

Wang, Weining; Bobojonov, Ihtiyor; Härdle, Wolfgang Karl; Odening, Martin

Working Paper

Increasing weather risk: Fact of fiction?

SFB 649 Discussion Paper, No. 2011-077

Provided in Cooperation with:

Collaborative Research Center 649: Economic Risk, Humboldt University Berlin

Suggested Citation: Wang, Weining; Bobojonov, Ihtiyor; Härdle, Wolfgang Karl; Odening, Martin (2011) : Increasing weather risk: Fact of fiction?, SFB 649 Discussion Paper, No. 2011-077, Humboldt University of Berlin, Collaborative Research Center 649 - Economic Risk, Berlin

This Version is available at:

<https://hdl.handle.net/10419/56661>

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.

SFB 649 Discussion Paper 2011-077

Increasing Weather Risk: Fact or Fiction?

Weining Wang*
Ihtiyor Bobojonov*
Wolfgang Karl Härdle*
Martin Odening*



* Humboldt-Universität zu 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



SFB 649 ECONOMIC RISK BERLIN

Increasing Weather Risk: Fact or Fiction? *

Weining Wang¹, Ihtiyor Bobojonov², Wolfgang Karl Härdle³, Martin Odening⁴

Abstract

It is an undisputed fact that weather risk increases over time due to climate change. However, qualification of this statement with regard to the type of weather risk and geographical location is needed. We investigate the application of novel statistical tools for assessing changes in weather risk over time. We apply local t -test, change point tests and Mann-Kendall test as well as quantile regression to weather risk indicators that are relevant from the viewpoint of agricultural production. Our results show that weather risk follows different pattern depending on the type of risk and the location.

Keywords: weather extremes, agricultural risk, change point test, quantile regressions

JEL classification: C00, C14, J01, J31

1 Introduction

A wide range of scientific studies provides empirical evidence for increasing weather risk (e.g. Tebaldi et al., 2006, Vasiliades et al., 2009). Nevertheless, we believe that the statistical measurement of weather risk and weather extremes deserves further attention. The main message of this paper is that the “increasing-weather-risk” hypothesis needs to be qualified in several directions. First, there is no single clear definition of weather risk and meaning of weather risk is often not obvious. This is not surprising, since different sectors in an economy

* The financial support from the Deutsche Forschungsgemeinschaft via CRC 649 “Economic Risk”, Humboldt-Universität zu Berlin is gratefully acknowledged.

¹ Research associate at the Institute for Statistics and Econometrics of Humboldt-Universität zu Berlin, Germany

² Research associate at the Department of Agricultural Economics, Humboldt-Universität zu Berlin, Germany

³ Professor at Humboldt-Universität zu Berlin and Director of C.A.S.E. - Center for Applied Statistics and Economics, Berlin, Germany

⁴ Professor at the Department of Agricultural Economics, Humboldt-Universität zu Berlin, Germany
Correspondence to: M. Odening (m.odening@agrار.hu-berlin.de)

are affected in a very specific, complex and often nonlinear manner by weather events. Second, the finding of the studies demonstrating increased risk over time may be valid only for the locations, where weather data have been recorded. It is not trivial to draw conclusions about the change of weather risk in other locations (Vasiliades et al., 2009). Third, the time dimension of increasing weather risk needs further investigation. An important aspect for predicting future risk exposures is to know if weather risk increases steadily over time or increase is characterized by jumps and discontinuities. Finally, improving the methodology of assessing weather risk trends is considered as one of the important topics in the field of risk and uncertainty assessment (Hegerl et al., 2007; Tebaldi et al., 2006).

In this paper a battery of statistical test procedures is utilized, among them a local t -test, the change point test and the commonly used Mann-Kendall test. Moreover, upper and lower quantiles and their confidence bands are estimated using quantile regression. These techniques are applied to four weather indices, two of them are temperature based (Growing Degree Days (GDD), Frost Days Index (FDI)) and two are rainfall based (Cumulative Rainfall Index (CRI) and Potential Flood Index (PFI)). These indicators have been used in earlier studies on weather risk exposure in agriculture (e.g. World Bank, 2005). The objective of this paper is to describe the historical pattern of the weather risk indicators and to test for significant changes over time. Our results are illustrative and not comprehensive due to the limited number of weather indices and locations we analyse here. However, the suggested procedures can be easily applied to other weather events and locations. Our contribution to the existing literature is twofold. First, we apply local tests instead of global tests. Estimation is done nonparametrically allowing for a flexible estimation of the trends, both in means and in quantiles. Second, we apply alternative tests for trend detection.

2 Methodology

2.1 Local tests for the trend in weather variables

There are numerous approaches available for assessing the existence of trend in time series data. The t -test and the Mann-Kendall test are among the most commonly used methods to examine if the value of the time series data increases or decreases over time. The change point test is another important statistical method widely used to analyse the time series data for sudden jumps. Global tests, however, which consider a fixed, predetermined observation period, may not be able to indicate when a change of weather risk occurred. Andriyashin et al.

