Did the Bologna Process Challenge the German Apprenticeship System? Evidence from a Large-scale Natural Experiment

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Work in progress. Comments welcome!

1. Motivation

Motivation

- **Advantages of a strong vocational education and training (VET) system:**
  - Occupation-specific skill formation as well as close links between trainee and employer
    → facilitated labour market entry of youth and low unemployment rates (see e.g. Ryan 2001; Zimmermann et al. 2013)
  - Investment-oriented use to secure future supply of skilled workers (Mohrenweiser and Backes-Gellner 2010; Wolter and Ryan 2011)
- **Potentially challenged due to Bologna Process (initiated in 1999):**
  - Academic education and apprenticeship training became more comparable in terms of length, content and expected returns:
    - Former university system required about 4.5 years until first graduation, reformed system requires 3 years and is identical in length with duration of most VETs in apprenticeship system
    - Bologna process featured employability as explicit objective of university qualification (not contained in former system)
- **Further threats of dual system of VET in Germany**
  - Demographic change
  - Educational expansion

Our Paper

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- **Contributions**
  - Measuring causal effect of Bologna Process on apprentice supply
  - Disentangling effects by qualification and investigating peer externalities for lower qualified persons
  - Enriching discussion of general education vs. VET (see e.g. Golsteyn and Stenberg 2017; Hanushek et al. 2017; Verhaest et al. 2018)
  - Addressing ongoing debate about success or failure of the Bologna Process by providing evidence on side effects

- **Empirical approach**
  - Exploiting the institutional setting that caused exogenous variation in the availability of bachelor degrees
  - Using a combined dataset of administrative data and data on apprentices extracted from the SIAB on level of 141 German labour market regions, covering period of 1996-2013

In a Nutshell – Results

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- Results
  - No effects on whole apprentice supply (containing apprentices with and without higher education entrance qualification)
  - Robust negative effects on the treated target group (new apprentices with higher education entrance qualification)
  - Heterogeneous effects:
    - Effects for males twice as high as the avg; no significant effects for females
    - Mainly driven by occupations with a high share of apprentices with higher education entrance qualification

- Interpretation
  - Support for presumption that Bologna Process had negative impact on apprentice supply of school leavers with higher education entrance qualification → **acceleration effect**
  - No evidence for peer externalities for lower qualified

