Macroeconomic effects of low water levels on the Rhine – a statistical analysis

Workshop 'Low waters and consequences on navigation of the Rhine' on 26th November 2019

Ministry of transport and digital infrastructure (Bonn, Germany)

Dr. Norbert Kriedel (CCNR), Administrator for Statistics and Market Observation

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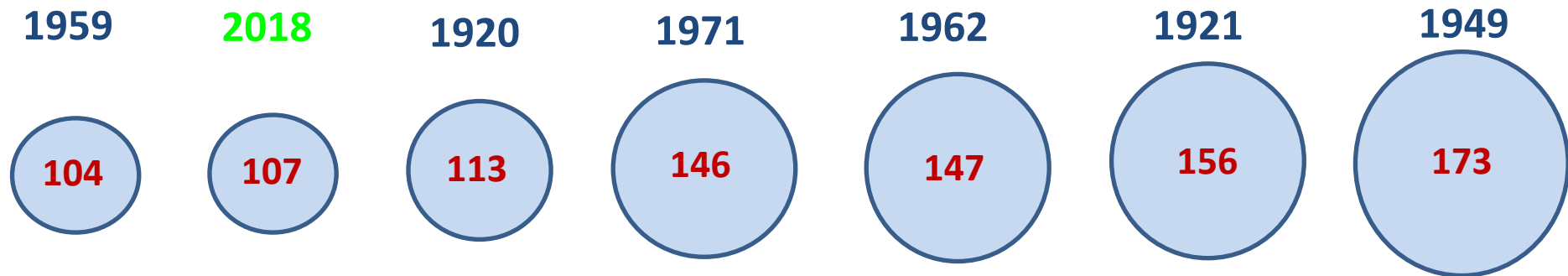FOR THE NAVIGATION OF THE RHINE

01

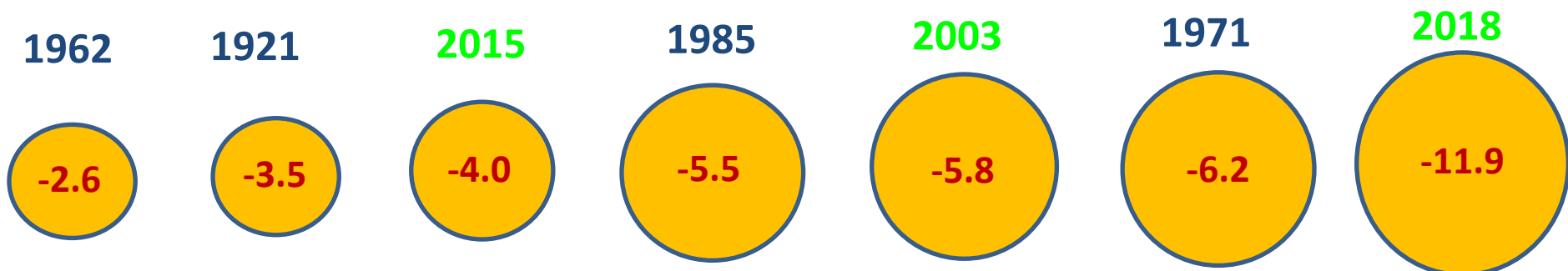# Low water years and Rhine traffic from 1900 until 2018 – a ranking analysis

The 7 most severe low water years and the 7 most severe years for the rate of change in Rhine traffic (1900-2018)
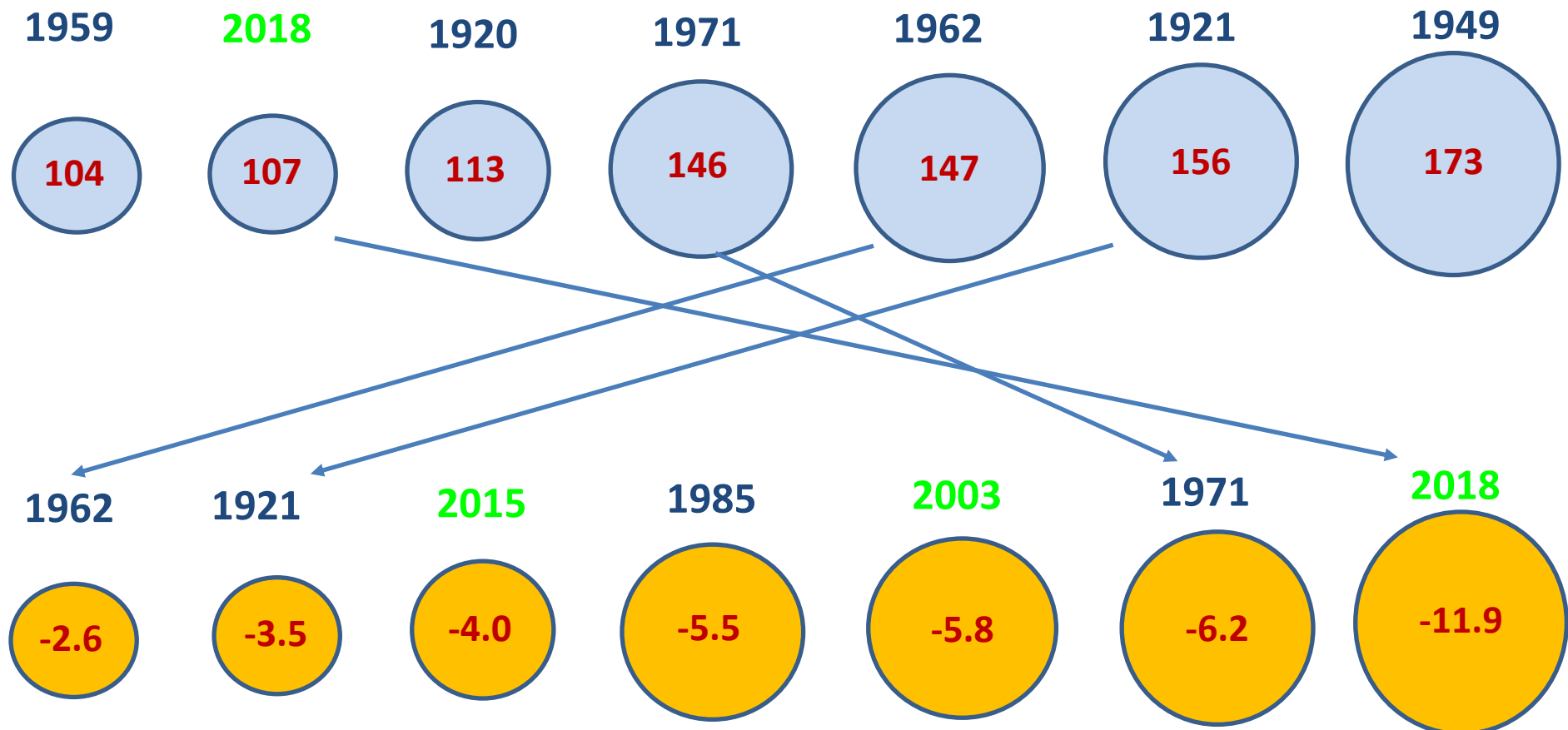
Years and number of days at Kaub < 78 cm *