(2006) introduce a localized version of a t -test, a change point test and a Mann-Kendall test, where the whole observation period is divided into smaller sub periods. In this study we apply localized versions of all three tests mentioned above. An advantage of local tests is the possibility of examining when exactly changes happen. Such tests can also better detect a local behavior in the data and check if there are upward and downward trends in the observation period.

As an example, we demonstrate the localization of the t -test. The Mann-Kendall test and the change point test can be localized in a similar fashion. The main idea of the t -test is to identify if the slope of the linear model is significantly different from zero. The linear model has the form:

$$m(j) = \alpha + \beta j \quad j = 1, \dots, n, \quad (1)$$

where n is the number of observations, $m(j)$ denotes the mean function $E(Y_j)$. Y_j is the temperature or rainfall index, and α and β are the intercept and slope parameters. These parameters are estimated by minimizing the sum of squares:

$$(\hat{\alpha}, \hat{\beta}) = \underset{\alpha, \beta}{\operatorname{argmin}} \sum_j \{Y_j - \alpha - \beta j\}^2 \quad (2)$$

The statistical significance of the slope parameter β , i.e. the trend, is tested by the null hypothesis $\beta = 0$, and $\beta \neq 0$ otherwise. Test statistics (t^*) are defined as:

$$t^* = \frac{\hat{\beta} - 0}{\tilde{\sigma}}, \quad (3)$$

where $\tilde{\sigma}$ is from the residuals of the linear model in Eq. (2), and t^* asymptotically converges to a t distribution with $n-2$ degree of freedom. Instead of assuming linearity of $m(j)$ in Eq. (1) for the whole sample period one can divide the data set into small subintervals (windows) L and estimate the parameters α_L, β_L for each window L . Under this condition, parameters α and β may also change with respect to subintervals (windows). The sequence of test results is interpreted by P-values, i.e. the probability of test statistic to fall in the rejection region of the null hypothesis. We identify change points only if a sufficient number of consecutive significant signals in the P-values sequence occur. How consecutive they should be is basically controlled by aggregation parameters τ and κ . τ indicates the minimum number of subsequent P-values eligible to create a summation

measure and κ is the maximum number of insignificant P-values to drop the summation to zero. To decide when exactly a change is considered to be significant a threshold value η for the cumulative P-values needs to be specified. There is no common agreement on how to select the aggregation parameters τ and κ and the threshold value η although these are very important hyper parameters that affect the outcome of the tests. Following Andriyashin et al. (2006) we set the value of τ equal to 4 and κ equal to 2. The threshold value η is set to the half of the maximum accumulated P-value.

We apply the same idea of localization to the change point test and the Mann-Kendall test. In what follows we briefly review these two tests in a global setting.

The (global) change point test divides the data into two sub intervals and tests whether there is a significant difference between the means in two sub intervals, which are denoted as L_1 and L_2 with n_1 and n_2 number of observations each respectively. We calculate the sample mean for both of the intervals as follows:

$$\mu_i = \frac{1}{n_i} \sum_j^{n_i} Y_j \quad i = 1, 2 \quad (4)$$

The null hypothesis assumes equal means $\mu_1 = \mu_2$ and the alternative is $\mu_1 \neq \mu_2$. The test statistics V can be estimated as:

$$V = \frac{n_1 n_2}{n_1 + n_2} \frac{(\hat{\mu}_1 - \hat{\mu}_2)^2}{\tilde{\sigma}^2}, \quad (5)$$

where V asymptotically converges to a $\chi^2(1)$ distribution and $\tilde{\sigma}$ is the unknown standard error estimated from residuals. Residuals are estimated using the whole sample with $n = n_1 + n_2$ observations:

$$\tilde{r}_j = Y_j - \hat{m}_h(j) \quad j = 1, \dots, n \quad (6)$$

Herein $\hat{m}_h(j)$ denotes the local constant nonparametric estimator (cf. Härdle, 1990).

The Mann-Kendall test (global) is a nonparametric test widely used in studies related to climate change and weather extremes (e.g. Wang and Swail, 2001; Adamowski et al., 2003). This test compares the value of each point with the subsequent data values. The standardized test statistics is:

$$S^* = \frac{\sum_{i=2}^n \sum_{j=1}^{i-1} \text{sign}(y_i - y_j)}{\sqrt{n(n-1)(2n+5)/18}}, \quad (7)$$

where S^* has an asymptotic standard normal distribution. A significant positive value of S indicates an increasing trend whereas a negative value indicates a decreasing trend.

2.2 Quantile Regression and Bands

Quantile regression is one of the widely used techniques in modern statistics (Koenker and Bassett, 1978). In contrast to traditional regression, quantile regression looks at different quantiles of the conditional distribution instead of looking at the conditional mean curve. This approach is particularly useful for analysing the tail behaviour of the conditional distribution of climate variables.

