

Unemployment and volunteering: Does unemployment affect content generation on Wikipedia?

SEEK Conference, Mannheim

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Motivation

- (1)
 - Time spent online can be **wasteful** (Wallsten, 2013) or **beneficial** for society, e.g. online knowledge
 - As the **opportunity cost of leisure time** is lower for people with lower incomes, with more spare time poorer people increase their time online (Goldfarb and Prince (2008))

- (2)
 - With a raise in income, consumption increases smoothly while “giving” is **sensitive** (time, donations) (Randolf, 1995; Andreoni and Vesterlund (2001))

- **Why care?:** What are the side effects of economic crises?
Public goods

Contribution

- **Research question:**
 - Do contributions to online public goods raise due to the economic crisis via unemployment?
- **Data:**
 - Country-level data for European countries
 - unemployment rates, hours worked + contributions (editors, edits) to Wikipedia
 - District[Kreise]-level data for Germany:
 - unemployment rates, part-time jobs + contributions (edits, bytes)
 - **Method:**
 - Difference-in-difference approach
- **Findings:** with shocks to unemployment, more edits takes place on Wikipedia

State of Research

■ Contribution to public goods

- Charity (Vesterlund, 2006)
- Spillovers from articles (Kummer, 2014; Gorbatai, 2014; Aaltonen and Seiler, 2015),
- Spillovers from editors (Zhang and Zhu, 2011; Algan et al., 2013; Slivko, 2014)

■ Unemployment and time use

- Leisure activities decrease at the time of *reemployment*
- Leisure time absorbs app.50% of foregone market work hours (TV)
- Knabe, 2010, Krueger and Mueller, 2012, Aguiar et al., 2012, 2013
- Goldfarb and Prince (2008): having Internet access, *poorer people* spend more time online than wealthy people as they have a *lower opportunity cost of time*.

- **Our contribution:** with an increase in unemployment, more online public good is provided

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Data - Basics

- World's largest platform for encyclopedic knowledge.
- Millions of Articles and 100s of volunteers;
- In more than 100 languages.
- Collected country level data for Europe.

WIKIPEDIA

<p>English <i>The Free Encyclopedia</i> 4 509 000+ articles</p> <p>日本語 フリー百科事典 308 000+ 記事</p> <p>Русский Свободная энциклопедия 1 111 000+ статей</p> <p>Italiano <i>L'enciclopedia libera</i> 1 120 000+ voci</p> <p>Polski <i>Wolna encyklopedia</i> 1 044 000+ hasel</p>		<p>Español <i>La enciclopedia libre</i> 1 099 000+ artículos</p> <p>Deutsch <i>Die freie Enzyklopädie</i> 1 716 000+ Artikel</p> <p>Français <i>L'encyclopédie libre</i> 1 503 000+ articles</p> <p>Português <i>A enciclopédia livre</i> 827 000+ artigos</p> <p>中文 自由的百科全書 767 000+ 條目</p>
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Deutsch

Find Wikipedia in a language:

[Deutsch](#) • [English](#) • [Español](#) • [Français](#) • [Italiano](#) • [Nederlands](#) • [Polski](#) • [Русский](#) • [Svenska](#)

Data - Country Level

- *Variables on the country level:*
 - Wikipedia monthly stats: active Wikipedians, views, edits per article, words added
 - Unemployment rates, hours worked (monthly by country)
- *Affected countries, Crisis start:*
 - A significant decrease in hours worked + media events and EU reports

At the country level: unemployment

Tabelle: Crisis Indicators: unemployment rates and the difference between them (%)

	Affected by crisis	Crisis start	Unemp.rate,%	Change in Unempl.,%
Bulgarian	yes	Oct 2008	6	3
Catalan	yes	Sept 2008	11	10
Czech	yes	Oct 2008	5	4
Danish	no	.	4	4
Dutch	no	.	3	1
Finnish	no	.	7	6
German	no	.	8	2
Greek	yes	June 2009	9	5
Hungarian	yes	March 2009	9	4
Icelandic	yes	Oct 2008	5	10
Italian	yes	May 2009	8	4
Japanese	no	.	4	2
Norwegian	no	.	3	1
Polish	no	.	8	2
Romanian	yes	Oct 2008	6	2
Russian	yes	Oct 2008	7	4
Slovene	yes	Oct 2008	5	2
Swedish	no	.	7	5
Turkish	yes	Oct 2008	11	6