1959	2018	1920	1971	1962	1921	1949
104	107	113	146	147	156	173

Years and decrease in Rhine traffic in % compared to previous year *

1962	1921	2015	1985	2003	1971	2018
-2.6	-3.5	-4.0	-5.5	-5.8	-6.2	-11.9

Source: CCNR and analysis based on data provided by the Federal German Office of Hydraulicity. * war years (1914-1918; 1940-1945) and economic depression years (1919, 1923, 1931, 1932, 1975, 2009) are excluded.
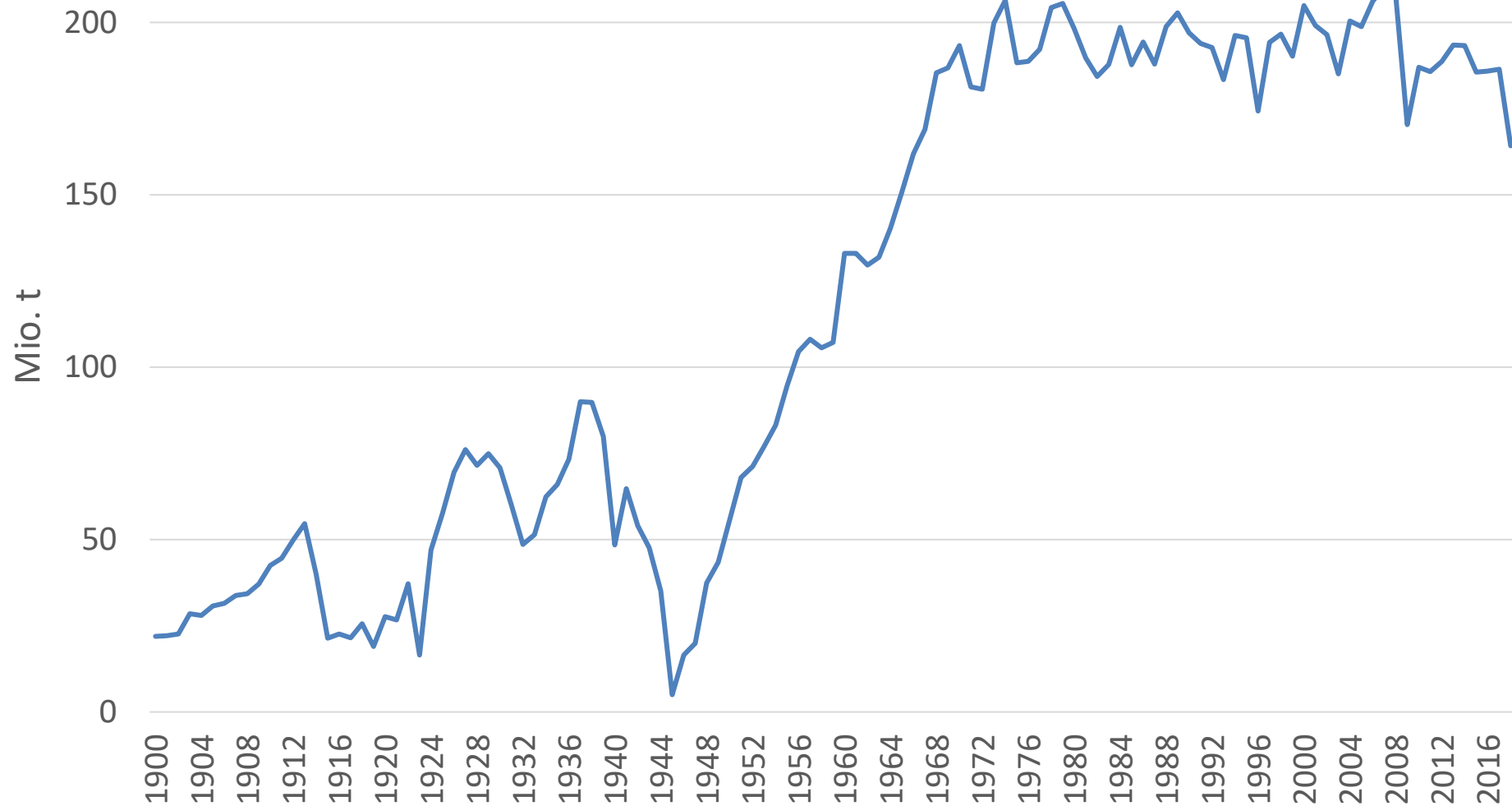
The vulnerability towards low water periods seems to have increased

