mentioned throughout the paper.

beginning of cause-and-effect chains, the current study does not assume this exogeneity; after all, oil is traded in US dollar, and changes in the value of this means of payment might clearly matter for the nominal price. Therefore, the pure observation for instance of coinciding oil price increase and dollar devaluation is not sufficient for revealing any structural economic interpretation.

Obviously, the simultaneity in potential causalities inevitably induces a classical identification problem. This is addressed employing the methodology suggested by Weber (2007a), which exploits the heteroscedasticity in financial data to identify the contemporaneous impacts without recourse to exclusion restrictions. As a conceptual enhancement, the present approach additionally takes asymmetries into account. While the following section discusses the methodology in more detail, empirical results of the application to the euro / dollar example are presented in section 3. The last section concludes.

2 Econometric Methodology

The data generating process of the n -dimensional vector y_t (here containing daily oil and FX returns) is approximated by the structural VAR with lag length q

$$Ay_t = \mu_0 + \mu_1 d_t + \sum_{j=1}^q B_j y_{t-j} + \varepsilon_t, \quad (1)$$

where the B_j represent $n \times n$ coefficient matrices of lagged effects and ε_t is an n -dimensional vector of uncorrelated structural residuals. The contemporaneous impacts are included in the matrix A with diagonal elements normalised to one. The deterministics comprise a constant and day-of-the-week dummies d_t .

Model (1) as it stands is not identified and therefore cannot be consistently estimated. A first step thus derives the reduced-form VAR

$$y_t = \mu_0^r + \mu_1^r d_t + \sum_{j=1}^q B_j^r y_{t-j} + u_t \quad (2)$$

with all coefficients obtained by premultiplying A^{-1} in (1), therefore marked by the superscript r for "reduced". Accordingly, the new residuals are given by $u_t = A^{-1}\varepsilon_t$.

Naturally, it proves impossible to recover the structural parameters from the reduced form without further constraints: In the matrix A with normalised diagonal, $n(n-1)$ simultaneous impacts have to be estimated, whereas in (2), this contemporaneous interaction

is reflected by cross-correlation of the reduced-form residuals. However, the information contained in the according covariance-matrix is not sufficient for identification, because due to its symmetry, it delivers only $n(n-1)/2$ equations for simultaneous covariances. The recent literature of identification through heteroscedasticity (e.g. Rigobon 2003) addresses this problem by assuming separate time regimes with differing variances of the structural residuals ε_t . The volatility shift between the regimes would deliver two distinct reduced-form covariance-matrices, so that $n(n-1)/2$ additional covariance and n additional variance equations could be obtained from the second matrix. Since the number of free parameters only rises by n , the number of structural variances, full identification can be achieved. The approach of Weber (2007a) specifies multivariate EGARCH processes for the structural residuals, thereby basically keeping up the intuition of identification through volatility regimes: An ARCH-type model practically defines a distinct variance state for every single observation, leading to a quasi continuum of regimes. For a discussion on identification issues in this context, see as well Weber (2007b).

Formalising the model setup, first denote the conditional variances of the elements in $\varepsilon_t = Au_t$ by

$$\text{Var}(\varepsilon_{jt}|\Omega_{t-1}) = h_{jt} \quad j = 1, \dots, n, \quad (3)$$

where Ω_{t-1} stands for the whole set of available information at time $t-1$. The assumption of uncorrelated structural shocks supersedes considering any covariances.

Then, stack the conditional variances in the vector $H_t = \begin{pmatrix} h_{1t} & \dots & h_{nt} \end{pmatrix}'$.

