

Online Appendix

Free Movement of Workers and Native Demand for Tertiary Education

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1 Tables

Table A1: Exposure to Cross-Border Commuters by Educational Level (Robustness Checks to Treatment Definition)

	Outcome: share of cross-border commuters			
	All	Up to lower-secondary	Upper-secondary	Tertiary
	(1)	(2)	(3)	(4)
<hr/> Panel A: 25 min threshold value <hr/>				
25min * 2002-2006	0.014* (0.007)	-0.003 (0.009)	0.021** (0.010)	0.013 (0.009)
25min * 2008-2016	0.037*** (0.014)	0.017 (0.011)	0.049*** (0.018)	0.041*** (0.013)
Mean outcome	0.072	0.070	0.069	0.069
Sd outcome	0.109	0.129	0.103	0.098
Commuting zones within 25 min	106 28	106 28	106 28	106 28
N	1166	1166	1166	1160
<hr/> Panel B: 35 min threshold value <hr/>				
35min * 2002-2006	0.012** (0.005)	-0.001 (0.007)	0.019** (0.007)	0.006 (0.006)
35min * 2008-2016	0.029*** (0.010)	0.012 (0.008)	0.040*** (0.014)	0.029*** (0.010)
Mean outcome	0.072	0.070	0.069	0.069
Sd outcome	0.109	0.129	0.103	0.098
Commuting zones within 35 min	106 41	106 41	106 41	106 41
N	1166	1166	1166	1160
<hr/> Panel C: Continuous treatment <hr/>				
Travel time * 2002-2006	0.016* (0.009)	-0.003 (0.011)	0.026** (0.012)	0.012 (0.010)
Travel time * 2008-2016	0.044*** (0.017)	0.020 (0.014)	0.060*** (0.021)	0.048*** (0.015)
Mean outcome	0.072	0.070	0.069	0.069
Sd outcome	0.109	0.129	0.103	0.098
Commuting zones	106	106	106	106
N	1166	1166	1166	1160

Source: SESS.

Note: The table shows difference-in-differences estimates using biennial data at the commuting zone level for the period 1996–2016. The continuous function equals $\exp(-0.05 \times \text{travel time})$. The dependent variable is the share of cross-border commuters in total employment by educational level. Observations are weighed by the number of total employees in 1996. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A2: Native Enrollment Rate by Institutional Type (Robustness Checks to Treatment Definition)

	Outcome: share of native first-year students in birth cohort		
	All	University	University of applied sciences
	(1)	(2)	(3)
Panel A: 25 min threshold value			
25min * 2002-2006	0.003 (0.007)	-0.004 (0.005)	0.007 (0.005)
25min * 2007-2017	0.011 (0.007)	-0.003 (0.006)	0.015*** (0.004)
Mean outcome	0.326	0.183	0.143
Sd outcome	0.089	0.071	0.050
Commuting zones	106	106	106
within 25 min	28	28	28
N	2226	2226	2226
Panel B: 35 min threshold value			
35min * 2002-2006	0.008 (0.007)	0.000 (0.004)	0.008* (0.004)
35min * 2007-2017	0.020*** (0.007)	0.004 (0.005)	0.015*** (0.005)
Mean outcome	0.326	0.183	0.143
Sd outcome	0.089	0.071	0.050
Commuting zones	106	106	106
within 35 min	41	41	41
N	2226	2226	2226
Panel C: Continuous treatment			
Travel time * 2002-2006	0.005 (0.008)	-0.004 (0.006)	0.009* (0.005)
Travel time * 2007-2017	0.014* (0.009)	-0.002 (0.007)	0.016*** (0.004)
Mean outcome	0.326	0.183	0.143
Sd outcome	0.089	0.071	0.050
Commuting zones	106	106	106
N	2226	2226	2226

Source: SHIS-studex.