Considering independent random variables $\{\varepsilon_i\}_{i=1}^n$, the model can be presented as:

$$Y_j = l(j) + \varepsilon_j, \quad (8)$$

where the q^{th} quantile of the distribution of ε_j is 0, and $l(j)$ is the q^{th} quantile of Y_j . The nonparametric estimation for a fixed point s ($1 \leq i \leq n$) is calculated as:

$$\hat{l}(i) = \underset{l(i)}{\text{argmin}} (1-q) \sum_{j=1} (l(i) - Y_j) I(l(i) > Y_j) w_j - q \sum_{j=1} (Y_j - l(i)) I(l(i) \leq Y_j) w_j, \quad (9)$$

where $I(\cdot)$ is the indicator function, $w_j = K\left(\frac{j-i}{h}\right)$ with $K(\cdot)$ as a kernel function (e.g. Gaussian Kernel), and h is a bandwidth.

The confidence band estimation follows Härdle and Song (2010) and can be presented as following:

$$\hat{l}(j) \pm (nh)^{-1/2} \{d_n + c(\rho)(2\delta \log n)^{-1/2}\} \hat{\lambda}(j), \quad (10)$$

where ρ is the significance level. d_n , $\hat{\lambda}(j)$ and $c(\rho)$ are constants related to the kernel and the conditional distribution. The confidence band around a nonparametric estimator can be used for testing the functional form of an estimator.

3 Description of Data and Specification of Weather Indices

We apply the tests to weather data at three locations: Taipei (Taiwan), Berlin (Germany) and Mason (Iowa, USA). These weather stations have been selected for two reasons. First, they are located in different agro-ecological environments and thus it can be expected to find different weather patterns over time. Second, the quality of the weather records is good in terms of length and completeness of the data. Temperature and precipitation observations are available for the years 1910-2008 in Taipei, 1948-2010 in Berlin and 1905-2010 in Mason. The mean substitution method is used to fill occasionally missing values in the datasets.

Four weather indices are calculated from the daily observations, which capture different kinds of risk for agricultural production. The first index is the Growing Degree Days (GDD) index, which is frequently used to measure the risk of insufficient temperatures during the vegetation season (World Bank, 2005):

$$GDD = \sum_{j=b}^d \max\{(T_{\max,j} + T_{\min,j})/2 - T_{\text{base}}, 0\}, \quad (11)$$

where $T_{\max,j}$ and $T_{\min,j}$ denote maximum and minimum daily temperature and T_{base} represents the temperature that triggers plant growth. We set this parameter to 5°C. b and d denote the beginning (March 1st) and the end (October 31st) of the vegetation season, respectively. The rationale of the GDD is that plant growth (and hence yields) is proportional to temperature above the threshold T_{base} . Another temperature related index is the Frost Days Index (FDI):

$$FDI = \sum_{j=b}^d \mathbf{1}\{T_j < 0\} \quad (12)$$

where $\mathbf{1}\{.\}$ is the indicator function, which counts the number of days when temperature is below zero. The FDI takes into account the risk associated with frost on the beginning of the vegetation period, e.g. frost during the flowering period.

To capture drought risk in agricultural production we use the Cumulative Rainfall Index (CRI), which is defined as:

$$CRI = \sum_{j=k}^m R_j, \quad (13)$$

where R_j denotes daily rainfall, and k and m are the beginning and end of the accumulation period. The CRI is usually defined on a monthly basis. We restrict our analysis to May since precipitation shortfalls are most harmful in this month. Bad yields, however, may also result from excessive rainfall. This kind of weather risk can be measured with the Potential Flood Indicator (PFI) (Frich et al., 2002):

$$PFI = \max_{\tau \in \{1, \dots, 365-s+1\}} \left(\sum_{j=\tau}^{s+\tau-1} R_j \right), \quad (14)$$