1959 — 104
2018 — 107
1920 — 113
1971 — 146
1962 — 147
1921 — 156
1949 — 173

1962 — -2.6
1921 — -3.5
2015 — -4.0
1985 — -5.5
2003 — -5.8
1971 — -6.2
2018 — -11.9

Goods Transport on the Traditional Rhine (1900-2018)

02

A low water effect on the growth rate of German industry production ('Kiel model')

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FOR THE NAVIGATION OF THE RHINE

Kiel model published in: Kieler Konjunkturberichte Nr. 50 (2018), Q4

ifw KIEL INSTITUT FÜR WELTWIRTSCHAFT

KIELER
KONJUNKTUR-
BERICHTE

Deutsche Konjunktur
im Winter 2018

Abgeschlossen am 11. Dezember 2018

Nr. 50 (2018|Q4)

Martin Ademmer, Jens Boysen-Hogrefe,
Salomon Fiedler, Dominik Groll, Nils Jannsen,
*Stefan Kooths, Saskia Mösle und*
Galina Potjagailo

Tabelle K1-2:
Einfluss des Niedrigwassers auf die per Binnenschifffahrt beförderten Mengen und die Produktion im Verarbeitenden Gewerbe

	Δ Beförderungsmenge 1993–2018		Δ Produktion Prod. Gewerbe 1991–2018	
Δ Tage Niedrigwasser	-0.760***	(0.083)	-0.039**	(0.016)
Δ Tage Niedrigwasser (t-1)	-0.201**	(0.100)	-0.032*	(0.017)
Konstante	0.087	(0.326)	-0.161**	(0.068)
Δ Welthandel	0.220***	(0.048)	-	-
Δ Welthandel (t-1)	0.088*	(0.050)	-	-
Δ Beförderungsmenge (t-1)	-0.416***	(0.053)	-	-
Δ Weltindustrieproduktion	-	-	1.169***	(0.118)
Δ Weltindustrieproduktion (t-1)	-	-	0.561***	(0.134)
Δ Produktion Prod. Gewerbe (t-1)	-	-	-0.359***	(0.051)
Beobachtungen	306		331	
Adj. R²	0.36		0.34	
DW-Stat.	2.24		2.16	

Standardfehler in Klammern. ***/**/* : Effekte sind auf dem 1%/5%/10%-Niveau signifikant.

Abbildung K1-2:
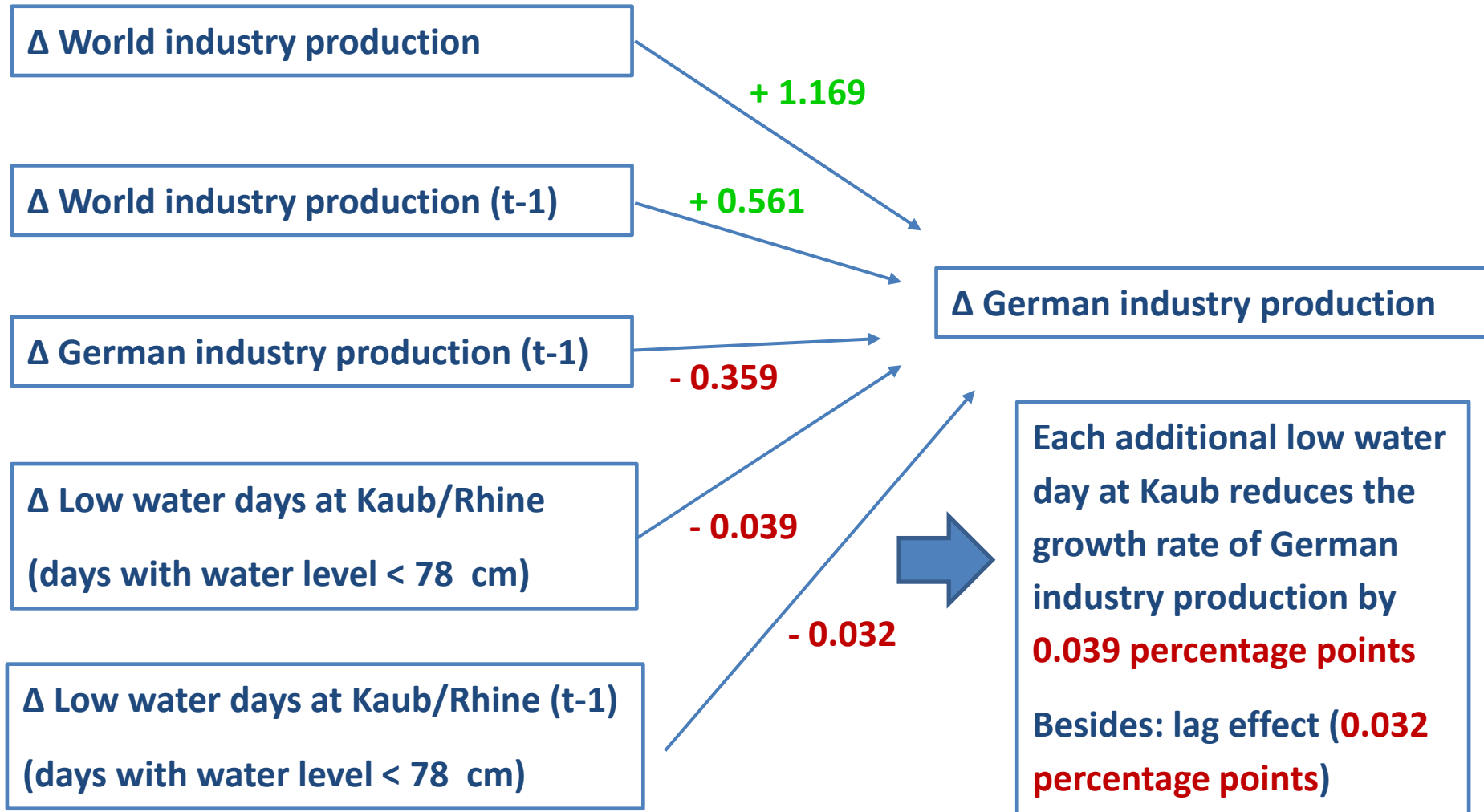Monate mit Niedrigwasser im Rhein 1991–2018
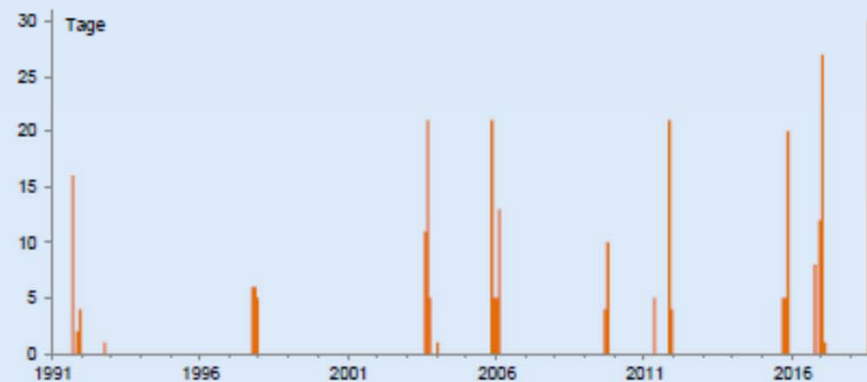
Monatsdaten. Zahl der Tage mit einem Pegelstand bei Kaub geringer als 78cm.