At last, denote the standardised innovations by

$$\tilde{\varepsilon}_{jt} = \varepsilon_{jt}/\sqrt{h_{jt}} \quad j = 1, \dots, n. \quad (4)$$

The multivariate EGARCH(1,1)-process, as suggested by Weber (2007a), is given by

$$\log H_t = C + G \log H_{t-1} + D(|\tilde{\varepsilon}_{t-1}| - \iota\sqrt{2/\pi}) + F\tilde{\varepsilon}_{t-1}, \quad (5)$$

where C is a n -dimensional vector of constants and G , D and F are $n \times n$ coefficient matrices. With ι denoting a column vector of n ones, the second term in parentheses simply equals the expectation of the preceding shocks in absolute value. In addition, going beyond the pure magnitude of shocks, the signed $\tilde{\varepsilon}_t$ introduce asymmetric volatility effects.

3 Empirical Assessment

Daily data were obtained for the WTI crude oil price from the EIA and the euro / US dollar exchange rate (ECU before 1999) from Reuters for the sample period 1/2/1986 until 12/31/2007. Before 1986, the oil market had been characterised by strong OPEC agreement and steadily increasing prices. The log series and the continuously compounded returns can be seen in Figure 1. The oil price roughly maintained its level until 1999, except for the short Gulf war spike in 1990. The subsequent continuous rise has only been interrupted during the recession in 2001. This development coincided first with the euro depreciation directly following its introduction, and since 2002 with the ongoing dollar weakening. The return series reveal the typical financial volatility clustering.

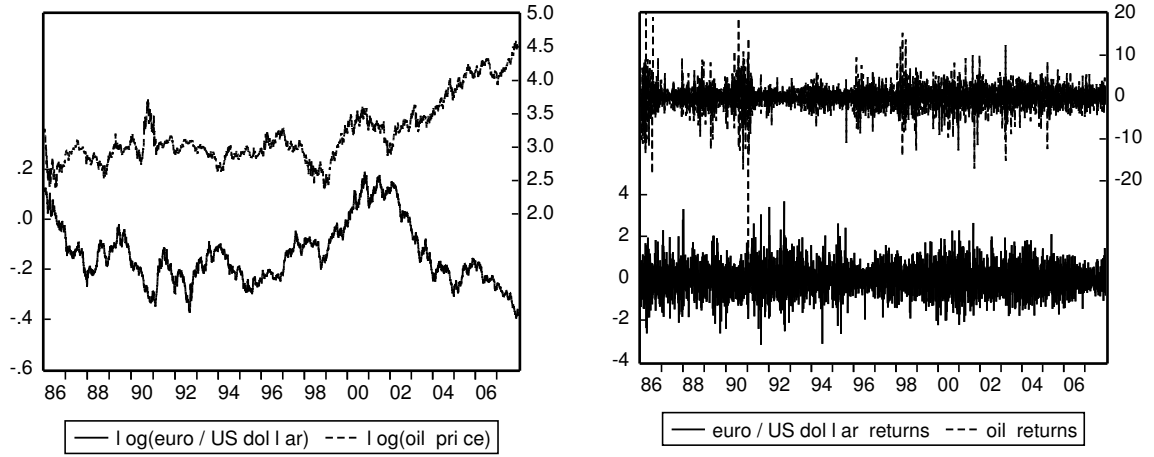


Figure 1: Euro / US dollar and crude oil log prices and returns

At first, the reduced-form model (2) for the returns is considered. Both the Hannan-Quinn and Schwarz criterion suggest a lag length of $q = 0$. Even with three lags as favoured by the Akaike criterion, no-Granger-causality hypotheses in both directions cannot be rejected by Wald tests. Therefore, I obtain the residuals \hat{u}_t from (2) without any lags for use in further analysis.

Estimation of the structural EGARCH is done by Quasi Maximum Likelihood (QML) as in Weber (2007a). Numerical optimisation is performed using the BHHH algorithm (Berndt et al. 1974). With the variable names FX_t and OIL_t and QML standard errors in parentheses, the simultaneous mean equations for the full sample result as

$$\begin{aligned} FX_t &= -0.009 OIL_t + \hat{\varepsilon}_{1t} \\ &\quad (0.005) \\ OIL_t &= 0.060 FX_t + \hat{\varepsilon}_{2t} . \\ &\quad (0.066) \end{aligned} \tag{6}$$