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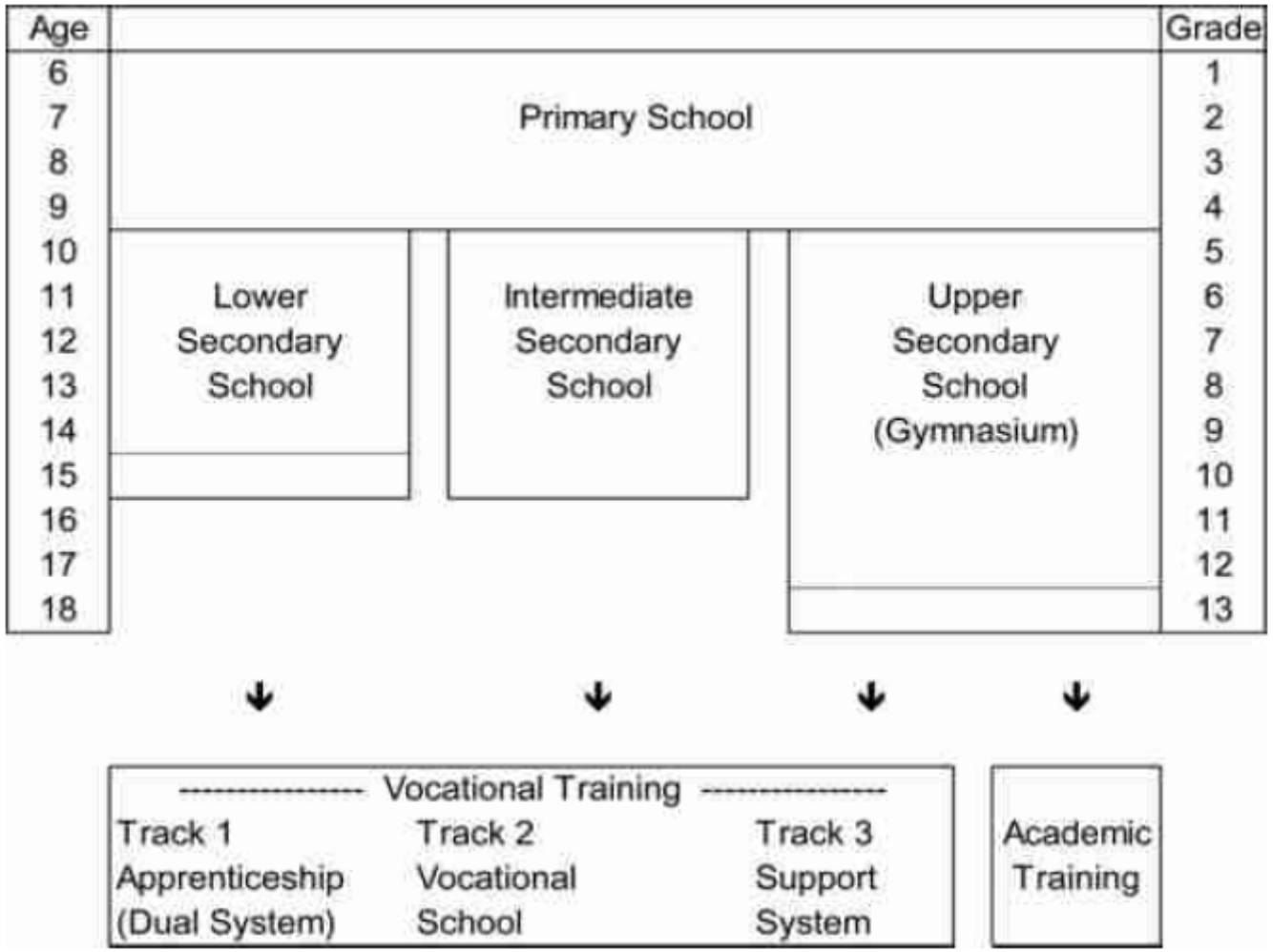
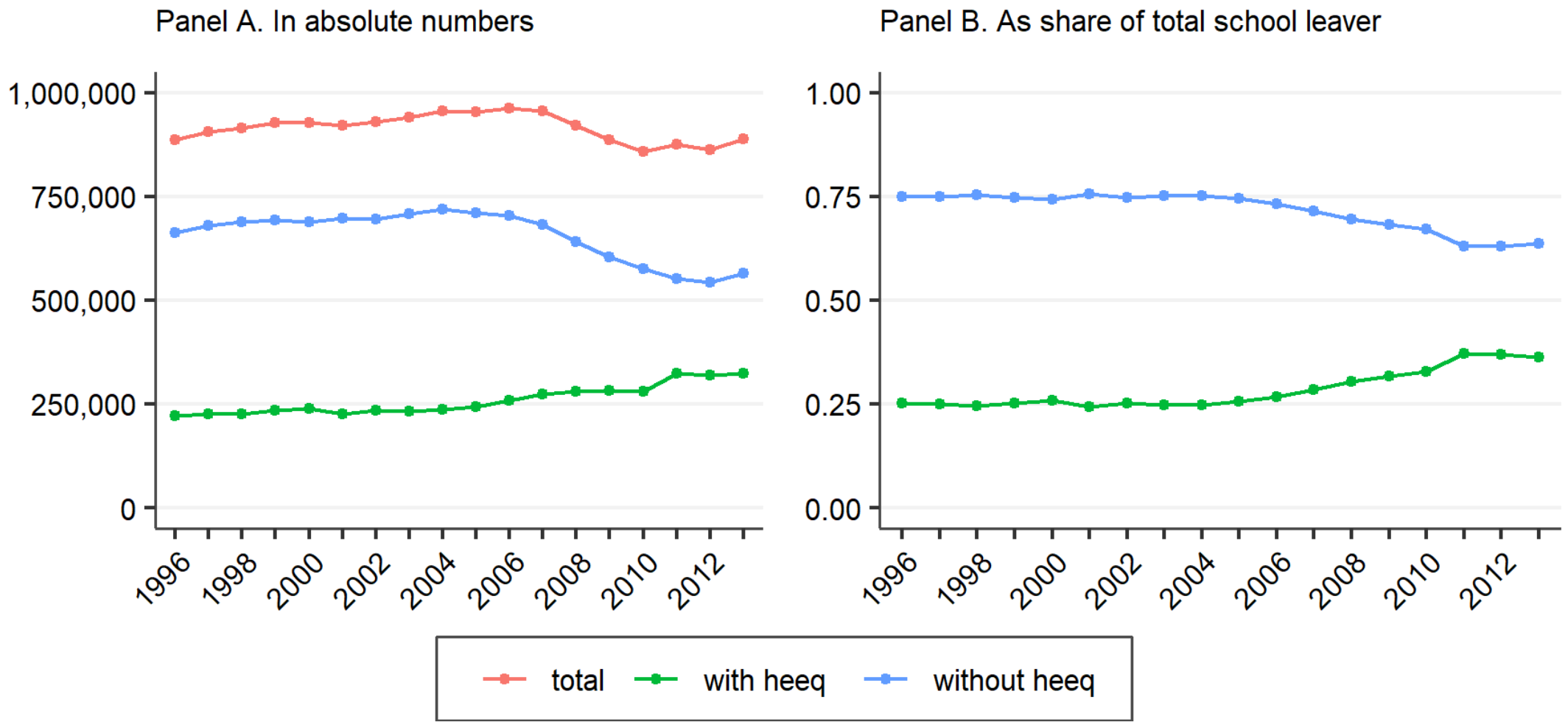
2. Institutional Background

The German Education System



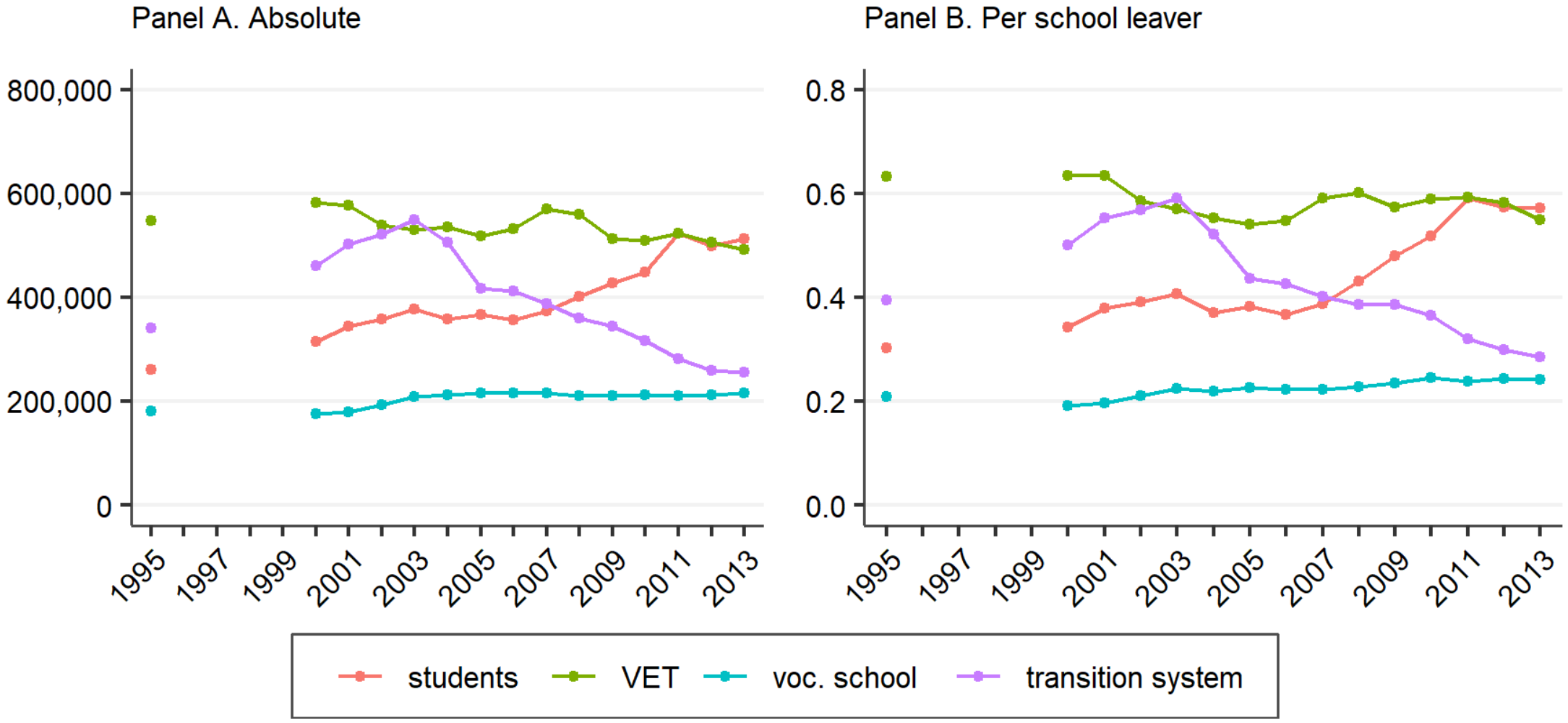
Source: Riphahn and Zibrowius (2016)