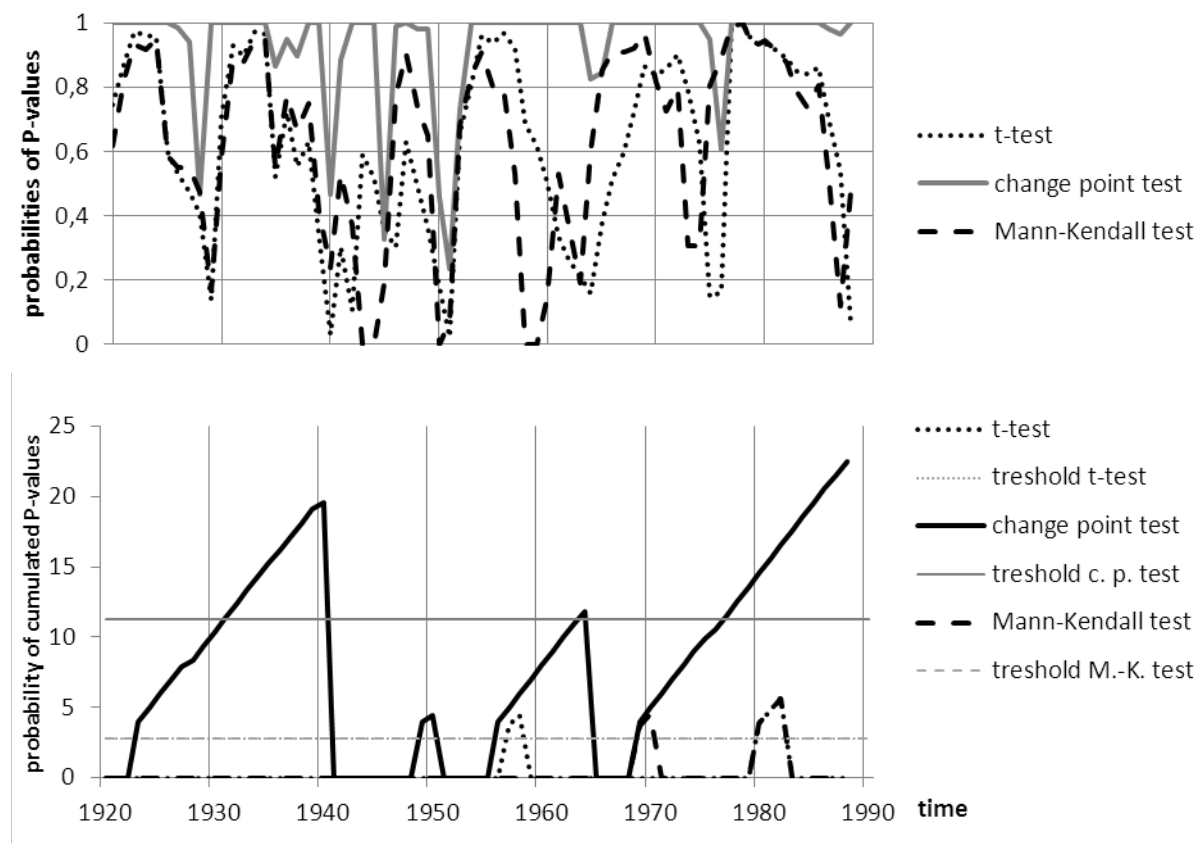
The PFI measures rainfall in the wettest s -day-period of the year. Following usual convention we set s to 5 days.

4 Empirical Results

4.1 Local trend tests

Fig. 1 illustrates the results of the local t -test, change point test and Mann-Kendall test for the GDD in Mason. The upper panel in Fig. 1 depicts the plot of 1- P-values of the local tests over consecutive windows of 20 observations (years). The year on the x-axis indicates the beginning of a 20-years-window. The last window, for example, starts in 1990 and covers the time period until 2010. The lower panel presents the accumulated P-values for the same time period. Summation starts if there are more than τ consecutive windows with significant P-value ($P < 0.05$). The threshold values for the different tests are represented by horizontal lines. We reject the null hypothesis of no trend (or no change point) unless the cumulative values in the lower panel cross the threshold values of the respective test. The change point test, for example, indicates significant jumps in the level of the GDD in Mason during the period 1932-1941, in the year 1965 and from 1978 until 2009. The direction of the change can be identified by means of the sign of the slope parameter (β) in case of t -test and the sign of $\hat{\mu}_1 - \hat{\mu}_2$ in case of the change point test. The tests are conducted for all indices at all three weather stations with the exception of the FDI in Taipei, since no frost occurs in this region.

Figure 1. Local test results for GDD in Mason



The results of the GDD and the FDI are summarized in Table 1. The second column reports the beginning and the end of the time period, in which a change of a weather risk indicator appears to be significant. To be precise, “From” indicates the beginning of the first 20-years-window showing a significant change in the mean of the risk indicator and “To” means the beginning of the last 20-years-window, until which this change continues.

Apparently, the detected changes differ in their duration, as well as in their direction. In some cases there are only a few consecutive windows where a change appears to be significant while other changes are more persistent. In particular, we find a clear positive trend for the GDD in Berlin detected by all tests during different periods. Note that a positive trend of the GDD indicates more favourable temperature conditions for agricultural production. The development of the GDD is less clear in Taipei and Mason since positive and negative changes occur during the observation period. A positive trend of the FDI in Mason indicates increasing frost risk in this area whereas no such tendency can be found for Berlin.

Table 1. Trends of temperature indices

City / Indices	GDD				FDI			
	From	To	Sign	Test	From	To	Sign	Test
Taipei	1939	1949	+	C,T,M	n.a.	n.a.	n.a.	n.a.
	1959	1960	-	C				
	1981	2008	+	C				
Mason	1932	1941	-	C	1986	1987	+	T
	1958	1959	-	T				
	1965	1965	+	C				
	1970	1971	+	M				
	1978	2009	-	C				
	1981	1983	-	M,T				
Berlin	1977	1982	+	T	none	none	none	none
	1979	2009	+	C				
	1988	1989	+	M,T				

C = change point test, M = Mann-Kendall Test, T = t-test

The test results for the two rainfall based indices are summarized in Table 2. There is a clear positive trend in the CRI in Berlin indicating a reduced risk of water shortage in May. A significant positive jump of CRI can also be observed in Taipei. In contrast, several positive and negative changes of the CRI occur in Mason. It is also difficult to make a clear statement on the risk of excessive rainfall. We find several positive jumps between 1928 and 1971 in Mason. This increase of risk, however, is partially compensated by a negative change of the PFI in the late seventies. No change in the risk of excessive rainfall was detected for Berlin. Note that all changes of the CRI and the PFI are solely reported by the change point test and not confirmed by any other test.