At the country level: Wikipedia

Tabelle: Wikipedia key variables within the period of 12 months before and 12 months after the crisis

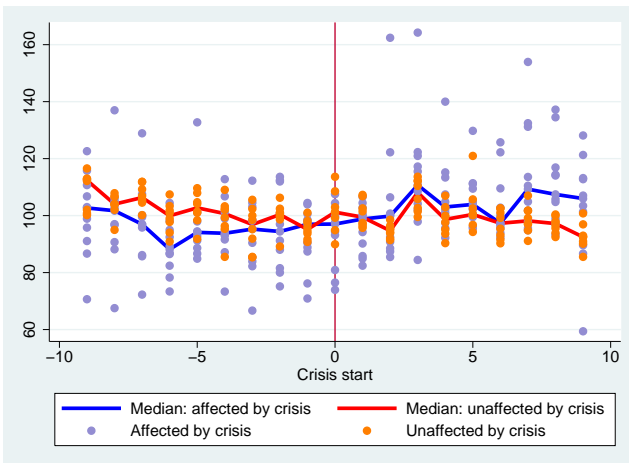
	Language speakers (m)	In main country, %	Views per speaker	Wikipedians, %	Active 5-100 edits, %	Active > 100 edits, %
Bulgarian	8.16	86.05	2	0.02	10.7	3.5
Catalan	4.08	.	3	0.06	13.3	3.9
Czech	10.62	97.93	4	0.04	12.3	2.8
Danish	5.52	97.42	3	0.06	9.9	2.3
Dutch	21.94	71.54	6	0.06	9.6	2.2
Finnish	5.39	94.58	10	0.13	9.7	2.3
German	78.25	89.21	12	0.10	9.0	1.4
Greek	13.43	79.65	1	0.02	6.0	1.8
Hungarian	12.61	78.06	2	0.04	12.8	3.3
Icelandic	0.24	94.32	9	0.16	11.8	5.4
Italian	63.66	90.64	5	0.04	10.2	2.2
Japanese	122.06	99.13	8	0.03	12.7	1.5
Norwegian	4.74	97.85	6	0.13	9.7	2.1
Polish	38.66	94.66	8	0.04	10.8	2.3
Romanian	23.78	83.67	1	0.01	12.1	2.9
Russian	167.33	81.87	1	0.01	17.0	3.4
Slovene	2.09	91.60	4	0.07	12.6	2.8
Swedish	9.20	96.12	7	0.09	11.0	2.4
Turkish	70.81	93.92	1	0.01	10.6	1.9
Total	34.87	89.90	5	0.06	11.2	2.7

Columns (3)-(6) are means of the interval 12 months before to 12 months after crisis

Sources: stats.wikimedia.org

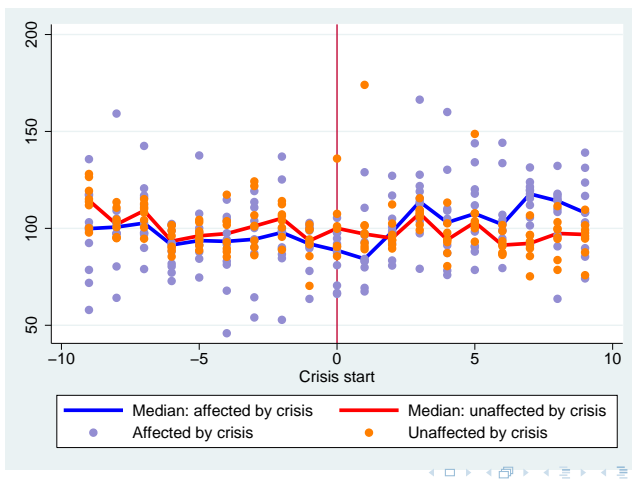
Trends: Active Wikipedians (5 to 100 edits monthly)

(Median values of the dependent variable for the groups of affected and unaffected countries 9 months before and after the crisis)



Trends: Words growth monthly

(Median values of the dependent variable for the groups of affected and unaffected countries 9 months before and after the crisis)