Note: The table shows difference-in-differences estimates using annual data at the commuting zone level for the period 1997–2017. The continuous function equals $\exp(-0.05 \times \text{travel time})$. The dependent variable is the share of native first-year students in the birth cohort by institutional type. Observations are weighed by the cohort size in 1997. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A3: Native Enrollment Rate at Universities of Applied Sciences (Robustness Checks)

	Outcome: share of native first-year students in birth cohort					
	Baseline (1)	+ Education supply (2)	+ Labor demand (3)	No controls (4)	No weights (5)	+ Immigrant peers (6)
30min * 2002-2006	0.003 (0.004)	0.002 (0.004)	0.003 (0.004)	0.008** (0.004)	0.007 (0.005)	0.004 (0.004)
30min * 2007-2017	0.011** (0.004)	0.010** (0.004)	0.011** (0.004)	0.013** (0.005)	0.011** (0.005)	0.012*** (0.004)
UAS within 20km		0.008** (0.003)				
Number of UAS fields within 20km		0.001 (0.001)				
Bartik control			-0.039 (0.037)			
L imm sh UNI enrolled						0.018 (0.019)
L imm sh UAS enrolled						0.061*** (0.020)
Mean outcome	0.143	0.143	0.143	0.143	0.140	0.143
Sd outcome	0.050	0.050	0.050	0.050	0.054	0.050
Commuting zones	106	106	106	106	106	106
within 30 min	35	35	35	35	35	35
N	2226	2226	2226	2226	2226	2120

Source: SHIS-studex.

Note: The table shows difference-in-differences estimates using annual data at the commuting zone level for the period 1997–2017. The dependent variable is the share of native first-year students in the birth cohort. Column 1 is the baseline specification from Table 6. Column 2 includes a dummy variable for a university of applied sciences within a 20 kilometer radius of the main city of the commuting zone and the number of study fields at the one-digit ISCED level available at universities of applied sciences within a 20 kilometer radius of the main city of the commuting zone. Column 3 includes a Bartik-type control variable for employment growth. Column 4 includes only year and commuting zone fixed effects as controls. Column 5 is unweighed. Column 6 includes the lagged enrollment rate of immigrant first-year students at universities and universities of applied sciences as controls. Observations are weighed by the cohort size in 1997. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A4: Native Enrollment Rate at Universities of Applied Sciences (Robustness Checks to Outcome Definition)

	Native enrollment rate (baseline)	ln nr natives enrolled	Native + immigrant enrollment rate	Graduation rate
	(1)	(2)	(3)	(4)
30min * 2002-2006	0.003 (0.004)	0.048 (0.032)	0.001 (0.004)	0.005 (0.009)
30min * 2007-2017	0.011** (0.004)	0.101*** (0.035)	0.008* (0.004)	
30min * 2007-2013				-0.001 (0.007)
Mean outcome	0.143	4.772	0.122	0.816
Sd outcome	0.050	0.907	0.044	0.073
Commuting zones	106	106	106	106
within 30 min	35	35	35	35
N	2226	2224	2226	1800

Source: SHIS-studex.

Note: The table shows difference-in-differences estimates using annual data at the commuting zone level for the period 1997–2017. The dependent variable is the share of native first-year students in the birth cohort in Column 1. In Column 2 it is the natural log of the number of native first-year students. In Column 3 it is the share of native and immigrant first-year students in the birth cohort. In Column 4 it is the number of first-year students who enrolled in year t and graduated until 2017 divided by the number of first-year students in year t , while t goes from 1997 to 2013. Observations are weighed by the cohort size in 1997. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A5: Native Enrollment Rate at Universities of Applied Sciences by Individual and Commuting Zone Characteristics

	Outcome: share of native first-year students in birth cohort							
	Young	Old	Male	Female	Urban	Rural	German	Non-German
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
30min * 2002-2006	0.007** (0.003)	-0.005** (0.002)	0.001 (0.004)	0.004 (0.007)	0.002 (0.006)	0.005 (0.007)	-0.004 (0.004)	0.002 (0.005)
30min * 2007-2017	0.011*** (0.003)	0.000 (0.002)	0.013** (0.006)	0.009 (0.008)	0.014** (0.005)	0.008 (0.006)	0.007 (0.006)	0.009 (0.005)
Mean outcome	0.072	0.072	0.151	0.136	0.144	0.141	0.143	0.143
Sd outcome	0.033	0.027	0.039	0.071	0.049	0.053	0.050	0.052
Commuting zones	106	106	106	106	48	58	75	31
within 30 min	35	35	35	35	19	16	20	15
N	2226	2226	2226	2226	1008	1218	1575	651

Source: SHIS-studex.

