Adjusting Production Indices for Varying Weather Effects

Erik Haustein[⋆] **& Sven Schreiber**[⋆⋆]
[⋆]Christian-Albrechts-Universität zu Kiel
[⋆⋆]Institut für Makroökonomie und Konjunkturforschung,
[⋆⋆]Freie Universität Berlin

Contact Information:
IMK
Hans-Böckler-Stiftung
Hans-Böckler-Straße 39, 40476 Düsseldorf, Germany

Phone: +49 211 7778 0
Email: Sven-Schreiber@boeckler.de

IMK Macroeconomic Policy Institute

Introduction

Analyzing different important economic indicators and time series in the context of abnormal weather phenomena might broaden the perspective and help to assess the current economic dynamics. Furthermore, weather data for Germany have recently begun to be provided on a daily basis and are freely available. Given that the weather data are published almost immediately - in contrast to the production data that suffer from a publication delay of at least one month - this allows one to predict the weather effect for different indices on a real time basis. Therefore, we estimated these effects for two monthly production indices: first for the total industrial production, because it represents an important cyclical indicator, and secondly for the construction sector as the part of economic activity which is most likely to depend on weather conditions.

Main Objectives

1. Disentangle the irregular weather component from the economic component. Therefore, we looked at monthly specific weather effects.
2. Provide timely prediction of weather effects on economic variables (now-casting) as data is available within one day.

Data

- Dependent variables are the growth rate of total industrial production (IP) and the production in the construction sector in Germany
- Sample period of weather data: Jan. 1991 - Oct. 2015
- We aggregated daily weather data of 251 weather stations available on www.dwd.de
- Advantage: Weather data is timely and freely available
- Disadvantage: Most recent data mostly still not checked for measurement errors

Operationalisation

- Weather variables of individual weather stations were aggregated at the federal state level and weighted by the number of employees to obtain aggregated data at the national level
- We considered three weather aspects:
  - air temperature
  - snow height in cm
  - snow fall per week in cm
- Other weather variables would also be possible like ice-days in a specific time interval
- We defined abnormal weather as the deviation of the specific variable from the respective month-specific average

Unusual Weather

Weather deviation is therefore defined as:

$$\hat{X}_t = X_{t,} - \bar{X}_{t,m} \tag{1}$$

- With X_t as weather variable (temperature, snow height, snow fall) at point in time t
- And $\bar{X}_{t,m}$ as the month specific average of weather variable X_t in month m at point in time t

Econometric Model

The Baseline Model is defined as:

$$\begin{aligned} y_t = c_0 &+ \alpha(L)y_t + \sum_{m=1}^{12} \beta_m(D_{t,m} \times Temperaturedev_t) \\ &+ \sum_{m=1}^{12} \gamma_m(D_{t,m} \times Snowheightdev_t) \\ &+ \sum_{m=1}^{12} \delta_m(D_{t,m} \times Snowfalldev_t) \\ &+ \eta(L)Temperaturedev_t + \kappa(L)Snowheightdev_t \\ &+ \lambda(L)Snowfalldev_t + \epsilon_t \end{aligned}$$

with:

- $\beta_m, \gamma_m, \delta_m$ as the coefficients of the interaction terms
- $\alpha(L) = (\alpha_1 L + \alpha_2 L^2 + \alpha_3 L^3 + \alpha_4 L^4)$
  $\vdots$
  $\lambda(L) = (\lambda_1 L + \lambda_2 L^2 + \lambda_3 L^3 + \lambda_4 L^4)$
- $D_{i,m}$ as the month-dummy in month m at point in time t

Results

Results Total Industrial Production

	Total Industrial Production
Sum of Coefficients Lags Endogenous Variable	0.6084
	β
Deviation Temperature × January	0.0046 **
Deviation Temperature × October	-0.0045***
Deviation Snow Height × February	-0.0018***
Deviation Snow Height × September	0.4371**
Deviation Snow Height × October	-0.1243***
Deviation Snow Height (t-1)	0.0013***
Deviation Snow Height (t-2)	0.0006*
Deviation Snow Height (t-3)	0.0009**
Observations	292
P-Value$_{Chow-Test}$ > F	0.0831
F(5,256)$_{Chow-Test}$	1.99
R^2	0.3285
Adjusted R^2	0.2367

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Robust standard errors are used.