Econometric specifications

Dif-in-Dif: comparing countries affected and unaffected by crisis before and after the crisis

$$\text{Contributions}_{it} = \beta \text{After}_t + \gamma (\text{After}_t \times \text{Affected}_i) + \mu_i + \nu_t + \epsilon_{it}$$

Results - DiD

Time period - for each country +/- 6 months from the crisis

Tabellen: DiD Regression for the period of 6 months before and 6 months after the crisis

	(1)	(2)	(3)	(4)	(5)
	Views	Active 5-100e.	Active more 100e.	Edits p.article	Words growth
After crisis	-11.05 (9.390)	-8.134 (4.801)	0.206 (3.592)	-3.399* (1.686)	2.090 (6.944)
Affected after crisis	14.49** (6.448)	10.87* (5.280)	2.059 (4.074)	3.665** (1.582)	5.275 (8.870)
Time trend	1.191 (0.850)	0.790* (0.393)	0.490 (0.382)	1.348*** (0.166)	0.453 (0.580)
Constant	109.8*** (2.415)	107.1*** (4.420)	102.0*** (1.904)	94.61*** (0.773)	104.8*** (4.865)
Observations	247	247	247	247	247

NOTES: The table contains different measures of contributions to Wikipedia in each column: (1) views of Wikipedia, (2) the number of active Wikipedians (with at least 5 edits), (3) the number of very active Wikipedians (with more than 100 edits), (4) the average number of edits per article, (5) the new words added. All indicators of contributions to Wikipedia are normalized such that the mean value of the variable across all periods is considered 100%. The rest of the monthly values are computed as a percentage of this value. The variable of interest, which represents the treatment effect, *affected_tafter_t*, is an interaction term between dummies for the countries that are affected by the crisis with the time dummy indicating the period after the crisis. All specifications include month and year dummies, and a common time trend. Standard errors, clustered by countries, are in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. no. of obs. = ; no. of clusters = ; no. of articles = .

Results - DiD

Time period - for each country +/- 12 months from the crisis

Tabella: DID Regression for the period of 12 months before and 12 months after the crisis

	(1)	(2)	(3)	(4)	(5)
	Views	Active 5-100e.	Active more 100e.	Edits p.article	Words growth
After crisis	-7.942 (5.705)	-6.634 (4.036)	-3.525 (2.870)	-3.458* (1.822)	-5.758 (5.127)
Affected after crisis	13.15* (7.006)	14.70*** (4.571)	11.42** (4.386)	6.181** (2.688)	13.43** (5.706)
Time trend	0.207 (0.424)	0.159 (0.186)	0.130 (0.174)	1.129*** (0.0872)	0.287 (0.422)
Constant	108.3*** (3.972)	88.25*** (3.326)	96.81*** (2.956)	84.70*** (1.652)	101.0*** (4.728)
Observations	429	475	475	475	475

NOTES: The table contains different measures of contributions to Wikipedia in each column: (1) views of Wikipedia, (2) the number of active Wikipedians (with at least 5 edits), (3) the number of very active Wikipedians (with more than 100 edits), (4) the average number of edits per article, (5) the new words added. All indicators of contributions to Wikipedia are normalized such that the mean value of the variable across all periods is considered 100%. The rest of the monthly values are computed as a percentage of this value. The variable of interest, which represents the treatment effect, *affected₂after*, is an interaction term between dummies for the countries that are affected by the crisis with the time dummy indicating the period after the crisis. All specifications include month and year dummies, and a common time trend. Standard errors, clustered by countries, are in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. no. of obs. = ; no. of clusters = ; no. of articles = .

Robustness check - OLS: Unemployment

OLS Regression: unemployment and contributions (−12, 0) months

Tabelle: OLS Regression for the period of 12 months before the crisis

	(1)	(2)	(3)	(4)	(5)
	Views	Active 5-100e.	Active more 100e.	Edits p.article	Words growth
Unemployment rate (norm.)	-0.208*** (0.0687)	-0.0910 (0.167)	-0.0249 (0.0877)	0.0103 (0.0221)	-0.178 (0.204)
Time trend	0.130 (0.339)	0.300 (0.422)	0.345 (0.289)	1.420*** (0.117)	0.0133 (0.484)
Constant	124.9*** (10.33)	98.44*** (13.07)	97.82*** (8.370)	83.44*** (2.204)	113.6*** (15.82)
Observations	182	228	228	228	228