Note: The table shows difference-in-differences estimates using annual data at the commuting zone level for the period 1997–2017. The dependent variable is the share of native first-year students in the birth cohort by individual characteristics. In Column 1 the sample includes first-year students at and below the median age of 21 and in Column 2 above the median age. Column 3 includes male and Column 4 female first-year students. Column 5 includes individuals from urban and Column 6 from intermediate and rural commuting zones. German is the main language spoken in the commuting zones included in Column 7 and French, Italian or Romansh in Column 8. Observations are weighed by the cohort size in 1997. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A6: Native Enrollment Rate by Detailed Field of Study at Universities of Applied Sciences

Outcome: share of native first-year students in birth cohort						
	Agriculture (1)	Architecture (2)	Arts (3)	Biology (4)	Business (5)	Education (6)
30min * 2002-2006	0.000 (0.000)	0.001* (0.001)	0.001** (0.001)	-0.000 (0.000)	0.000 (0.001)	-0.000 (0.002)
30min * 2007-2017	0.000** (0.000)	0.001 (0.001)	0.002*** (0.001)	0.001 (0.000)	0.004* (0.002)	-0.001 (0.002)
Mean outcome	0.001	0.008	0.010	0.002	0.033	0.027
Sd outcome	0.002	0.005	0.006	0.003	0.015	0.019
Commuting zones	106	106	106	106	106	106
within 30 min	35	35	35	35	35	35
N	2226	2226	2226	2226	2226	2226
	Engineering (7)	Environment (8)	Forestry (9)	Health (10)	Information (11)	Journalism (12)
30min * 2002-2006	-0.001 (0.001)	-0.000 (0.000)	-0.000 (0.000)	0.002 (0.001)	0.000 (0.001)	0.000 (0.000)
30min * 2007-2017	-0.000 (0.001)	-0.000 (0.000)	-0.000 (0.000)	0.002 (0.002)	0.000 (0.001)	0.000 (0.000)
Mean outcome	0.021	0.001	0.000	0.010	0.007	0.003
Sd outcome	0.009	0.002	0.001	0.012	0.005	0.003
Commuting zones	106	106	106	106	106	106
within 30 min	35	35	35	35	35	35
N	2226	2226	2226	2226	2226	2226
	Languages (13)	Law (14)	Manufacturing (15)	Personal services (16)	Physics (17)	Welfare (18)
30min * 2002-2006	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.001* (0.000)	-0.000 (0.000)	0.001 (0.001)
30min * 2007-2017	-0.000 (0.000)	0.001 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.004*** (0.001)
Mean outcome	0.001	0.002	0.000	0.004	0.001	0.012
Sd outcome	0.001	0.003	0.001	0.004	0.001	0.009
Commuting zones	106	106	106	106	106	106
within 30 min	35	35	35	35	35	35
N	2226	2226	2226	2226	2226	2226

Source: SHIS-studex.

Note: The table shows difference-in-differences estimates using annual data at the commuting zone level for the period 1997–2017. Each column shows estimates from a separate regression with the share of enrolled native first-year students in the birth cohort by detailed study field as the dependent variable. Two-digit ISCED-F 2013 classification is used to define the study fields. Observations are weighed by the cohort size in 1997. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A7: Native Enrollment Rate by Type of Study Field at Universities of Applied Sciences (Robustness Checks to Treatment Definition)

Outcome: share of native first-year students in birth cohort				
	STEM (1)	Non-STEM (2)	Affected (3)	Non-affected (4)
Panel A: 25 min threshold value				
25min * 2002-2006	0.003 (0.003)	0.004 (0.003)	0.002 (0.002)	0.004 (0.004)
25min * 2007-2017	0.007** (0.003)	0.008*** (0.002)	0.006*** (0.002)	0.009*** (0.003)
Mean outcome	0.053	0.091	0.052	0.091
Sd outcome	0.020	0.039	0.014	0.043
Commuting zones	106	106	106	106
within 25 min	28	28	28	28
N	2226	2226	2226	2226
Panel B: 35 min threshold value				
35min * 2002-2006	0.003 (0.003)	0.004 (0.003)	0.002 (0.002)	0.005 (0.004)
35min * 2007-2017	0.005* (0.003)	0.010*** (0.003)	0.004** (0.002)	0.011*** (0.004)
Mean outcome	0.053	0.091	0.052	0.091
Sd outcome	0.020	0.039	0.014	0.043
Commuting zones	106	106	106	106
within 35 min	41	41	41	41
N	2226	2226	2226	2226
Panel C: Continuous treatment				
Travel time * 2002-2006	0.004 (0.003)	0.005 (0.003)	0.003 (0.002)	0.006 (0.005)
Travel time * 2007-2017	0.007** (0.003)	0.010*** (0.002)	0.006** (0.002)	0.010*** (0.003)
Mean outcome	0.053	0.091	0.052	0.091
Sd outcome	0.020	0.039	0.014	0.043
Commuting zones	106	106	106	106
N	2226	2226	2226	2226

Source: SHIS-studex.