School Leavers from Schools of General Education by Type of Degree (1996 to 2013)



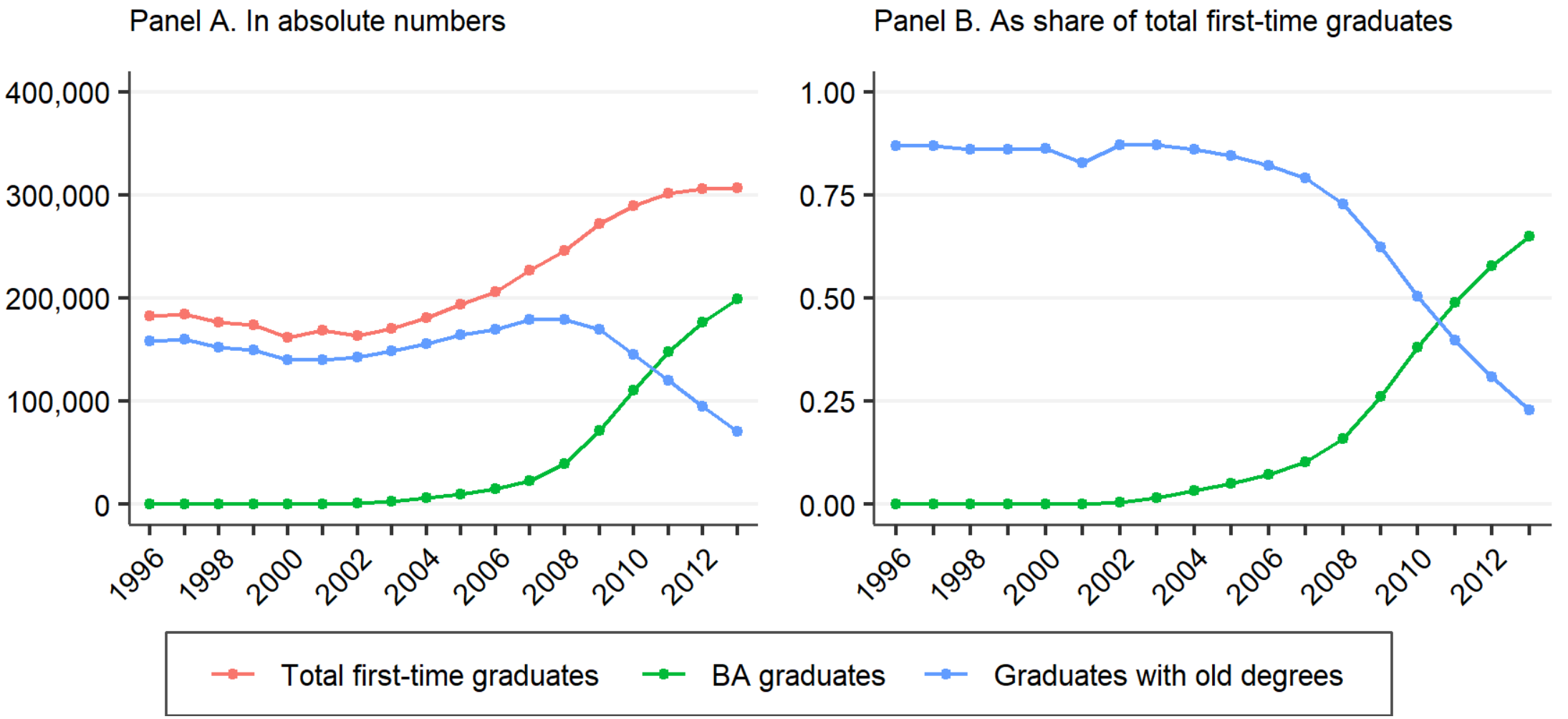
Source: Own illustration based on data from Destatis (2019)