At best, the coefficient for the OIL influence might reach borderline significance, but still stays economically small. This is consistent with literature results (e.g. Mork 1989, Hooker 2002) stating distinctly weakening significance of the oil linkage with the macroeconomy going along with the first substantial price drop in 1986; presently, the empirical sample correlation only amounts to -0.3% . However, corresponding to the situation before 1986, a stronger connection could be expected to (re)appear with the significant price increases during the most recent decade. Consequently, the model is re-estimated beginning at 12/10/1998, the day of the oil price minimum (see Figure 1):³

$$\begin{aligned} \text{FX}_t &= \underset{(0.019)}{-0.053} \text{OIL}_t + \hat{\varepsilon}_{1t} \\ \text{OIL}_t &= \underset{(0.287)}{0.551} \text{FX}_t + \hat{\varepsilon}_{2t} \end{aligned} \quad (7)$$

Compared to (6), both spillovers are considerably larger and clearly more significant. The negative oil coefficient represents the expected dollar-depreciating effect of oil price increases (the exchange rate was defined as euro per dollar). The positive FX coefficient implies that dollar appreciation causes the oil price to rise, although the opposite should be true considering the role of the dollar as measuring unit. Solving this puzzle, dollar appreciation might be ascribed signals of positive US real activity shocks (or according expectations), thereby boosting demand for oil along with its price.⁴ Before further interpretation in this line will be provided, note that the difference in magnitudes of the two coefficients should be taken with care: In terms of variance contributions, it is the oil shocks proving more important, accounting for 4% of FX variation (reverse only 2%).

In the relevant literature, for instance Hamilton (1988), Bohi (1989, 1991) and Ferderer (1996) established asymmetries in macroeconomic reactions to oil price in- and decreases. To account for these findings, both causal effects in (7) are interacted with dummies D indicating positive OIL respectively FX returns:

$$\begin{aligned} \text{FX}_t &= \underset{(0.019)}{-0.040} \text{OIL}_t - \underset{(0.012)}{0.005} D_{\text{OIL}_t > 0} \text{OIL}_t + \hat{\varepsilon}_{1t} \\ \text{OIL}_t &= \underset{(0.352)}{0.163} \text{FX}_t + \underset{(0.181)}{0.434} D_{\text{FX}_t > 0} \text{FX}_t + \hat{\varepsilon}_{2t} \end{aligned} \quad (8)$$

Surprisingly, it is not the oil price exerting significant asymmetric influences, but far more it reacts itself asymmetrically to exchange rate impulses. The positive dummy coefficient indicates that dollar appreciation substantially raises the oil price, while depreciation stays

³Moderate variations, including shifting the sample start to the distinctive local minimum at 11/15/2001, leave the results qualitatively unchanged.

⁴Note that this explanation is based on the plausible assumption that US, more than European, shocks matter for the world economy and the oil market.

relatively neutral in this respect. In this case, an implicit negative growth innovation as explained above might lower the oil price, but the loss in value of the measuring unit naturally increases it. While these conflicting influences might balance each other, the measuring unit effect may be absent in the appreciation case: Just like commercial banks normally pass down monetary policy rate changes to their clients rather in case of decreases than increases, oil suppliers might prefer to retain currency gains rather than losses. Additionally, one could think of inelasticities preventing demand from falling in view of a more expensive dollar, even though a cheaper dollar may well trigger expansion.

Besides the transmission effects analysed until now, variance spillovers might be of further interest. For the shorter sample, the multivariate EGARCH-process (5), with insignificant regressors excluded, resulted as

$$\begin{pmatrix} \log h_{1t} \\ \log h_{2t} \end{pmatrix} = \begin{pmatrix} -0.002 \\ (0.001) \end{pmatrix} + \begin{pmatrix} 0.997 & 0 \\ (0.001) & \end{pmatrix} \begin{pmatrix} \log h_{1t-1} \\ \log h_{2t-1} \end{pmatrix} + \begin{pmatrix} 0.026 & 0.027 \\ (0.012) & (0.011) \end{pmatrix} \begin{pmatrix} |\tilde{\varepsilon}_{1t-1}| \\ |\tilde{\varepsilon}_{2t-1}| \end{pmatrix} + \begin{pmatrix} 0 & 0.021 \\ (0.007) & 0 \end{pmatrix} \begin{pmatrix} \tilde{\varepsilon}_{1t-1} \\ \tilde{\varepsilon}_{2t-1} \end{pmatrix} . \quad (9)$$