Quelle: Bundesanstalt für Gewässerkunde (BfG); Wasserstraßen- und Schifffahrtsverwaltung des Bundes (WSV).

Source: Kiel Institute for the World Economy

'Kiel' model results (monthly seasonally adjusted Δ data, 1991-2018)

Δ World industry production

+ 1.169

Δ World industry production (t-1)

+ 0.561

Δ German industry production (t-1)

- 0.359

Δ German industry production

Δ Low water days at Kaub/Rhine

(days with water level < 78 cm)

- 0.039

Δ Low water days at Kaub/Rhine (t-1)

(days with water level < 78 cm)

- 0.032

Each additional low water day at Kaub reduces the growth rate of German industry production by 0.039 percentage points

Besides: lag effect (0.032 percentage points)

8

The effects of low water on German industrial production in the 'Kiel model'

Source: Kiel Institute for the World Economy
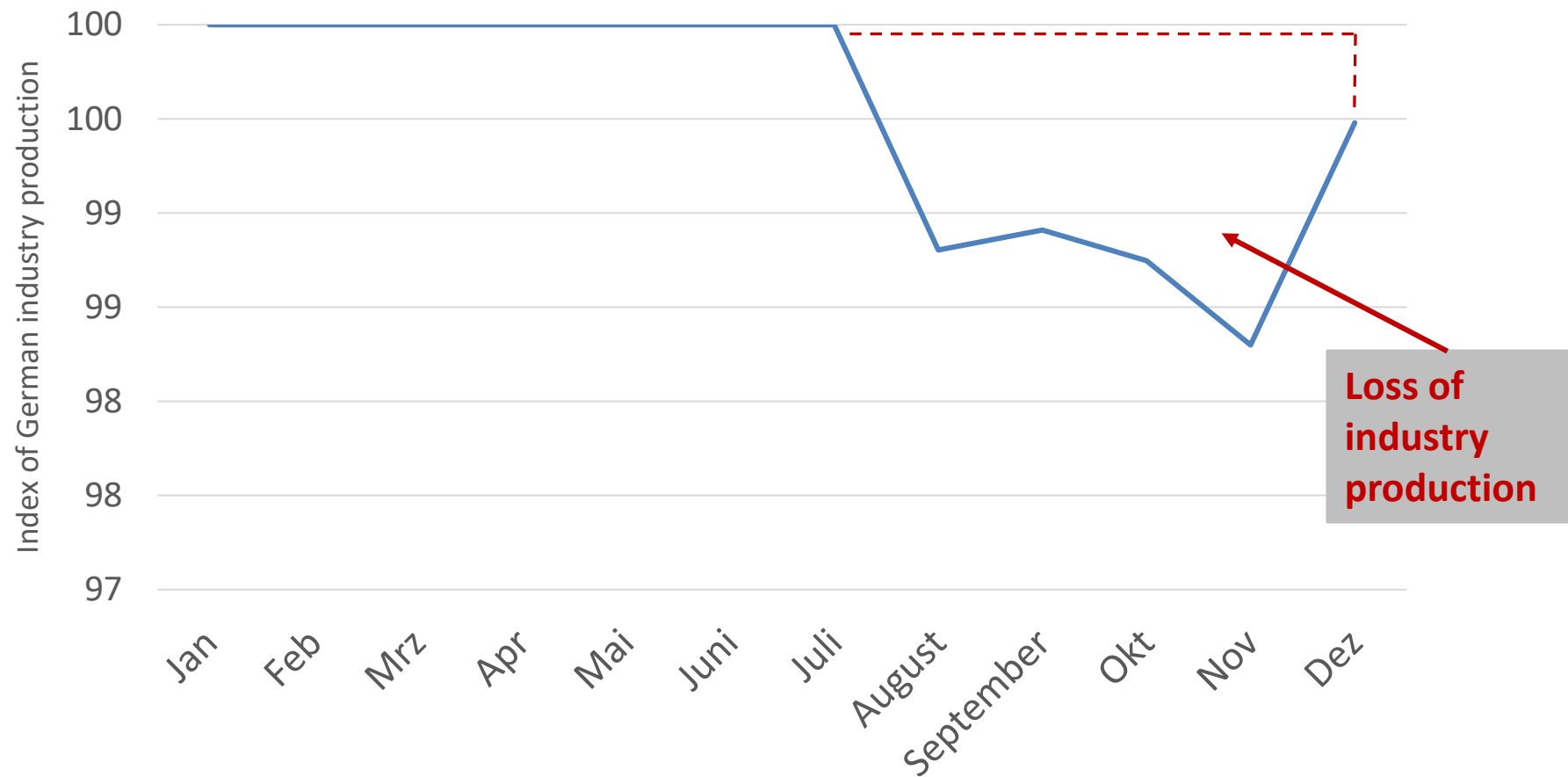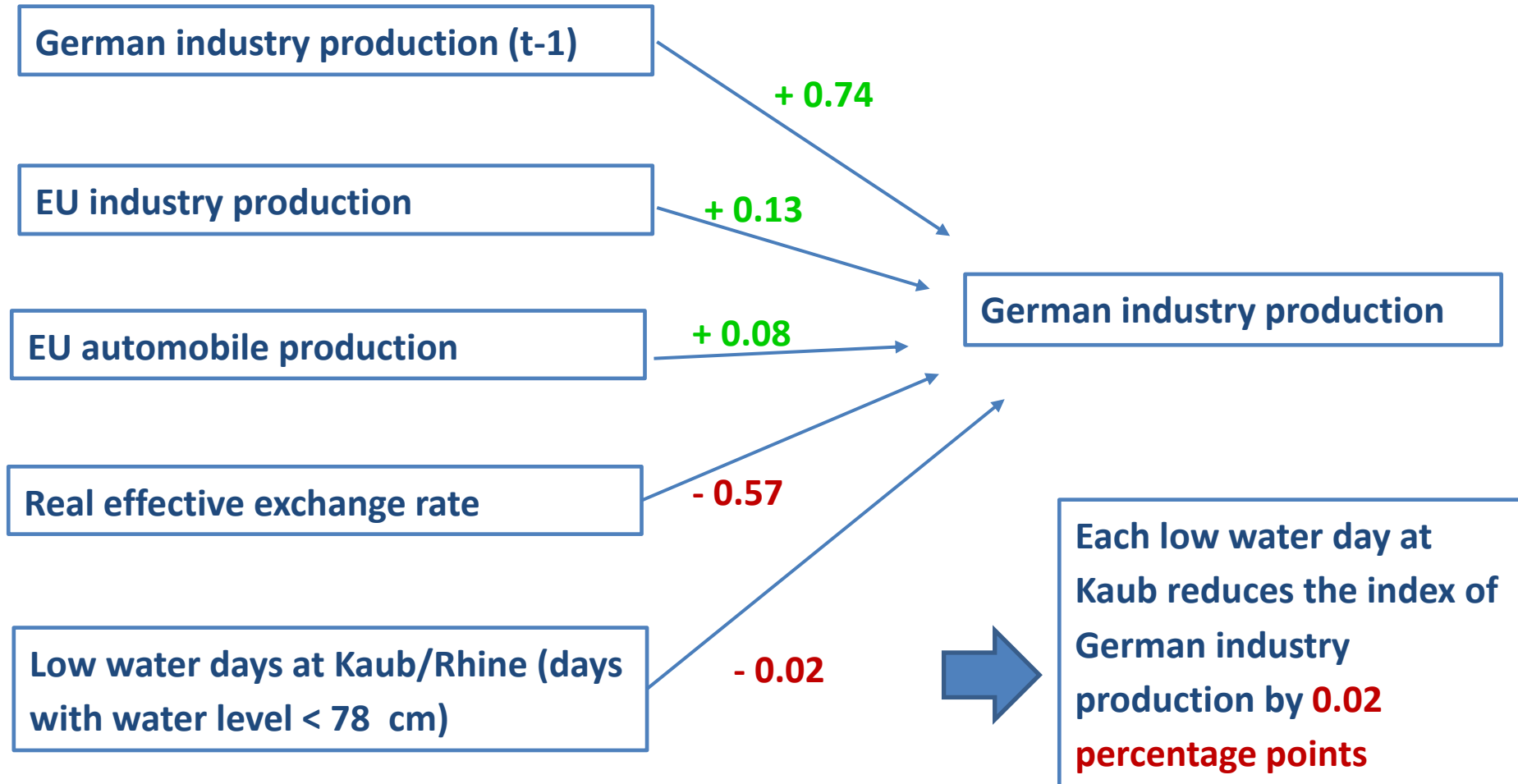
03

A low water effect on the index of German industry production ('CCNR model')

CCNR model results (monthly seasonally adjusted index data, 2000-2019)

German industry production (t-1)

+ 0.74

EU industry production

+ 0.13

EU automobile production

+ 0.08

German industry production

Real effective exchange rate

- 0.57

Low water days at Kaub/Rhine (days with water level < 78 cm)

- 0.02

Each low water day at Kaub reduces the index of German industry production by **0.02 percentage points**

04

The results of the Kiel and the CCNR model compared - within an index

and a growth rate framework

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The effects on German industrial production in the CCNR and the Kiel model compared