Entrants into the Post-secondary Education System



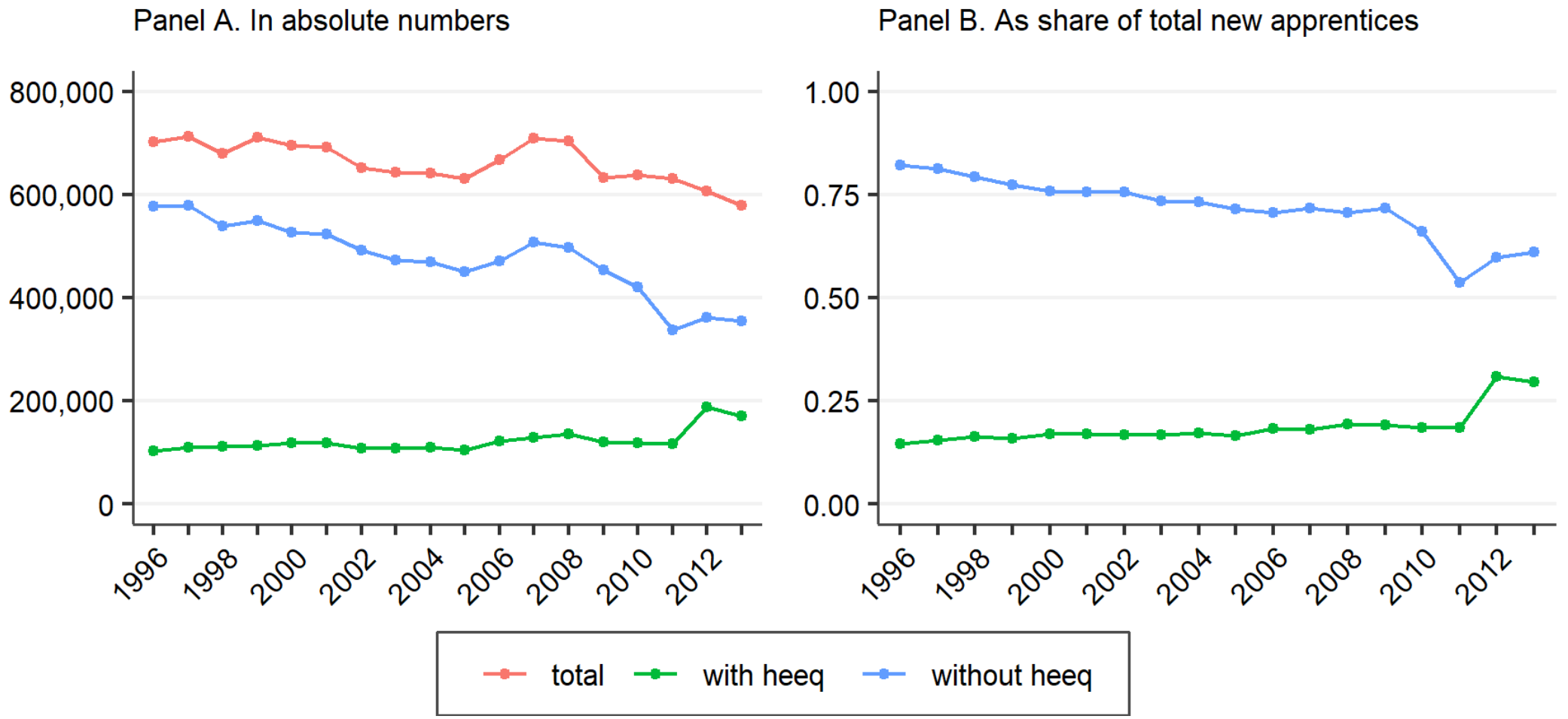
Source: Own illustration based on data from AGER (2016)

First-time Graduates from Universities



Source: Own illustration based on data from Destatis (2019)

New Apprentices by Type of School Degree



Note: Apprentices with missing information on type of school degree not shown. Number of apprentices obtained from SIAB scaled by 50 to meet population relation.
Source: Own illustration based on data derived from the weakly anonymous Sample of Integrated Labour Market Biographies (Years 1975 - 2014). Data access was provided via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) and subsequently remote data Access. DOI:10.5164/IAB.SIAB7517.de.en.v1

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3. Data

Sample of Integrated Labour Market Biographies (SIAB)

- 2%-random sample of all employees subject to social security contributions in Germany
- Represents about 70% of the working population in Germany during our observation period, excluding e. g. civil servants, soldiers, and self-employed
- All apprenticeship contracts are subject to social security contributions and therefore covered in SIAB

→ Used to identify the number of **new apprentices** per year and labour market region

- Identification according to definition of "**newly concluded training contracts**" by Destatis
- New apprentice: first-time entry of person with employment status "**trainees**" in respective year
- Inconsistencies and missing values in variable "**school**" are imputed using approach by Fitzenberger et al. 2006
- Further differentiation by school degree:
  - **Total apprentices**
  - **Apprentices with higher education entrance qualification**
  - **Apprentices without higher education entrance qualification**

Administrative Data

- **Statistics of examinations (Destatis):**
  - Administrative data on all final exams passed at publicly acknowledged universities (including universities of applied sciences), distinguished by type of degree (former degrees, e.g. Diplom, state examinations, and current degrees, Bachelor and Master)
  - Used to capture the regional and temporal variation in the implementation of the Bologna Process
    - Bachelor graduates
    - Graduates with former degrees (*old graduates*)
- **Regional controls:**
  - **Demand controls:**
    Unemployment rate, GDP growth, population density, share of employees in industry, share of employees subject to social security contributions with tertiary education
  - **Additional supply controls**:
    pupils in vocational schools that represent transition system
  - **Migration controls:**
    migration balance of the population aged 18-25, cross-border migration balance
  - **University dummy**