Besides the usual persistence, spillovers from oil price shocks to the exchange rate variance are revealed. Thereby, the estimate 0.021 for the signed $\tilde{\varepsilon}_{2t-1}$ together with the 0.027 for the absolute shock indicates that positive price innovations cause a considerable volatility impulse, whereas for negative ones the two coefficients simply offset each other. Evidently, the FX market is only susceptible to uncertainties going along with *increasing* oil prices.

4 Concluding Summary

This paper examined financial market causalities between the daily euro / US dollar exchange rate and the crude oil price. Major findings are that

- relevant interactions are restricted to the period of rising oil prices since the late 1990s,
- increasing (decreasing) oil prices weaken (strengthen) the dollar,
- dollar appreciation asymmetrically boosts the oil price and
- positive oil price shocks asymmetrically drive FX volatility.

Importantly, while the dollar depreciating effect of rising oil prices might have been expected, the underlying study shows distinct endogenous influences on the oil price, being far from exogenous as a financial variable. An interesting approach in future research could employ macroeconomic news data and further financial variables to assess the fundamental determinants and channels of transmission.

References

- [1] Barsky, R.B., L. Kilian (2004): Oil and the Macroeconomy Since the 1970s. *Journal of Economic Perspectives*, 18, 115-134.
- [2] Berndt, E., B. Hall, R. Hall, J. Hausman (1974): Estimation and Inference in Non-linear Structural Models. *Annals of Social Measurement*, 3, 653-665.
- [3] Bohi, D.R. (1989): *Energy Price Shocks and Macroeconomic Performance*. Resources for the Future, Washington, D.C.
- [4] Bohi, D.R. (1991): On the Macroeconomic Effects of Energy Price Shocks. *Resources and Energy*, 13, 145- 162.
- [5] Darby, M.R. (1982): The Price of Oil and World Inflation and Recession. *American Economic Review*, 72, 738-751.
- [6] Ferderer, J.P. (1996): Oil Price Volatility and the Macroeconomy. *Journal of Macroeconomics*, 18, 1-26.
- [7] Hamilton, J.D. (1983): Oil and the macroeconomy since World War II. *Journal of Political Economy*, 91, 228-248.
- [8] Hamilton, J.D. (1988): A neoclassical model of unemployment and the business cycle. *Journal of Political Economy*, 96, 593-617.
- [9] Hooker, M.A. (2002): Are Oil Shocks Inflationary? Asymmetric and Nonlinear Specifications versus Changes in Regime. *Journal of Money, Credit and Banking*, 34, 540-561.
- [10] Mork, K.A. (1989): Oil and the Macroeconomy when Prices Go Up and Down: An Extension of Hamilton's Results. *Journal of Political Economy*, 97, 740-744.
- [11] Rigobon, R. (2003): Identification through heteroscedasticity. *Review of Economics and Statistics*, 85, 777-792.
- [12] Weber, E. (2007a): *Volatility and Causality in Asia Pacific Financial Markets*. CRC 649 Discussion Paper 2007-004, Humboldt-Universität zu Berlin.
- [13] Weber, E. (2007b): *Correlation vs. Causality in Stock Market Comovement*. CRC 649 Discussion Paper 2007-064, Humboldt-Universität zu Berlin.

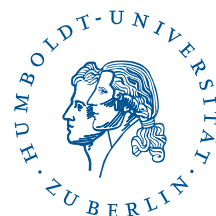
SFB 649 Discussion Paper Series 2008

For a complete list of Discussion Papers published by the SFB 649, please visit <http://sfb649.wiwi.hu-berlin.de>.