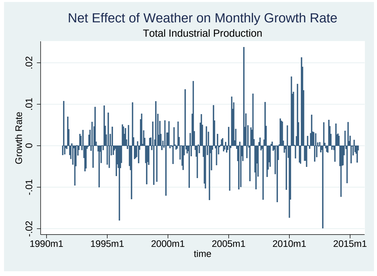

Figure 1: May 1991 - Sept. 2015

Results Construction Sector

	Construction Sector Production
Sum of Coefficients Lags Endogenous Variable	-0.7830
	β
Deviation Temperature × January	0.0252***
Deviation Temperature × February	0.0119**
Deviation Snow Height × February	-0.0076***
Deviation Snow Height × March	-0.0150***
Deviation Temperature (t-2)	-0.0030**
Deviation Temperature (t-4)	-0.0031*
Deviation Snow Height (t-1)	0.0009***
Observations	292
P-Value$_{Chow-Test}$ > F	0.1892
F(5,252)$_{Chow-Test}$	1.50
R^2	0.6234
Adjusted R^2	0.5655

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Robust standard errors are used

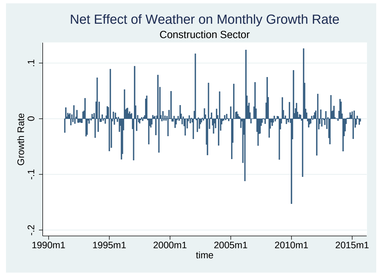

Figure 2: May 1991 - Sept. 2015

Results Now-Casting

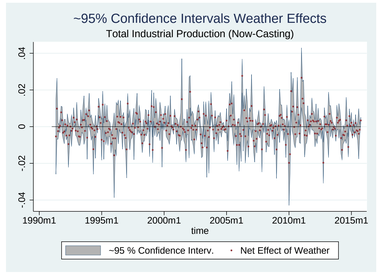

Figure 3: May 1991 - Oct. 2015

Date	Net Weather Effect	Upper Bound 95%-Intervals	Lower Bound 95%-Intervals
Oct. 2015	0.0033899	0.0050396	0.0017401
Sept. 2015	-0.0016513	0.0013745	-0.004677
Aug. 2015	-0.0038774	0.0098009	-0.0175557
July. 2015	-0.0024085	0.0024682	-0.0072851

Table 1: Month Specific Weather Effects with Confidence Intervals for Total Industrial Production (Now-Casting)

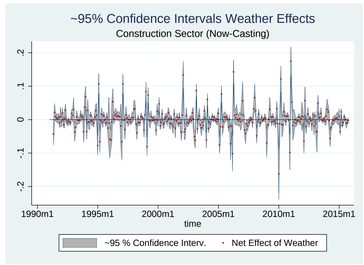

Figure 4: May 1991 - Oct. 2015

Date	Net Weather Effect	Upper Bound 95%-Intervals	Lower Bound 95%-Intervals
Oct. 2015	0.0026589	0.0059656	-0.0112834
Sept. 2015	-0.0092001	-0.003207	-0.0151932
Aug. 2015	-0.011179	0.0034607	-0.0258187
Feb. 2015	-0.0356999	-0.0245839	-0.0468159

Table 2: Month Specific Weather Effects with Confidence Intervals for the Construction Sector (Now-Casting)

Conclusions

- Extraordinary weather not addressed by seasonal adjustment
- Unusual weather might affect the economy
- Influence of unusual weather larger in the construction sector
- Weather data are immediately available and may help to nowcast total industrial production and the production of the construction sector
- Weather effects are month-specific
- Significant catching-up effects

Forthcoming Research

Further research will concentrate on some non-linear relationships between production indices and weather variables as well as including some threshold values. Moreover, other weather variables like ice-days used by the Bundesbank will be considered. As we are specifically interested in providing real time estimations for weather effect, the future focus lies in the quality of the predictions