Kiel Institute model ——— CCNR model

Index of German industry production

Nov. 2018

-1.1 %

-1.7 %

Jan Feb Mrz Apr Mai Juni Juli August September Okt Nov Dez

Source: CCNR and Kiel Institute for the World Economy
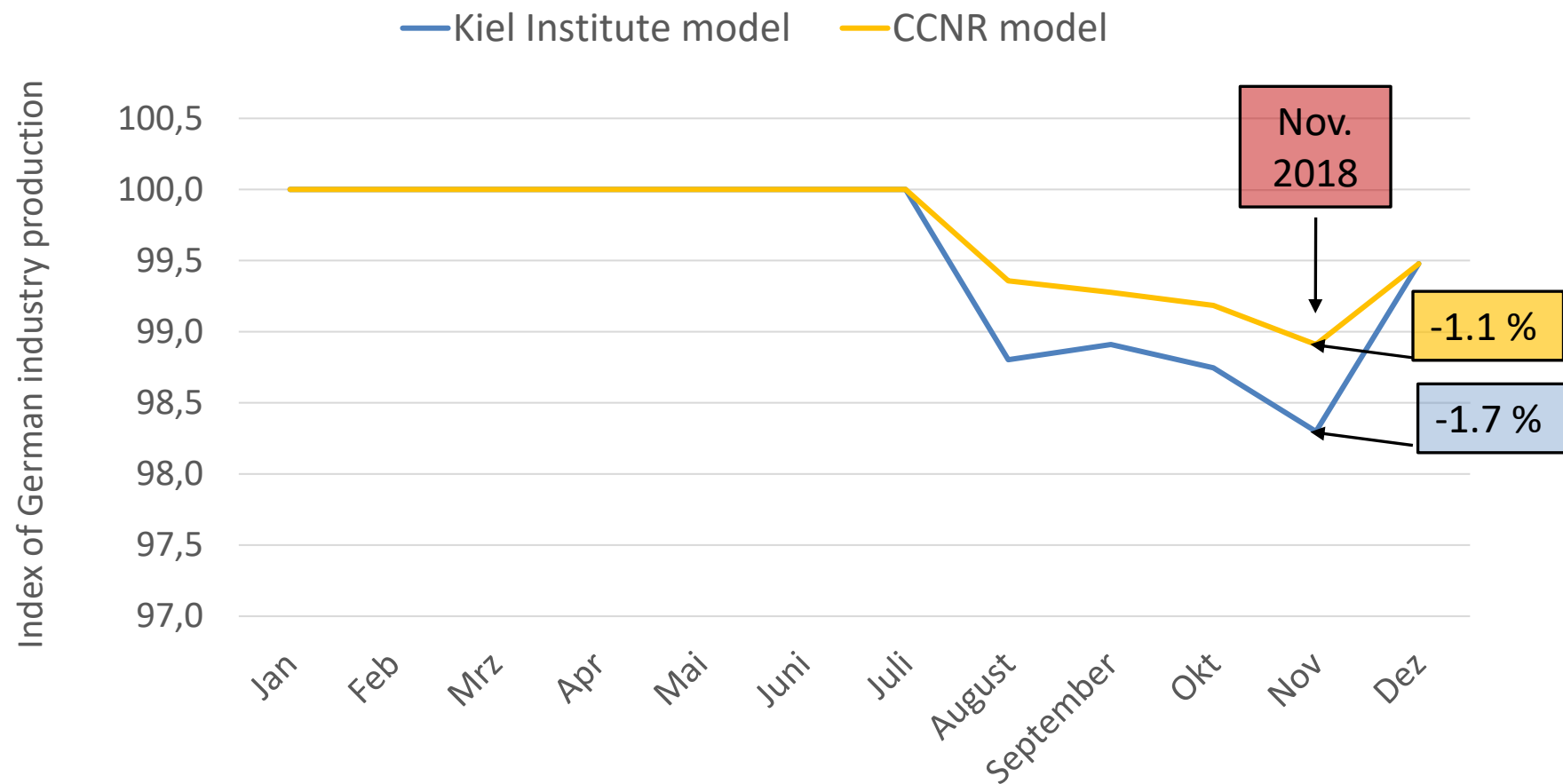
Effect on quarter-to-quarter growth rate of industry production (based on seasonally adjusted data)*

Effect on growth rate Qt / Qt-1
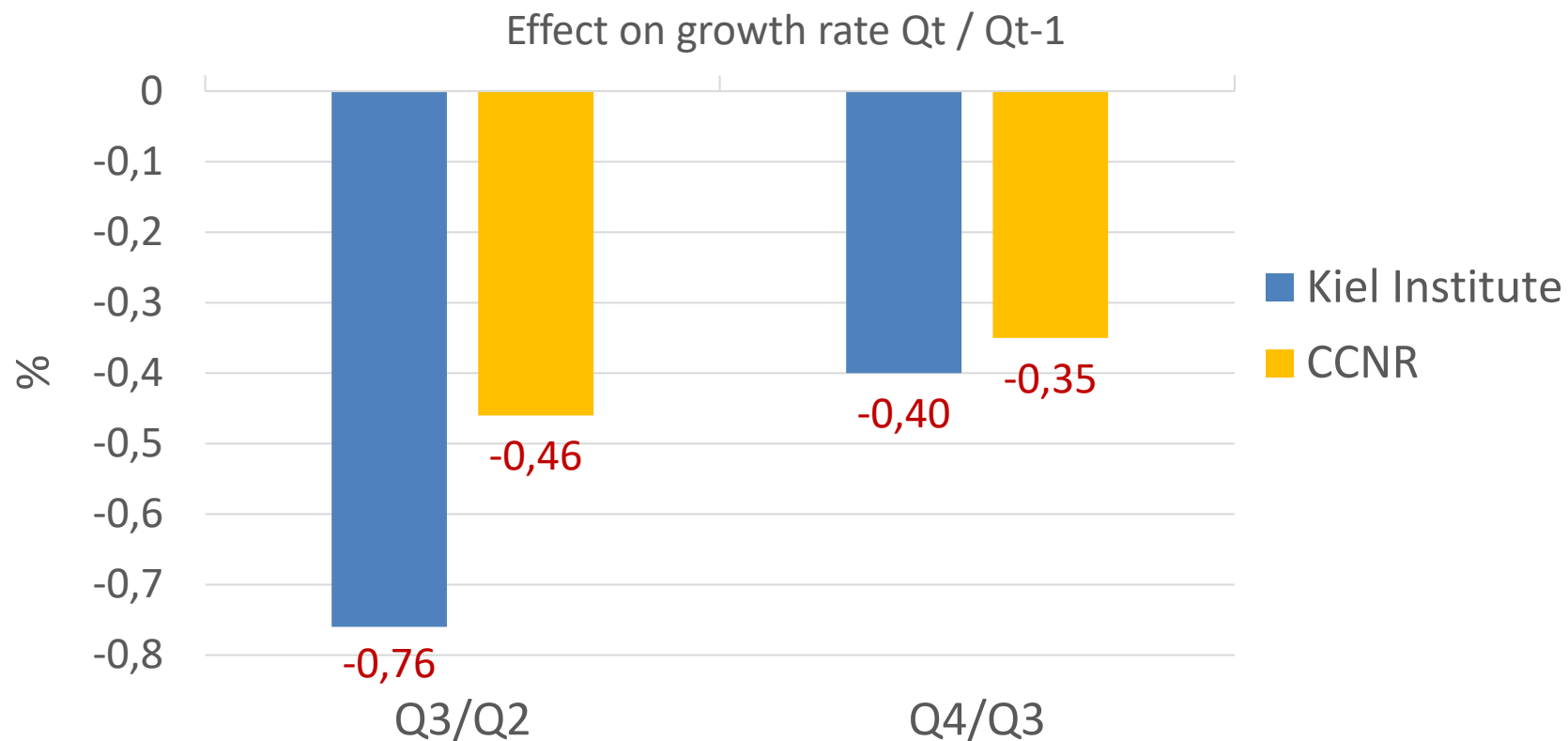
05 Monetary effects of the 2018 low water period