Table 2. Trends of precipitation indices

City / Indices	CRI				PFI			
	From	To	Sign	Test	From	To	Sign	Test
Taipei	1953	1966	+	C	1949	1959	-	C
					1960	1965	+	C
Mason	1928	1933	+	C	1928	1929	+	C
	1939	1939	-	C	1961	1964	+	C
	1948	1950	+	C	1968	1971	+	C
	1988	1989	+	C	1977	1980	-	C
Berlin	1956	1958	+	C	none	none	none	none
	1963	1966	+	C				

C = change point test, M = Mann-Kendall Test, T = t-test

The results presented above show that the four risk indicators follow different trends. Moreover, their development is region specific. From tables 1 and 2 it is also apparent that the sensitivity of the test procedures differs. The change point test detects changes more often than the t-test and the Mann-Kendall test.

4.2 Quantile regressions

We now turn to the results of the quantile regression, which complement the information provided in the previous section. Instead of considering changes in the mean of weather (risk) indicators we now focus on changes in the tails of their distribution function. Fig. 2 illustrates the results for the CRI in Mason (left panel) and Berlin (right panel). The bold line represents the 10% quantile (i.e. the downside risk of rainfall) and the two thin lines show the corresponding confidence bands. The confidence bands can be employed for testing the significance of changes of the quantile over time. This can be done by checking whether a linear line with positive or negative slope fits into the corridor. For example, inspection of the left panel in Fig. 2 shows that the 10% quantile of the CRI exhibits a positive trend in Mason since 1990, which indicates a declining probability of rainfall shortfalls in May. In contrast, we observe a decline of the 10% quantile of the CRI in Berlin during the seventies and eighties as well as in the last decade. This finding seems to contradict the results of the local test of the previous section where no significant change in mean value of the CRI has been detected. One should recall, however, that the subjects of the two statistical procedures are not the same.

Figure 2. 10% Quantiles of CRI in Mason and in Berlin with confidence bands

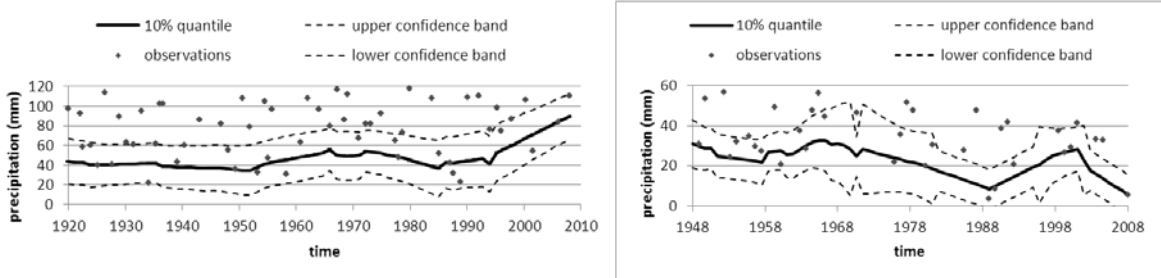


Table 3. Summary of changes of quantiles

City / Indices	GDD (10%)	FDI (90%)	CRI (10%)	PFI (90%)
Taipei	+	n.a.	-	no change
Mason	no change	-	+	+
Berlin	- +	-	-	no change

The results of the quantile regression for all weather indices and weather stations are reported in Table 3. All in all we find mixed evidence for the increasing-weather-risk-hypothesis. The 10% quantile of the GDD exhibits a positive trend in Taipei and no change can be observed in Mason GDD. We neither found evidence for increasing frost risk. There is a significant increase in the 90% quantile of the PFI in Mason, which confirms the results of the local mean test. This trend, however, does not exist in the other two cities. The 10% of the CRI tends to decline in Berlin and Taipei. This can be interpreted as an increasing exposure to drought risk at least in Berlin, since the level of rainfall is rather low in that region.

5 Conclusions

We have applied different statistical tests to analyse the presence of trends in weather indices, which are relevant to agriculture and capture the production risk in this sector. We have selected three weather stations located in Europe, Asia and North America to investigate the dynamics of weather risk indicators in different climatic zones. The results confirm our conjecture that a general trend of increasing weather risk cannot be identified.