- 001 "Testing Monotonicity of Pricing Kernels" by Yuri Golubev, Wolfgang Härdle and Roman Timonfeev, January 2008.
- 002 "Adaptive pointwise estimation in time-inhomogeneous time-series models" by Pavel Cizek, Wolfgang Härdle and Vladimir Spokoiny, January 2008.
- 003 "The Bayesian Additive Classification Tree Applied to Credit Risk Modelling" by Junni L. Zhang and Wolfgang Härdle, January 2008.
- 004 "Independent Component Analysis Via Copula Techniques" by Ray-Bing Chen, Meihui Guo, Wolfgang Härdle and Shih-Feng Huang, January 2008.
- 005 "The Default Risk of Firms Examined with Smooth Support Vector Machines" by Wolfgang Härdle, Yuh-Jye Lee, Dorothea Schäfer and Yi-Ren Yeh, January 2008.
- 006 "Value-at-Risk and Expected Shortfall when there is long range dependence" by Wolfgang Härdle and Julius Mungo, January 2008.
- 007 "A Consistent Nonparametric Test for Causality in Quantile" by Kiho Jeong and Wolfgang Härdle, January 2008.
- 008 "Do Legal Standards Affect Ethical Concerns of Consumers?" by Dirk Engelmann and Dorothea Kübler, January 2008.
- 009 "Recursive Portfolio Selection with Decision Trees" by Anton Andriyashin, Wolfgang Härdle and Roman Timofeev, January 2008.
- 010 "Do Public Banks have a Competitive Advantage?" by Astrid Matthey, January 2008.
- 011 "Don't aim too high: the potential costs of high aspirations" by Astrid Matthey and Nadja Dwenger, January 2008.
- 012 "Visualizing exploratory factor analysis models" by Sigbert Klink and Cornelia Wagner, January 2008.
- 013 "House Prices and Replacement Cost: A Micro-Level Analysis" by Rainer Schulz and Axel Werwatz, January 2008.
- 014 "Support Vector Regression Based GARCH Model with Application to Forecasting Volatility of Financial Returns" by Shiyi Chen, Kiho Jeong and Wolfgang Härdle, January 2008.
- 015 "Structural Constant Conditional Correlation" by Enzo Weber, January 2008.
- 016 "Estimating Investment Equations in Imperfect Capital Markets" by Silke Hüttel, Oliver Mußhoff, Martin Odening and Nataliya Zynych, January 2008.
- 017 "Adaptive Forecasting of the EURIBOR Swap Term Structure" by Oliver Blaskowitz and Helmut Herwatz, January 2008.
- 018 "Solving, Estimating and Selecting Nonlinear Dynamic Models without the Curse of Dimensionality" by Viktor Winschel and Markus Krätzig, February 2008.
- 019 "The Accuracy of Long-term Real Estate Valuations" by Rainer Schulz, Markus Staiber, Martin Wersing and Axel Werwatz, February 2008.
- 020 "The Impact of International Outsourcing on Labour Market Dynamics in Germany" by Ronald Bachmann and Sebastian Braun, February 2008.
- 021 "Preferences for Collective versus Individualised Wage Setting" by Tito Boeri and Michael C. Burda, February 2008.

SFB 649, Spandauer Straße 1, D-10178 Berlin
<http://sfb649.wiwi.hu-berlin.de>

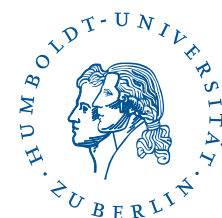
This research was supported by the Deutsche
Forschungsgemeinschaft through the SFB 649 "Economic Risk".