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CCNR model

Estimated low water effects on German industry production in 2018 - in billion Euro
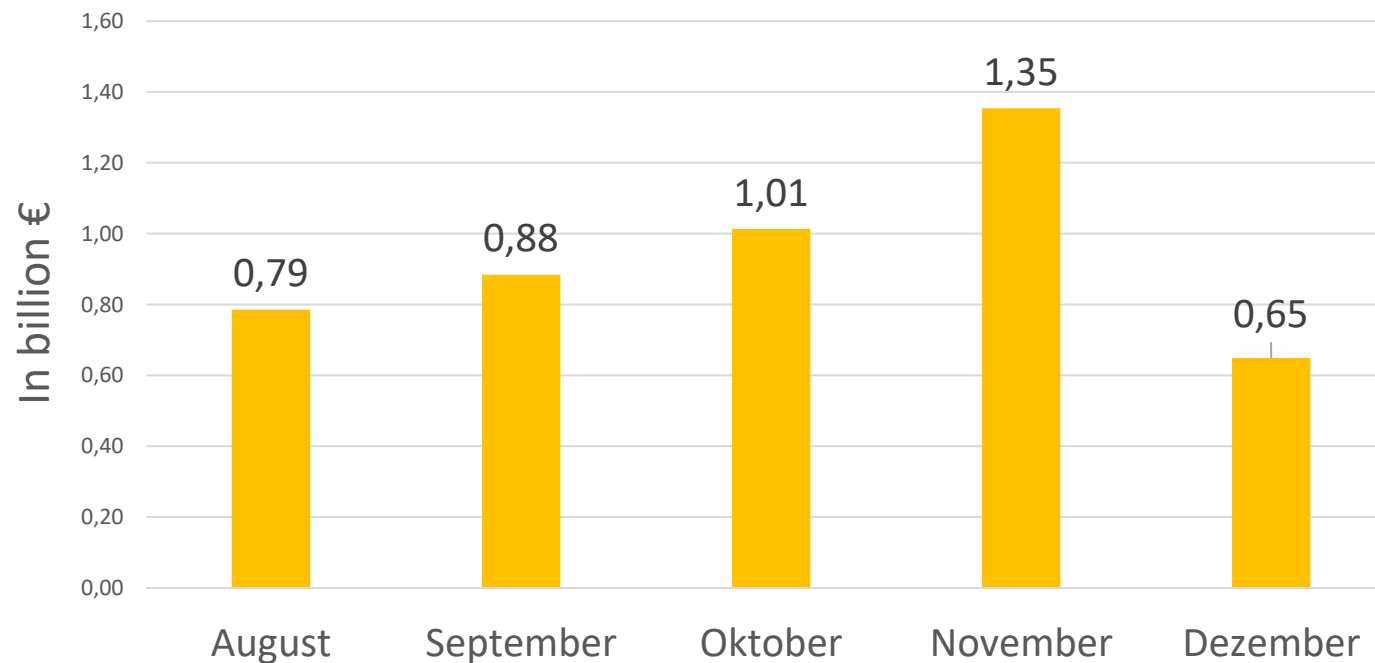
➡ Total estimated effect in Q3 and Q4 2018 : 4.68 billion Euro

≈ 0.63 % of total German industry production in Q3 and Q4 2018 *

Source: CCNR calculation. According to destatis, Fachserie 4 Reihe 3.1, production in German manufacturing accounted for 739.2 billion Euro in Q3 and Q4 2018.