The analysis reveals that different weather risk indicators show different pattern over time. Moreover, the changes of the weather indices are also location specific. For example, we reveal declining temperature related risk (e.g. GDD) in Taipei and Berlin but increasing temperature risk in Mason. Another feature of weather risk is that indices rarely follow long lasting trends but exhibit local jumps, sometimes in opposite direction. We also found that the test results are affected by the chosen statistical test. As a general conclusion we recommend to be specific when stating that weather risk increases under climate change. This refers to the type of risk, geographical location, time and duration of risk changes as well as the test procedure.

The analysis presented here can be extended in several directions. It would be worth to apply the test procedures to other regions and other weather events. This would allow for a generalization of the results reported here. Moreover, it would be interesting to test for trends in basic weather variables, like daily temperatures and daily precipitation and analyse if and how changes in the volatility of these variables translate into indices that directly measure the risk exposure for producers in various sectors. Finally, the power and the robustness of the statistical test procedures deserve further attention. Simulation experiments could be helpful to find out, which kind of test is most appropriate for identifying increasing weather risk.

References

- Adamowski, K. and Bougadis, J.: Detection of trends in annual extreme rainfall, *Hydrol. Process* 17: 3547–3560, 2003.
- Andriyashin, A., Benko, M., Härdle, W., Timofeev, R. and Ziegenhagen, U.: Color harmonization in car manufacturing processes, applied stochastic models for business and industry, *Business, Industry and Government* 22: 519–532, 2006.
- Frich, P., Alexander, L., Della-Marta, P., Gleason, B., Haylock, M., Tank, A. K. and Peterson, T.: Observed coherent changes in climatic extremes during the second half of the twentieth century, *Climate Research* 19: 193–212, 2002.
- Härdle, W.: *Applied Nonparametric Regression* (Econometric Society Monographs). Cambridge University Press, 1990.
- Härdle, W. and Song, S.: Confidence bands in quantile regression, *Econometric Theory* 26: 1180–1200, 2010.
- Hegerl, G. C., Zwiers, F., Kharin, S. and Stott, P.: Detectability of anthropogenic changes in temperature and precipitation extremes, *J. Clim.* 17: 3683–3700, 2007.
- Koenker, R. and Bassett, G.: Regression quantiles, *Econometrica* 46(1): 33–50, 1978.
- Tebaldi, C., Hayhoe, K., Arblaster, J. M. and Meehl, G. A.: Going to the extremes: An intercomparison of model-simulated historical and future changes in extreme events, *Climatic Change* 79(3–4): 185–211, 2006.
- Vasiliades, L., Loukas A. and Patsonas, G.: Evaluation of a statistical downscaling procedure for the estimation of climate change impacts on droughts. *Nat. Hazards Earth Syst. Sci.*, 9: 879–894, 2009.
- Wang, X. L. and Swail, V. R.: Changes of extreme wave heights in northern hemisphere oceans and related atmospheric circulation regimes, *Journal of Climate Change* 14: 2204–2220, 2001.
- World Bank: *Managing agricultural production risk: Innovations in developing countries*, www.worldbank.org/rural, 2005.

SFB 649 Discussion Paper Series 2011

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

- 001 "Localising temperature risk" by Wolfgang Karl Härdle, Brenda López Cabrera, Ostep Okhrin and Weining Wang, January 2011.
- 002 "A Confidence Corridor for Sparse Longitudinal Data Curves" by Shuzhuan Zheng, Lijian Yang and Wolfgang Karl Härdle, January 2011.
- 003 "Mean Volatility Regressions" by Lu Lin, Feng Li, Lixing Zhu and Wolfgang Karl Härdle, January 2011.
- 004 "A Confidence Corridor for Expectile Functions" by Esra Akdeniz Duran, Mengmeng Guo and Wolfgang Karl Härdle, January 2011.
- 005 "Local Quantile Regression" by Wolfgang Karl Härdle, Vladimir Spokoiny and Weining Wang, January 2011.
- 006 "Sticky Information and Determinacy" by Alexander Meyer-Gohde, January 2011.
- 007 "Mean-Variance Cointegration and the Expectations Hypothesis" by Till Strohsal and Enzo Weber, February 2011.
- 008 "Monetary Policy, Trend Inflation and Inflation Persistence" by Fang Yao, February 2011.
- 009 "Exclusion in the All-Pay Auction: An Experimental Investigation" by Dietmar Fehr and Julia Schmid, February 2011.
- 010 "Unwillingness to Pay for Privacy: A Field Experiment" by Alastair R. Beresford, Dorothea Kübler and Sören Preibusch, February 2011.
- 011 "Human Capital Formation on Skill-Specific Labor Markets" by Runli Xie, February 2011.
- 012 "A strategic mediator who is biased into the same direction as the expert can improve information transmission" by Lydia Mechtenberg and Johannes Münster, March 2011.
- 013 "Spatial Risk Premium on Weather Derivatives and Hedging Weather Exposure in Electricity" by Wolfgang Karl Härdle and Maria Osipenko, March 2011.
- 014 "Difference based Ridge and Liu type Estimators in Semiparametric Regression Models" by Esra Akdeniz Duran, Wolfgang Karl Härdle and Maria Osipenko, March 2011.
- 015 "Short-Term Herding of Institutional Traders: New Evidence from the German Stock Market" by Stephanie Kremer and Dieter Nautz, March 2011.
- 016 "Oracally Efficient Two-Step Estimation of Generalized Additive Model" by Rong Liu, Lijian Yang and Wolfgang Karl Härdle, March 2011.
- 017 "The Law of Attraction: Bilateral Search and Horizontal Heterogeneity" by Dirk Hofmann and Salmai Qari, March 2011.
- 018 "Can crop yield risk be globally diversified?" by Xiaoliang Liu, Wei Xu and Martin Odening, March 2011.
- 019 "What Drives the Relationship Between Inflation and Price Dispersion? Market Power vs. Price Rigidity" by Sascha Becker, March 2011.
- 020 "How Computational Statistics Became the Backbone of Modern Data Science" by James E. Gentle, Wolfgang Härdle and Yuichi Mori, May 2011.
- 021 "Customer Reactions in Out-of-Stock Situations – Do promotion-induced phantom positions alleviate the similarity substitution hypothesis?" by Jana Luisa Diels and Nicole Wiebach, May 2011.