NOTES: The table contains different measures of contributions to Wikipedia in each column: (1) views of Wikipedia, (2) the number of active Wikipedians (with at least 5 edits), (3) the number of very active Wikipedians (with more than 100 edits), (4) the average number of edits per article, (5) the new words added. All indicators of contributions to Wikipedia are normalized such that the mean value of the variable across all periods is considered 100%. The rest of the monthly values are computed as a percentage of this value. The independent variable of interest, *Unemployment*, is the normalized monthly unemployment rate. All specifications include month and year dummies, and a common time trend. Standard errors, clustered by countries are in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; no. of obs. = ; no. of clusters = ; no. of articles = .

- No evidence of correlation between unemployment and contributions to Wikipedia before the shock

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German Districts



Data - Basics

- In German: 1,716,000 Articles; 1000s of volunteers.
- Public metatext-dump (1M pages) augmented with clicks (Dec. 2007 - Dec 2010.) and articles-links. (Size 1TB)
- Extracted IP level data matched to German districts.
- Combined it with district-level macro unemployment data.

Benutzerkonto erstellen  Anm

Lesen Bearbeiten Versionsgeschichte Suchen

Koordinaten: 35° S, 68° W 

[iki Loves Monuments: Fotografiere Denkmale, hilf der Wikipedia und gewinne!](#) 

st eine Republik im Süden [Südamerikas](#), dem [Südkegel](#). Es ist der größte des Kontinents; im Hinblick auf die Einwohnerzahl nimmt es dort en Nord-Süd-Ausdehnung hat das Land Anteil an zahlreichen Klimavom lateinischen Wort für *Silber* – *argentum* – und liefert einen Hinweis seinem Territorium zu finden glaubten. Bis zu seiner Unabhängigkeit [reiches](#).

s, ist Zentrum eines der größten Ballungsräume auf dem nes seiner größten Kulturzentren angesehen, in dem unter anderem 1 sind weite Teile des Landes, insbesondere der trockene Süden, nur sich bei Aroentlinien um eine [präsidiale Bundesrepublik](#). in der die

República Argentina
Argentinische Republik



Data - Basics

- In German: 1,716,000 Articles; 1000s of volunteers.
- Public meta-text dump (1M pages) augmented with clicks (Dec. 2007 - Dec 2010.) and articles-links. (Size 1TB).
- Extracted IP level data matched to German districts.
- Combined it with district-level macro unemployment data.

- (Aktuell | Vorherige) 20:23, 15. Mär. 2013 CroMagnon (Diskussion | Beiträge) K ... (146.015 Bytes) (0) ... (→Str
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- (Aktuell | Vorherige) 15:58, 11. Mär. 2013 2003:74.8f04:a600:59cf.2b61:5922:25ce (Diskussion) ... (149.414 Byt
- (Aktuell | Vorherige) 15:44, 10. Mär. 2013 79.252.190.161 (Diskussion) ... (149.414 Bytes) (-4) ... (→Kulinarik)

German Districts - Data

The dataset contains:

- Anonymous contributions with IP-addresses (in 2008-2009, 15% of all edits in German Wikipedia)
- matched to German districts
 - Dependent variables: Total monthly bytes of contributions and number of revisions
- Unemployment rates and Part-time jobs (monthly by districts)
- *Crisis start*: Jan 2009
- *Affected and unaffected districts*: by changes in the unemployment rates

Descriptive statistics at the level of districts (UR)

District-level averages by German states:

Tabelle: Crisis Indicators: unemployment rates and the difference between them (%)

	share of affected districts	Unemp.rate,%	Change in Unempl.,%
Baden-Wuerttemberg	0.63	4.69	1.13
Bavaria	0.69	4.46	1.25
Brandenburg	0.58	13.21	1.12
Bremen	0.50	13.23	0.40
Hamburg	.	8.33	0.83
Hessen	0.17	6.71	0.64
Lower Saxony	0.10	7.85	0.68
Mecklenburg-Western Pomerania	0.77	14.15	1.65
North Rhine-Westphalia	0.29	8.50	0.76
Rhineland-Palatinate	0.40	6.18	0.99
Saarland	0.00	6.62	0.86
Saxony	0.85	12.78	1.86
Saxony-Anhalt	0.80	13.72	1.34
Schleswig-Holstein	0.18	8.10	0.75
Thuringia	0.76	11.35	1.86