- 022 "Lumpy Labor Adjustment as a Propagation Mechanism of Business Cycles" by Fang Yao, February 2008.
- 023 "Family Management, Family Ownership and Downsizing: Evidence from S&P 500 Firms" by Jörn Hendrich Block, February 2008.
- 024 "Skill Specific Unemployment with Imperfect Substitution of Skills" by Runli Xie, March 2008.
- 025 "Price Adjustment to News with Uncertain Precision" by Nikolaus Hautsch, Dieter Hess and Christoph Müller, March 2008.
- 026 "Information and Beliefs in a Repeated Normal-form Game" by Dietmar Fehr, Dorothea Kübler and David Danz, March 2008.
- 027 "The Stochastic Fluctuation of the Quantile Regression Curve" by Wolfgang Härdle and Song Song, March 2008.
- 028 "Are stewardship and valuation usefulness compatible or alternative objectives of financial accounting?" by Joachim Gassen, March 2008.
- 029 "Genetic Codes of Mergers, Post Merger Technology Evolution and Why Mergers Fail" by Alexander Cuntz, April 2008.
- 030 "Using R, LaTeX and Wiki for an Arabic e-learning platform" by Taleb Ahmad, Wolfgang Härdle, Sigbert Klinke and Shafeeqah Al Awadhi, April 2008.
- 031 "Beyond the business cycle – factors driving aggregate mortality rates" by Katja Hanewald, April 2008.
- 032 "Against All Odds? National Sentiment and Wagering on European Football" by Sebastian Braun and Michael Kvasnicka, April 2008.
- 033 "Are CEOs in Family Firms Paid Like Bureaucrats? Evidence from Bayesian and Frequentist Analyses" by Jörn Hendrich Block, April 2008.
- 034 "JBendge: An Object-Oriented System for Solving, Estimating and Selecting Nonlinear Dynamic Models" by Viktor Winschel and Markus Krätzig, April 2008.
- 035 "Stock Picking via Nonsymmetrically Pruned Binary Decision Trees" by Anton Andriyashin, May 2008.
- 036 "Expected Inflation, Expected Stock Returns, and Money Illusion: What can we learn from Survey Expectations?" by Maik Schmeling and Andreas Schrimpf, May 2008.
- 037 "The Impact of Individual Investment Behavior for Retirement Welfare: Evidence from the United States and Germany" by Thomas Post, Helmut Gründl, Joan T. Schmit and Anja Zimmer, May 2008.
- 038 "Dynamic Semiparametric Factor Models in Risk Neutral Density Estimation" by Enzo Giacomini, Wolfgang Härdle and Volker Krätzschmer, May 2008.
- 039 "Can Education Save Europe From High Unemployment?" by Nicole Walter and Runli Xie, June 2008.
- 042 "Gruppenvergleiche bei hypothetischen Konstrukten – Die Prüfung der Übereinstimmung von Messmodellen mit der Strukturgleichungsmethodik" by Dirk Temme and Lutz Hildebrandt, June 2008.
- 043 "Modeling Dependencies in Finance using Copulae" by Wolfgang Härdle, Ostap Okhrin and Yarema Okhrin, June 2008.
- 044 "Numerics of Implied Binomial Trees" by Wolfgang Härdle and Alena Mysickova, June 2008.
- 045 "Measuring and Modeling Risk Using High-Frequency Data" by Wolfgang Härdle, Nikolaus Hautsch and Uta Pigorsch, June 2008.
- 046 "Links between sustainability-related innovation and sustainability management" by Marcus Wagner, June 2008.

SFB 649, Spandauer Straße 1, D-10178 Berlin
<http://sfb649.wiwi.hu-berlin.de>

This research was supported by the Deutsche
Forschungsgemeinschaft through the SFB 649 "Economic Risk".



- 047 "Modelling High-Frequency Volatility and Liquidity Using Multiplicative Error Models" by Nikolaus Hautsch and Vahidin Jeleskovic, July 2008.
- 048 "Macro Wine in Financial Skins: The Oil-FX Interdependence" by Enzo Weber, July 2008.

SFB 649, Spandauer Straße 1, D-10178 Berlin
<http://sfb649.wiwi.hu-berlin.de>

This research was supported by the Deutsche
Forschungsgemeinschaft through the SFB 649 "Economic Risk".