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

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



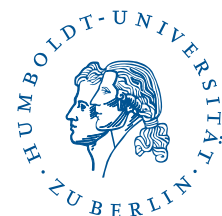
SFB 649 Discussion Paper Series 2011

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

- 022 "Extreme value models in a conditional duration intensity framework" by Rodrigo Herrera and Bernhard Schipp, May 2011.
- 023 "Forecasting Corporate Distress in the Asian and Pacific Region" by Russ Moro, Wolfgang Härdle, Saeideh Aliakbari and Linda Hoffmann, May 2011.
- 024 "Identifying the Effect of Temporal Work Flexibility on Parental Time with Children" by Juliane Scheffel, May 2011.
- 025 "How do Unusual Working Schedules Affect Social Life?" by Juliane Scheffel, May 2011.
- 026 "Compensation of Unusual Working Schedules" by Juliane Scheffel, May 2011.
- 027 "Estimation of the characteristics of a Lévy process observed at arbitrary frequency" by Johanna Kappus and Markus Reiß, May 2011.
- 028 "Asymptotic equivalence and sufficiency for volatility estimation under microstructure noise" by Markus Reiß, May 2011.
- 029 "Pointwise adaptive estimation for quantile regression" by Markus Reiß, Yves Rozenholc and Charles A. Cuenod, May 2011.
- 030 "Developing web-based tools for the teaching of statistics: Our Wikis and the German Wikipedia" by Sigbert Klinke, May 2011.
- 031 "What Explains the German Labor Market Miracle in the Great Recession?" by Michael C. Burda and Jennifer Hunt, June 2011.
- 032 "The information content of central bank interest rate projections: Evidence from New Zealand" by Gunda-Alexandra Detmers and Dieter Nautz, June 2011.
- 033 "Asymptotics of Asynchronicity" by Markus Bibinger, June 2011.
- 034 "An estimator for the quadratic covariation of asynchronously observed Itô processes with noise: Asymptotic distribution theory" by Markus Bibinger, June 2011.
- 035 "The economics of TARGET2 balances" by Ulrich Bindseil and Philipp Johann König, June 2011.
- 036 "An Indicator for National Systems of Innovation - Methodology and Application to 17 Industrialized Countries" by Heike Belitz, Marius Clemens, Christian von Hirschhausen, Jens Schmidt-Ehmcke, Axel Werwatz and Petra Zloczynski, June 2011.
- 037 "Neurobiology of value integration: When value impacts valuation" by Soyoung Q. Park, Thorsten Kahnt, Jörg Rieskamp and Hauke R. Heekeren, June 2011.
- 038 "The Neural Basis of Following Advice" by Guido Biele, Jörg Rieskamp, Lea K. Krugel and Hauke R. Heekeren, June 2011.
- 039 "The Persistence of "Bad" Precedents and the Need for Communication: A Coordination Experiment" by Dietmar Fehr, June 2011.
- 040 "News-driven Business Cycles in SVARs" by Patrick Bunk, July 2011.
- 041 "The Basel III framework for liquidity standards and monetary policy implementation" by Ulrich Bindseil and Jeroen Lamoot, July 2011.
- 042 "Pollution permits, Strategic Trading and Dynamic Technology Adoption" by Santiago Moreno-Bromberg and Luca Taschini, July 2011.
- 043 "CRRA Utility Maximization under Risk Constraints" by Santiago Moreno-Bromberg, Traian A. Pirvu and Anthony Réveillac, July 2011.