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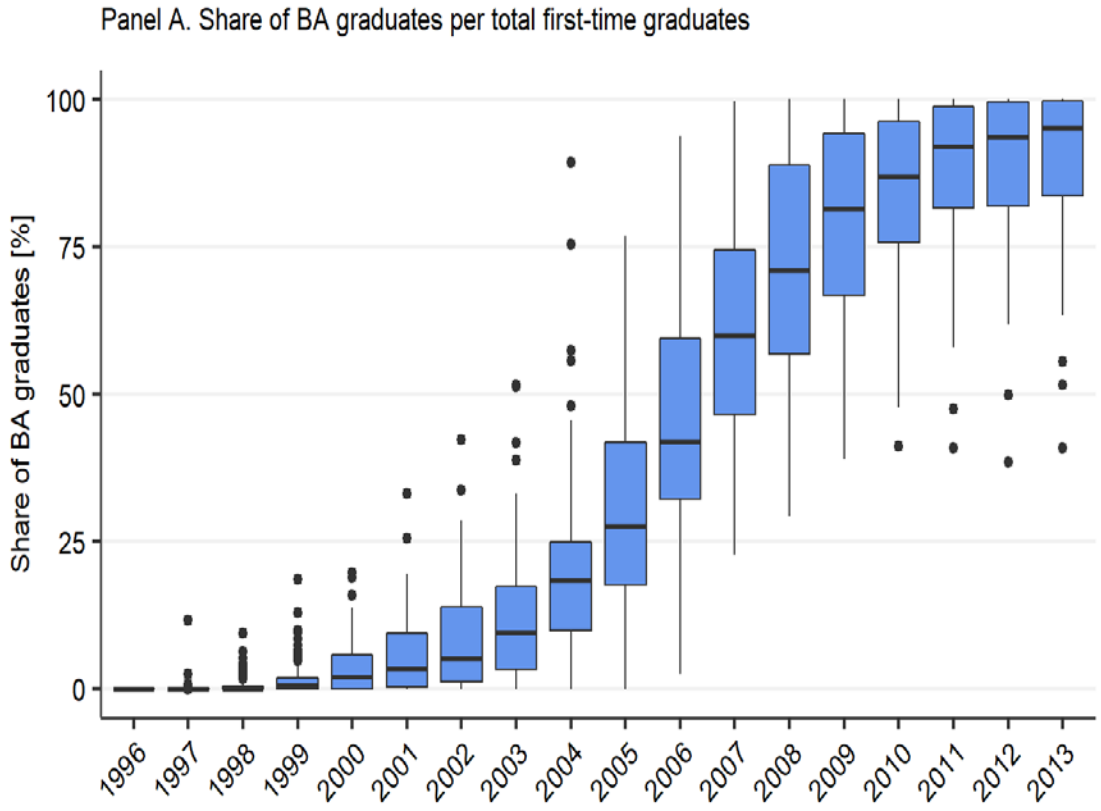
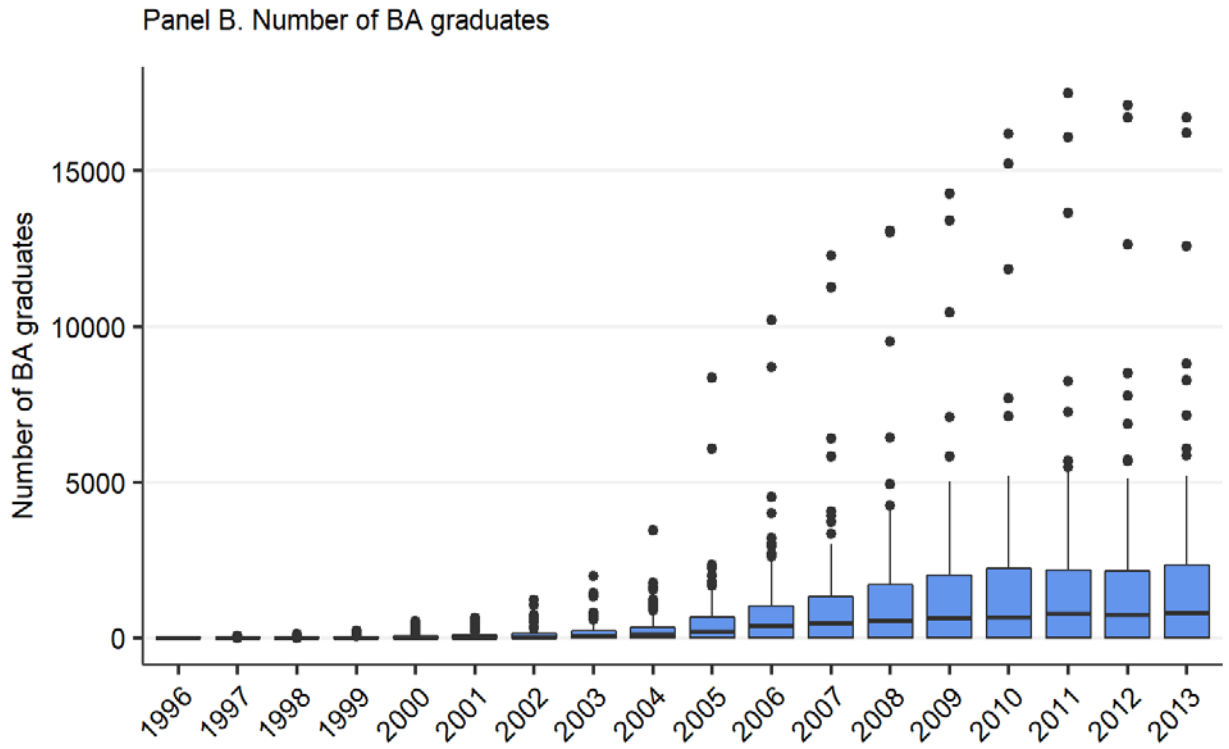
4. Empirical Strategy