- Unemployment rates increase less than in Europe

Econometric specifications

Dif-in-Dif: comparing German districts before and after the raise in unemployment

$$\text{Contributions}_{it} = \beta \text{After}_t + \gamma (\text{After}_t \times \text{Affected}_i) + \mu_i + \nu_t + \epsilon_{it}$$

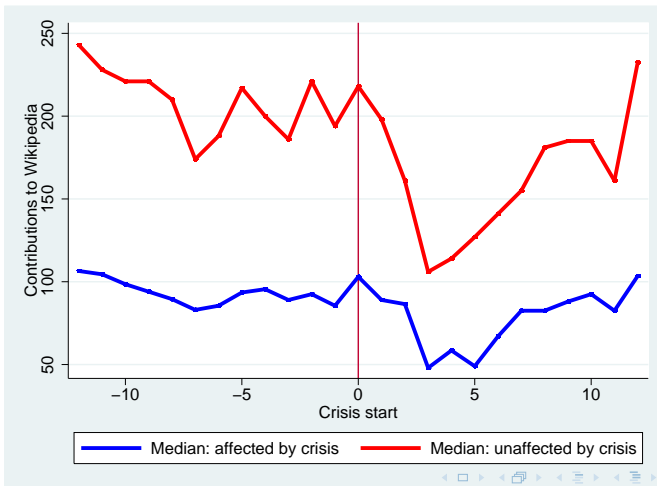
Two remarks

Using IP-addresses of anonymous contributions implies:

- Restricted set of contributions.
 - New users
 - Occasional users
- Restricted set of available dependent variables
 - We can only determine average properties of these edits:
→ number of edits and avg. length of edits in bytes.

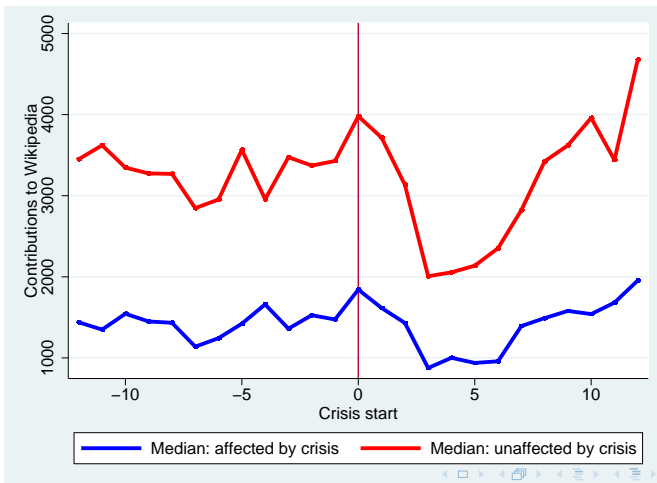
Trends: Edits

(Median values of the dependent variable for the groups of affected and unaffected districts 6 months before and after the crisis)



Trends: Bytes

(Median values of the dependent variable for the groups of affected and unaffected districts 6 months before and after the crisis)



DiD results for Unemployment as treatment (+/- 6 months)

Contributions made all day long

Table: DID Regression with robust estimator of variance (before and after 6 months, crisis: at t)

	(1)	(2)
	# Edits (norm.)	Contribution (KB) (norm.)
After	-32.62*** (2.954)	-16.53*** (4.286)
Affected after crisis	6.188** (2.515)	5.327 (3.913)
Constant	104.4*** (1.600)	110.2*** (2.886)
Observations	3341	3341

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

NOTES: The table contains different measures of contributions to Wikipedia in each column: (1) the number of revisions, (2) the total contribution length in kb. The variable of interest, which represents the treatment effect, *Affected after crisis*, is an interaction term between dummies for the districts that are affected by the crisis with the time dummy indicating the period after the crisis. All specifications include month and year dummies. Standard errors, clustered by districts, in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Correlation results for Unemployment (- 6, 0 months)

Tabelle: OLS Regression (range: before and after 6 months)

	(1)	(2)
	# Edits (norm.)	Contribution (KB) (norm.)
Unemployment	-5.680 (4.318)	-3.503 (5.979)
Constant	150.3*** (29.81)	133.7*** (41.40)
Observations	1541	1541