Note: The table shows difference-in-differences estimates using annual data at the commuting zone level for the period 1997–2017. The continuous function equals $\exp(-0.05 \times \text{travel time})$. The dependent variable is the share of native first-year students in the birth cohort by study field. Observations are weighed by the cohort size in 1997. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A8: Native Enrollment Rate in Non-STEM Fields at Universities of Applied Sciences (Robustness Checks)

	Outcome: share of native first-year students in birth cohort					
	Baseline	+ Education supply	+ Labor demand	No controls	No weights	+ Immigrant peers
	(1)	(2)	(3)	(4)	(5)	(6)
30min * 2002-2006	0.001 (0.003)	0.001 (0.003)	0.002 (0.003)	0.005* (0.003)	0.006** (0.003)	0.002 (0.003)
30min * 2007-2017	0.008*** (0.003)	0.008*** (0.003)	0.008*** (0.003)	0.008** (0.004)	0.008*** (0.003)	0.008*** (0.003)
UAS within 20km		0.001 (0.003)				
Number of UAS fields within 20km		0.001 (0.001)				
Bartik control			-0.012 (0.026)			
L imm sh UAS STEM enrolled						0.024 (0.025)
L imm sh UAS non-STEM enrolled						0.066*** (0.020)
Mean outcome	0.091	0.091	0.091	0.091	0.085	0.091
Sd outcome	0.039	0.039	0.039	0.039	0.041	0.039
Commuting zones	106	106	106	106	106	106
within 30 min	35	35	35	35	35	35
N	2226	2226	2226	2226	2226	2120

Source: SHIS-studex.

Note: The table shows difference-in-differences estimates using annual data at the commuting zone level for the period 1997–2017. The dependent variable is the share of native first-year students in the birth cohort in non-STEM fields. Column 1 is the baseline specification from Table 7. Column 2 includes a dummy variable for a university of applied sciences within a 20 kilometer radius of the main city of the commuting zone and the number of study fields at the one-digit ISCED level available at universities of applied sciences within a 20 kilometer radius of the main city of the commuting zone. Column 3 includes a Bartik-type control variable for employment growth. Column 4 includes only year fixed effects and commuting zone fixed effects as controls. Column 5 is unweighed. Column 6 includes the lagged enrollment rate of immigrant first-year students in STEM and non-STEM study fields at universities of applied sciences as controls. Observations are weighed by the cohort size in 1997. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A9: Native Labor Market Outcomes by Educational Level (Full Sample)

	All (1)	Up to lower-secondary (2)	Upper-secondary (3)	Tertiary (4)
<hr/> Panel A: ln gross hourly wage rate of natives <hr/>				
30min * 2002-2006	-0.005 (0.005)	-0.013 (0.011)	-0.006 (0.006)	0.019* (0.011)
30min * 2008-2010	-0.003 (0.006)	-0.005 (0.015)	-0.009 (0.007)	0.034*** (0.012)
30min * 2012-2016	-0.006 (0.005)	-0.015 (0.018)	-0.007 (0.004)	0.027** (0.013)
Mean outcome	0.002	-0.004	0.005	0.000
Sd outcome	0.072	0.073	0.076	0.079
Commuting zones	106	106	106	106
within 30 min	35	35	35	35
N	1166	1166	1166	1159
<hr/> Panel B: Share of natives in a managerial position <hr/>				
30min * 2002-2006	0.008** (0.003)	-0.002 (0.003)	0.006 (0.004)	0.033** (0.014)
30min * 2008-2010	0.006 (0.004)	0.002 (0.003)	0.002 (0.005)	0.035** (0.016)
30min * 2012-2016	0.007 (0.005)	-0.002 (0.004)	0.005 (0.006)	0.033 (0.022)
Mean outcome	-0.000	-0.001	-0.000	-0.002
Sd outcome	0.023	0.022	0.025	0.081
Commuting zones	106	106	106	106
within 30 min	35	35	35	35
N	1166	1166	1166	1159
<hr/> Panel C: ln number of natives employed <hr/>				
30min * 2002-2006	-0.006 (0.035)	0.006 (0.062)	-0.026 (0.041)	0.070 (0.053)
30min * 2008-2010	-0.001 (0.049)	0.011 (0.083)	-0.013 (0.056)	0.018 (0.071)
30min * 2012-2016	-0.053 (0.070)	-0.029 (0.051)	-0.031 (0.088)	-0.070 (0.110)
Mean outcome	10.263	7.967	9.795	8.588
Sd outcome	1.109	0.937	1.058	1.461
Commuting zones	106	106	106	106
within 30 min	35	35	35	35
N	1166	1166	1166	1159