Identification Strategy

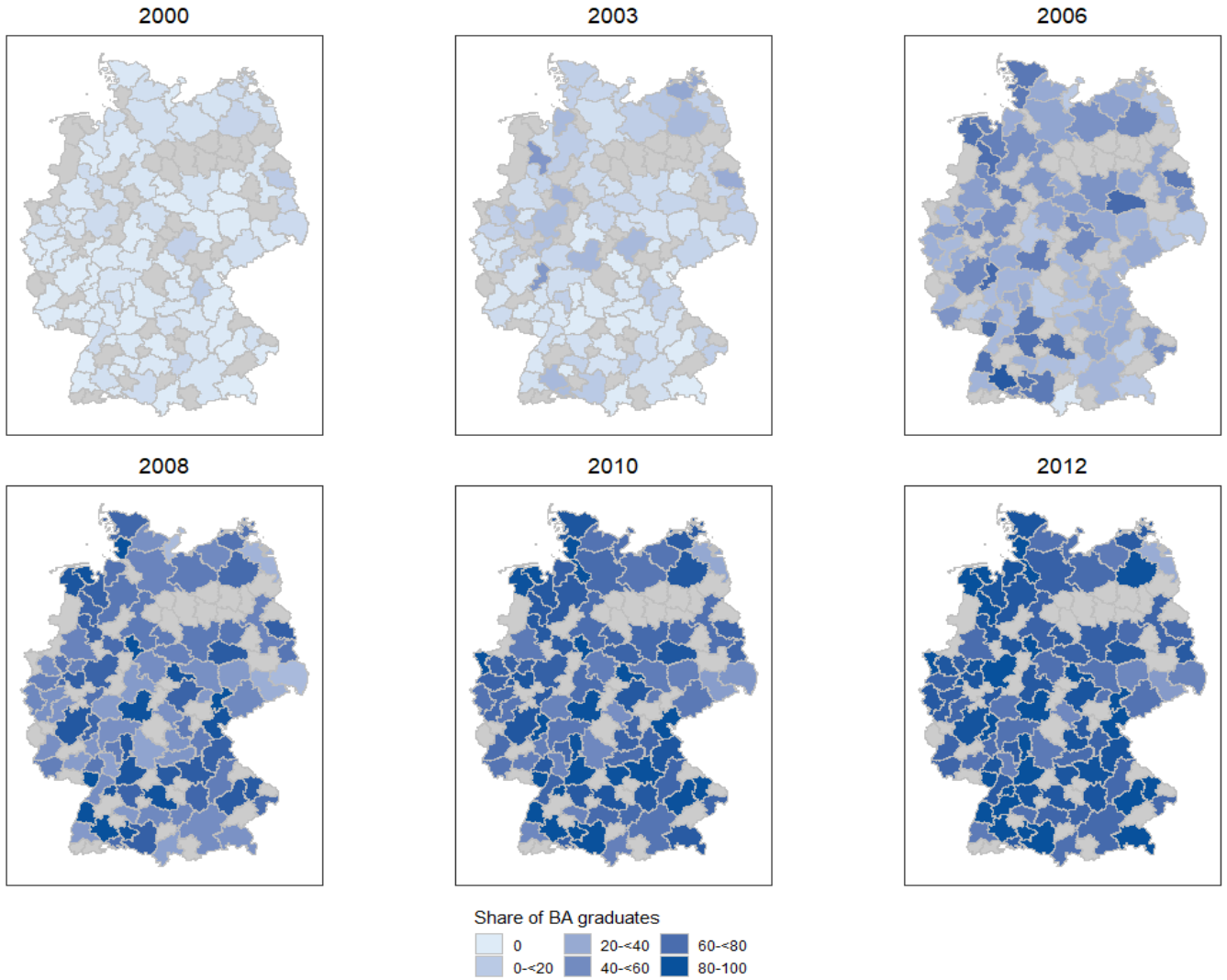
- Exploiting **regional and temporal variation** in the availability of bachelor courses due to
  - Federal state authority in education policy
  - Flexibility of universities to choose timing of transition from the old to the new system





Source: Own illustration based on data from Destatis (2019)

Share of BA Graduates Across Regions and Time



Source: Own illustration based on data from Destatis (2019)

Identification Assumptions

- Constant dropout and subject change rates across regions
- Constant mobility at enrolment across regions
- Implementation of the Bologna Process **as good as random** conditional on time and group-fixed effects
- **Common trend assumption**

Generalized DiD-Approach

(1) $y_{r,t}^{ALL} = \theta treat_{r,t} + school\_leaver_{r,t}^{ALL} + \beta \boldsymbol{X}'_{r,t} + \alpha_r + \delta_t + \varepsilon_{r,t}$

→ Interpretation as ITT

(2) $y_{r,t}^{HEEQ} = \theta treat_{r,t} + school\_leaver_{r,t}^{HEEQ} + \beta \boldsymbol{X}'_{r,t} + \alpha_r + \delta_t + \varepsilon_{r,t}$

→ Interpretation as ATT

(3) $y_{r,t}^{no\ HEEQ} = \theta treat_{r,t} + school\_leaver_{r,t}^{no\ HEEQ} + \beta \boldsymbol{X}'_{r,t} + \alpha_r + \delta_t + \varepsilon_{r,t}$

→ Interpretation as substitution effects

where $y_{r,t}$ = new apprentices, new apprentices with heeq or new apprentices without heeq → Poisson fixed effects estimator

treat = BA graduates (or old graduates),

including region-fixed (α_r) and time-fixed effects (δ_t) as well as a set of covariates ($\boldsymbol{X}'_{r,t}$)

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5. Estimation Results

Estimation Results: Full Sample

Poisson FE: New apprentices						
	ALL		*WITH HEEQ*		*WITHOUT HEEQ*	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 1000 BA graduates						
Time lag 0	0.002	-0.0029	-0.015*	**-0.016***	0.001	0.006
Time lag 1	0.003	-0.0030	-0.014*	**-0.017***	0.002	0.007
Time lag 2	0.003	-0.0025	-0.012*	**-0.016***	0.003	0.007
Time lag 3	0.004	-0.0025	-0.012*	**-0.017***	0.004	0.007
Time lag 4	0.004	-0.0032	-0.012*	**-0.019****	0.004	0.007
Time lag 5	0.004	-0.0016	-0.012*	**-0.020****	0.005	0.008
Regional Controls		x		x		x
Region Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x

Poisson FE: New apprentices						
	ALL		*WITH HEEQ*		*WITHOUT HEEQ*	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: 1000 Old graduates						
Time lag 0	-0.011	-0.0007	0.026***	0.017	-0.008	-0.014
Time lag 1	-0.009	-0.0059	0.029***	0.023	-0.008	-0.013
Time lag 2	-0.006	-0.0060	0.028***	**0.0258***	-0.006	**-0.016***
Time lag 3	-0.004	-0.0041	0.027*	**0.0267***	-0.005	-0.017
Time lag 4	-0.003	-0.0031	0.024*	0.025	-0.004	-0.017
Time lag 5	-0.001	0.0014	0.023	0.027	-0.004	-0.017
Regional Controls		x		x		x
Region Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x

Notes: The tables show Poisson fixed effects regression estimates for different model specifications. Standard errors are cluster-robust, but not shown in this table. *p<0.05; **p<0.01; ***p<0.001. Calculations by the authors.