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

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



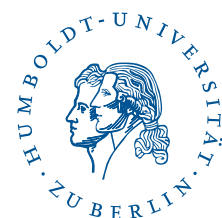
SFB 649 Discussion Paper Series 2011

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

- 044 "Predicting Bid-Ask Spreads Using Long Memory Autoregressive Conditional Poisson Models" by Axel Groß-Klußmann and Nikolaus Hautsch, July 2011.
- 045 "Bayesian Networks and Sex-related Homicides" by Stephan Stahlschmidt, Helmut Tausendteufel and Wolfgang K. Härdle, July 2011.
- 046 "The Regulation of Interdependent Markets", by Raffaele Fiocco and Carlo Scarpa, July 2011.
- 047 "Bargaining and Collusion in a Regulatory Model", by Raffaele Fiocco and Mario Gilli, July 2011.
- 048 "Large Vector Auto Regressions", by Song Song and Peter J. Bickel, August 2011.
- 049 "Monetary Policy, Determinacy, and the Natural Rate Hypothesis", by Alexander Meyer-Gohde, August 2011.
- 050 "The impact of context and promotion on consumer responses and preferences in out-of-stock situations", by Nicole Wiebach and Jana L. Diels, August 2011.
- 051 "A Network Model of Financial System Resilience", by Kartik Anand, Prasanna Gai, Sujit Kapadia, Simon Brennan and Matthew Willison, August 2011.
- 052 "Rollover risk, network structure and systemic financial crises", by Kartik Anand, Prasanna Gai and Matteo Marsili, August 2011.
- 053 "When to Cross the Spread: Curve Following with Singular Control" by Felix Naujokat and Ulrich Horst, August 2011.
- 054 "TVICA - Time Varying Independent Component Analysis and Its Application to Financial Data" by Ray-Bing Chen, Ying Chen and Wolfgang K. Härdle, August 2011.
- 055 "Pricing Chinese rain: a multi-site multi-period equilibrium pricing model for rainfall derivatives" by Wolfgang K. Härdle and Maria Osipenko, August 2011.
- 056 "Limit Order Flow, Market Impact and Optimal Order Sizes: Evidence from NASDAQ TotalView-ITCH Data" by Nikolaus Hautsch and Ruihong Huang, August 2011.
- 057 "Optimal Display of Iceberg Orders" by Gökhan Cebiroğlu and Ulrich Horst, August 2011.
- 058 "Optimal liquidation in dark pools" by Peter Kratz and Torsten Schöneborn, September 2011.
- 059 "The Merit of High-Frequency Data in Portfolio Allocation" by Nikolaus Hautsch, Lada M. Kyj and Peter Malec, September 2011.
- 060 "On the Continuation of the Great Moderation: New evidence from G7 Countries" by Wenjuan Chen, September 2011.
- 061 "Forward-backward systems for expected utility maximization" by Ulrich Horst, Ying Hu, Peter Imkeller, Anthony Réveillac and Jianing Zhang.
- 062 "On heterogeneous latent class models with applications to the analysis of rating scores" by Aurélie Bertrand and Christian M. Hafner, October 2011.
- 063 "Multivariate Volatility Modeling of Electricity Futures" by Luc Bauwens, Christian Hafner and Diane Pierret, October 2011.

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

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



SFB 649 Discussion Paper Series 2011

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

- 064 "Semiparametric Estimation with Generated Covariates" by Enno Mammen, Christoph Rothe and Melanie Schienle, October 2011.
- 065 "Linking corporate reputation and shareholder value using the publication of reputation rankings" by Sven Tischer and Lutz Hildebrandt, October 2011.
- 066 "Monitoring, Information Technology and the Labor Share" by Dorothee Schneider, October 2011.
- 067 "Minimal Supersolutions of BSDEs with Lower Semicontinuous Generators" by Gregor Heyne, Michael Kupper and Christoph Mainberger, October 2011.
- 068 "Bargaining, Openness, and the Labor Share" by Dorothee Schneider, October 2011.
- 069 "The Labor Share: A Review of Theory and Evidence" by Dorothee Schneider, October 2011.
- 070 "The Power of Sunspots: An Experimental Analysis" by Dietmar Fehr, Frank Heinemann and Aniol Llorente-Saguer, October 2011.
- 071 "Econometric analysis of volatile art markets" by Fabian Y. R. P. Bocart and Christian M. Hafner, October 2011.
- 072 "Financial Network Systemic Risk Contributions" by Nikolaus Hautsch, Julia Schaumburg and Melanie Schienle, October 2011.
- 073 "Calibration of self-decomposable Lévy models" by Mathias Trabs, November 2011.
- 074 "Time-Varying Occupational Contents: An Additional Link between Occupational Task Profiles and Individual Wages" by Alexandra Fedorets, November 2011.
- 075 "Changes in Occupational Demand Structure and their Impact on Individual Wages" by Alexandra Fedorets, November 2011.
- 076 "Nonparametric Nonstationary Regression with Many Covariates" by Melanie Schienle, November 2011.
- 077 "Increasing Weather Risk: Fact or Fiction?" by Weining Wang, Ihtiyor Bobojonov, Wolfgang Karl Härdle and Martin Odening, November 2011.

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

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