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

NOTES: The table contains different measures of contributions to Wikipedia in each column: (1) the number of revisions, (2) the total contribution length in kb. The independent variable of interest is *Unemployment rate* for each district. All specifications include month and year dummies. Standard errors, clustered by districts in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

- **Before the shock**, there is no evidence on correlation between economic situation and contributions to Wikipedia

Correlation results for Unemployment (0, 6 months)

Tabelle: OLS Regression (range: before and after 6 months)

	(1)	(2)
	# Edits (norm.)	Contribution (KB) (norm.)
Unemployment	4.059* (2.254)	5.645 (3.928)
Constant	49.62*** (18.52)	38.01 (32.14)
Observations	1554	1554

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

NOTES: The table contains different measures of contributions to Wikipedia in each column: (1) the number of revisions, (2) the total contribution length in kb. The independent variable of interest is *Unemployment rate* for each district. All specifications include month and year dummies. Standard errors, clustered by districts in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

- **After the shock**, there is correlation between economic situation and contributions to Wikipedia

DiD results for Youth Unemployment as treatment (+/- 6 months)

Contributions made all day long

Table: DID Regression with robust estimator of variance (before and after 6 months, crisis: at t)

	(1)	(2)
	# Edits (norm.)	Contribution (KB) (norm.)
After	-34.12*** (2.867)	-22.45*** (4.277)
Affected after crisis	6.116** (2.553)	5.936 (3.991)
Constant	102.9*** (1.508)	109.0*** (2.969)
Observations	3315	3315

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

NOTES: The table contains different measures of contributions to Wikipedia in each column: (1) the number of revisions, (2) the total contribution length in kb. The variable of interest, which represents the treatment effect, *Affected after crisis*, is an interaction term between dummies for the districts that are affected by the crisis with the time dummy indicating the period after the crisis. All specifications include month and year dummies. Standard errors, clustered by districts, in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

DiD results for Youth Unemployment as treatment (+/- 12 months)

Contributions made all day long

Table: DID Regression with robust estimator of variance (before and after 12 months, crisis: at t)

	(1)	(2)
	# Edits (norm.)	Contribution (KB) (norm.)
After	-6.882** (3.210)	21.67*** (5.786)
Affected after crisis	5.663** (2.529)	6.692* (3.598)
Constant	110.2*** (1.300)	107.1*** (2.343)
Observations	6400	6400

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

NOTES: The table contains different measures of contributions to Wikipedia in each column: (1) the number of revisions, (2) the total contribution length in kb. The variable of interest, which represents the treatment effect, *Affected after crisis*, is an interaction term between dummies for the districts that are affected by the crisis with the time dummy indicating the period after the crisis. All specifications include month and year dummies. Standard errors, clustered by districts, in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

DiD results for Unemployment as treatment (+/- 6 months)

Contributions made in leisure time of the day (6pm-9am and weekends)

Tabelle: DiD Regression with robust estimator of variance (before and after 6 months, crisis: at t)

	(1)	(2)	(3)
	# Edits (norm.)	Contribution (KB) (norm.)	Unemployment (norm.)
After	-35.08*** (3.281)	-19.45*** (5.068)	4.189*** (0.789)
Affected after crisis	7.939*** (2.707)	6.378 (4.381)	15.50*** (1.101)
Constant	109.4*** (2.111)	105.8*** (3.048)	86.98*** (0.378)
Observations	3377	3377	3365

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

NOTES: The table contains different measures of contributions to Wikipedia in each column: (1) the number of revisions, (2) the total contribution length in kb. The variable of interest, which represents the treatment effect, *Affected after crisis*, is an interaction term between dummies for the districts that are affected by the crisis with the time dummy indicating the period after the crisis. All specifications include month and year dummies. Standard errors, clustered by districts, in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Discussion

- Higher unemployment yields additional Wikipedia contributions.
 - based on states where the unemployment rose during the European Economic Crisis.
 - German districts
- Country-level evidence:
 - Insight: due to exogenous shocks to unemployment, more contributions to online public goods
- Districts level evidence:
 - Similar pattern on German districts, though weaker patterns, because unemployment was less strongly felt.
 - Effects are driven by leisure-time activity

THANK YOU FOR YOUR ATTENTION ;)

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