Effect Heterogeneity: Males

Poisson FE: New male apprentices						
	ALL		*WITH HEEQ*		*WITHOUT HEEQ*	
	(1)	(2).	(3)	(4).	(5)	(6).
Panel A: 1000 male BA graduates						
Time lag 0	0.0097	-0.0031	-0.0321*	**-0.0320****	0.0135	0.0166
Time lag 1	0.0097	-0.0030	-0.0345**	**-0.0383*****	0.0141	0.0175
Time lag 2	0.0104	-0.0025	-0.0275*	**-0.0321****	0.0142	0.0159
Time lag 3	0.0104	-0.0038	-0.0291*	**-0.0353****	0.0145	0.0161
Time lag 4	0.0128	-0.0035	-0.0250	**-0.0353****	0.0165	0.0159
Time lag 5	0.0145	0.0006	-0.0293*	**-0.0402****	0.0207	0.0209
Regional controls		x		x		x
Region Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x

Poisson FE: New male apprentices						
	ALL		*WITH HEEQ*		*WITHOUT HEEQ*	
	(1)	(2).	(3)	(4).	(5)	(6).
Panel B: 1000 male old graduates						
Time lag 0	-0.0435	-0.0100	0.0635***	**0.0466***	-0.0493	-0.0284
Time lag 1	-0.0364	-0.0185	0.0706***	**0.0608****	-0.0458	-0.0409
Time lag 2	-0.0304	-0.0249	0.0657***	**0.0621****	-0.0401	**-0.0485***
Time lag 3	-0.0237	-0.0213	0.0635***	**0.0623****	-0.0356	**-0.0504***
Time lag 4	-0.0196	-0.0210	0.0589**	**0.0587****	-0.0301	-0.0493
Time lag 5	-0.0133	-0.0109	0.0630**	**0.0689***	-0.0268	-0.0441
Regional controls		x		x		x
Region Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x

Notes: The tables show Poisson fixed effects regression estimates for different model specifications. Standard errors are cluster-robust, but not shown in this table. *p<0.05; **p<0.01; ***p<0.001. Calculations by the authors.

Effect Heterogeneity: Females

Poisson FE: New female apprentices						
	ALL		*WITH HEEQ*		*WITHOUT HEEQ*	
	(1)	(2)	(4)	(4)	(5)	(6)
Panel A: 1000 female BA graduates						
Time lag 0	0.0027	-0.0076	-0.0248	-0.0227	-0.0116	0.0069
Time lag 1	0.0013	-0.0056	-0.0210	-0.0245	-0.0077	0.0119
Time lag 2	0.0001	-0.0075	-0.0199	-0.0255	-0.0073	0.0086
Time lag 3	0.0016	-0.0077	-0.0180	-0.0260	-0.0057	0.0070
Time lag 4	0.0032	-0.0078	-0.0155	-0.0288	-0.0036	0.0086
Time lag 5	0.0024	-0.0040	-0.0153	-0.0320	-0.0017	0.0127
Regional controls		x		x		x
Region Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x

Poisson FE: New female apprentices						
	ALL		*WITH HEEQ*		*WITHOUT HEEQ*	
	(1)	(2)	(4)	(4)	(5)	(6)
Panel B: 1000 female old graduates						
Time lag 0	0.0096	0.0118	0.0399*	0.0263	0.0202	0.0222
Time lag 1	0.0069	0.0009	0.0448*	0.0336	0.0186	-0.0006
Time lag 2	0.0135	0.0098	0.0526*	0.0450	0.0227	-0.0018
Time lag 3	0.0116	0.0105	0.0473*	0.0442	0.0211	-0.0070
Time lag 4	0.0112	0.0095	0.0387	0.0373	0.0210	-0.0093
Time lag 5	0.0077	0.0025	0.0331	0.0395	0.0123	-0.0189
Regional controls		x		x		x
Region Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x

Notes: The tables show Poisson fixed effects regression estimates for different model specifications. Standard errors are cluster-robust, but not shown in this table. *p<0.05; **p<0.01; ***p<0.001. Calculations by the authors.

Effect Heterogeneity: Occupations with High Share of Apprentices with HEEQ

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Poisson FE: New apprentices in occupations with above-median share of heeq						
	ALL		*WITH HEEQ*		*WITHOUT HEEQ*	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 1000 BA graduates						
Time lag 0	0.0047	-0.0016	-0.0126	**-0.0174***	0.0024	0.0040
Time lag 1	0.0048	-0.0009	-0.0116	**-0.0179***	0.0038	0.0067
Time lag 2	0.0052	0.0003	-0.0098	**-0.0165***	0.0041	0.0067
Time lag 3	0.0050	-0.0002	-0.0087	**-0.0161***	0.0034	0.0052
Time lag 4	0.0050	-0.0002	-0.0086	**-0.0178***	0.0026	0.0033
Time lag 5	0.0043	0.0009	-0.0089	**-0.0189****	0.0032	0.0067
Regional Controls		x		x		x
Region Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x

Poisson FE: New apprentices in occupations with above-median share of heeq						
	ALL		*WITH HEEQ*		*WITHOUT HEEQ*	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: 1000 old graduates						
Time lag 0	-0.0056	0.0058	0.0188*	0.0142	0.0062	0.0171
Time lag 1	-0.0064	0.0029	0.0234*	0.0232	0.0009	0.0071
Time lag 2	-0.0058	0.0018	0.0220*	0.0240	0.0006	0.0048
Time lag 3	-0.0041	0.0042	0.0230*	**0.0279***	0.0007	0.0032
Time lag 4	-0.0041	0.0028	0.0200*	**0.0250***	0.0003	0.0008
Time lag 5	-0.0023	0.0031	0.0202*	**0.0281***	0.0007	-0.0023
Regional Controls		x		x		x
Region Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x

Notes: The tables show Poisson fixed effects regression estimates for different model specifications. Standard errors are cluster-robust, but not shown in this table. *p<0.05; **p<0.01; ***p<0.001. Calculations by the authors.