06 The results for the low water effect on the growth rate Qt / Q(t-4)

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Growth of German industry production in Qt compared to the same quarter one year earlier

CCNR model, Growth rate in Qt compared to Qt-4
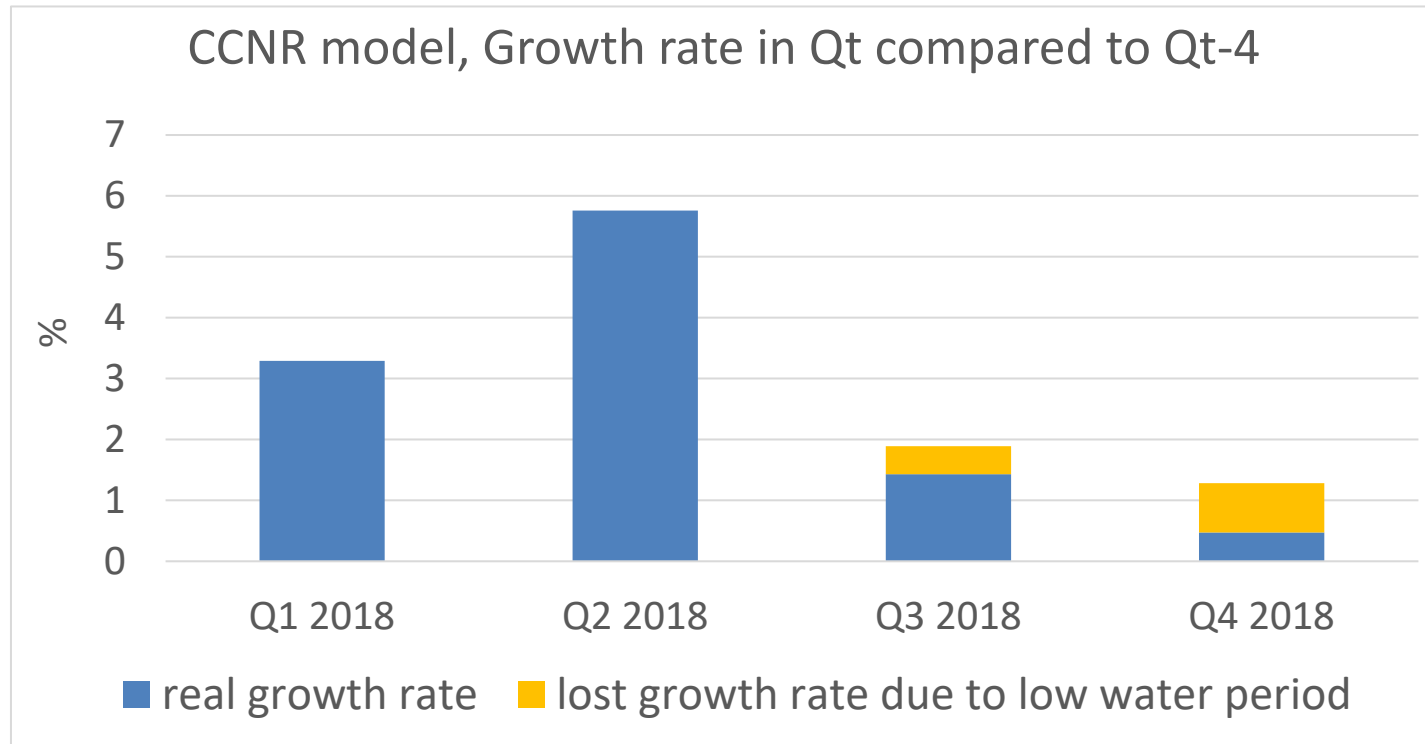
Growth of German industry production subsided in Q3 and Q4 2018, due to a slow down in international macro-economic business climate conditions

The low water period acted as an additional retardation factor, but NOT AS THE ONLY FACTOR !

Source: CCNR based on data on industrial production (destatis, Fachserie 4 Reihe 3.1)

THANK YOU VERY MUCH FOR YOUR ATTENTION

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06 Backup slides

Kiel model

Monthly data	Dependant variable: Δ German industry production (1991-2018)		
	Coefficient	Std. Deviation	Signif. level
Influencing factors:			
Δ World Industry production	1.169	0.118	1 %
Δ World industry production (t-1)	0.561	0.134	1 %
Δ German industry production (t-1)	-0.359	0.051	1 %
Constant	-0.0161	0.068	5 %
Δ days of low waters (Kaub < 78 cm)	-0.039	0.016	5 %
Δ days of low waters (Kaub < 78 cm) (t-1)	-0.032	0.017	10 %

Each additional low water day at Kaub reduces the growth rate of German industry production by 0.04 percentage points.

Besides: lag effect (around 0.03 percentage points)

Source: Kiel Institute for the World Economy (2018)

CCNR model on manufacturing in Germany (m2/2000-m6/2019)

Method: linear regression model (least squares)	Dependant variable: German manufacturing		
Explanatory variables	Coefficient	Std. Deviation	Signif. level
German manufacturing (t-1)	0.74	0.06	1 %
Real exchange rate	-0.57	0.14	1 %
EU manufacturing	0.13	0.05	1 %
EU automobile production	0.08	0.02	1 %
days of low waters (Kaub < 78 cm)	-0.02	0.01	6 %

Source: calculation CCNR based on Eurostat data from the German Federal Office of Hydrology

Data used

Variable	Role in the model	Unit	Frequency and time span	Source	seasonal and calender adjustment
Manufacturing in Germany	Dependant variable	Index values (2015=100)	Monthly, 1/2002-6/2019	Eurostat [sts_inpr_m]	Yes
Manufacturing in the EU	Explanatory variable	Index values (2015=100)	Monthly, 1/2002-6/2019	Eurostat [sts_inpr_m]	Yes
Automobile production in the EU	Explanatory variable	Index values (2015=100)	Monthly, 1/2002-6/2019	Eurostat [sts_inpr_m]	Yes
Real effective exchange rate	Explanatory variable	Index values (2015=100)	Monthly, 1/2002-6/2019	Eurostat [ert_eff_ic_m]	Yes
Producer prices in manufacturing in Germany *	Explanatory variable	Index values (2015=100)	Monthly, 1/2002-6/2019	Eurostat [sts_inpr_m]	No
Number of days at Kaub < 78 cm	Explanatory variable	Number of days	Monthly, 1/2002-6/2019	German Federal Office of Hydrology	No

* Erzeugerpreise in der Industrie. Industry (except construction, sewerage, waste management and remediation activities)