Effect Heterogenity: Occupations with Low Share of Apprentices with HEEQ

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Poisson FE: New apprentices in occupations with below-median share of heeq						
	ALL		*WITH HEEQ*		*WITHOUT HEEQ*	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 1000 BA graduates						
Time lag 0	0.0078	0.0020	-0.0042	-0.0054	0.0057	0.0109
Time lag 1	0.0074	0.0009	-0.0056	-0.0088	0.0059	0.0106
Time lag 2	0.0072	0.0003	-0.0041	-0.0073	0.0061	0.0095
Time lag 3	0.0073	-0.0013	-0.0059	-0.0122	0.0067	0.0098
Time lag 4	0.0075	-0.0023	-0.0079	-0.0180	0.0072	0.0096
Time lag 5	0.0071	-0.0014	-0.0098	-0.0218	0.0077	0.0097
Regional Controls		x		x		x
Region Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x

Poisson FE: New apprentices in occupations with below-median share of heeq						
	ALL		*WITH HEEQ*		*WITHOUT HEEQ*	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: 1000 old graduates						
Time lag 0	-0.0256	-0.0114	0.0135	0.0163	-0.0202	-0.0175
Time lag 1	-0.0264	**-0.0198*** **	0.0122	0.0154	-0.0200	**-0.0279***
Time lag 2	-0.0245	**-0.0199***	0.0151	0.0199	-0.0163	**-0.0295****
Time lag 3	-0.0153	-0.0172	0.0123	0.0163	-0.0139	**-0.0301***
Time lag 4	-0.0116	-0.0133	0.0135	0.0185	-0.0109	**-0.0275***
Time lag 5	-0.0094	-0.0079	0.0151	0.0259	-0.0107	0.02252
Regional Controls		x		x		x
Region Fixed Effects	x	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x	x

Notes: The tables show Poisson fixed effects regression estimates for different model specifications. Standard errors are cluster-robust, but not shown in this table. *p<0.05; **p<0.01; ***p<0.001. Calculations by the authors.

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6. Preliminary Conclusions

Conclusion

- **Key findings**
  - Support for presumption that Bologna Process had negative impact on apprentice supply of school leavers with higher education entrance qualification → **acceleration effect**
  - Effect heterogeneity:
    - Negative effects reported only for males
    - Particularly in occupations with a high share of apprentices with higher education entrance qualification
    - No evidence for peer externalities for lower qualified

- **Further robustness checks**
  - Observation period splits
  - Alternative model specifications: ratio-model (apprentices per school leaver)
  - Additional reform effects interaction: e.g. G8, abolishment of conscription

Thank you for your attention!
Questions and comments?

References

- **Authoring Group Educational Reporting [AGER].** 2018. "Bildung in Deutschland 2018. Ein indikatorengestützter Bericht mit einer Analyse zu Wirkungen und Erträgen von Bildung."
- **Fitzenberger, Bernd, Aderonke Osikominu, and Robert Voelter.** 2006. "Imputation Rules to Improve the Education Variable in the Iab Employment Subsample." *Schmollers Jahrbuch*, 126(3): 405–36.
- **Golsteyn, Bart H. H., and Anders Stenberg.** 2017. "Earnings over the Life Course: General versus Vocational Education." *Journal of Human Capital*, 11(2): 167–212.
- **Hanushek, Eric A., Guido Schwerdt, Ludger Woessmann, and Lei Zhang.** 2017. "General Education, Vocational Education, and Labor-Market Outcomes over the Lifecycle." *Journal of Human Resources*, 52(1): 48–87.
- **Havnes, Tarjei, and Magne Mogstad.** 2011. "No Child Left Behind: Subsidized Child Care and Children's Long-Run Outcomes." *American Economic Journal: Economic Policy*, 3(2): 97–129.
- **Lerman, Robert.** 2014. "Do firms benefit from apprenticeship investments?" *IZA World of Labor*, 55.
- **Mohrenweiser, Jens, and Uschi Backes-Gellner.** 2010. "Apprenticeship training: for investment or substitution?" *International Journal of Manpower*, 31(5): 545–62.
- **Riphahn, Regina T., and Michael Zibrowius.** 2016. "Apprenticeship, vocational training, and early labor market outcomes – evidence from East and West Germany." *Education Economics*, 24(1): 33–57.
- **Ryan, Paul.** 2001. "The School-to-Work Transition: A Cross-National Perspective." *Journal of Economic Literature*, 39(1): 34–92.
- **Verhaest, Dieter, Jeroen Lavrijsen, Eddy Omey, Walter van Trier, and Ides Nicaise.** 2018. "General education, vocational education and skill mismatches: short-run versus long-run effects." *Oxford Economic Papers*, 70(4): 974–93.
- **Wolter, Stefan C., and Paul Ryan.** 2011. "Apprenticeship." In *Handbook of the Economics of Education*. Vol. 3, *Handbook of the economics of education*, ed. Eric A. Hanushek, Finis Welch, Stephen Machin, and Ludger Woessmann, 521–76: Elsevier.
- **Zimmermann, Klaus F., Costanza Biavaschi, Werner Eichhorst, Corrado Giulietti, Michael J. Kendzia, Alexander Muravyev, Janneke Pieters, Núria Rodríguez-Planas, and Ricarda Schmidl.** 2013. "Youth unemployment and vocational training." *Foundations and Trends® in Microeconomics*, 9(1–2): 1–157.