Source: SESS.

Note: The table shows difference-in-differences estimates using biennial data at the commuting zone level for the period 1996–2016. The dependent variable in Panel A is the mean natural log of gross hourly wage of natives (residualized) in an education category, in Panel B the share of natives holding at least a middle management position (residualized) in an education category and in Panel C the natural log of number of natives employed in an education category. Observations are weighed by the number of native employees in a specific education category in 1996. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A10: Native Labor Market Outcomes by Education and Occupation (Full Sample)

	Upper-secondary		Tertiary	
	STEM (1)	Non-STEM (2)	STEM (3)	Non-STEM (4)
Panel A: ln gross hourly wage rate of natives				
30min * 2002-2006	0.005 (0.005)	-0.008 (0.006)	0.016 (0.015)	0.024 (0.017)
30min * 2008-2010	0.007 (0.006)	-0.010 (0.007)	0.016 (0.020)	0.051*** (0.019)
Mean outcome	0.002	0.004	0.003	-0.001
Sd outcome	0.062	0.090	0.076	0.087
Commuting zones	106	106	104	103
within 30 min	35	35	35	35
N	848	848	814	816
Panel B: Share of natives in a managerial position				
30min * 2002-2006	0.007 (0.006)	-0.001 (0.006)	0.007 (0.023)	0.036* (0.019)
30min * 2008-2010	0.003 (0.007)	-0.006 (0.007)	0.006 (0.025)	0.033 (0.025)
Mean outcome	-0.000	0.000	-0.005	0.001
Sd outcome	0.028	0.033	0.116	0.095
Commuting zones	106	106	104	104
within 30 min	35	35	35	35
N	848	848	814	822
Panel C: ln number of natives employed				
30min * 2002-2006	-0.056 (0.050)	0.018 (0.045)	0.032 (0.084)	0.060 (0.064)
30min * 2008-2010	-0.085 (0.053)	0.057 (0.068)	-0.080 (0.100)	0.055 (0.082)
Mean outcome	8.667	9.325	7.311	8.031
Sd outcome	0.916	1.193	1.357	1.518
Commuting zones	106	106	104	104
within 30 min	35	35	35	35
N	848	848	814	822

Source: SESS.

Note: The table shows difference-in-differences estimates using biennial data at the commuting zone level for the period 1996–2010. The dependent variable in Panel A is the mean natural log of gross hourly wage (residualized) of natives in an education-occupation category, in Panel B the share of natives holding at least a middle management position (residualized) in an education-occupation category and in Panel C the natural log of number of natives employed in an education-occupation category. Observations are weighed by the number of upper-secondary educated native employees in 1996 in Columns 1–2 and tertiary educated native employees in 1996 in Columns 3–4. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A11: Immigrant Enrollment Rate by Institutional Type

	Outcome: share of immigrant first-year students in birth cohort		
	All	University	University of applied sciences
	(1)	(2)	(3)
30min * 2002-2006	-0.009** (0.004)	-0.008*** (0.003)	-0.001 (0.002)
30min * 2007-2017	-0.001 (0.004)	-0.003 (0.003)	0.002 (0.003)
Mean outcome	0.101	0.061	0.041
Sd outcome	0.048	0.034	0.025
Commuting zones	106	106	106
within 30 min	35	35	35
N	2226	2226	2226

Source: SHIS-studex.

Note: The table shows difference-in-differences estimates using annual data at the commuting zone level for the period 1997–2017. The dependent variable is the share of immigrant first-year students in the birth cohort by institutional type. Observations are weighed by the cohort size in 1997. Standard errors in parentheses are clustered at the commuting zone level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

2 Figures

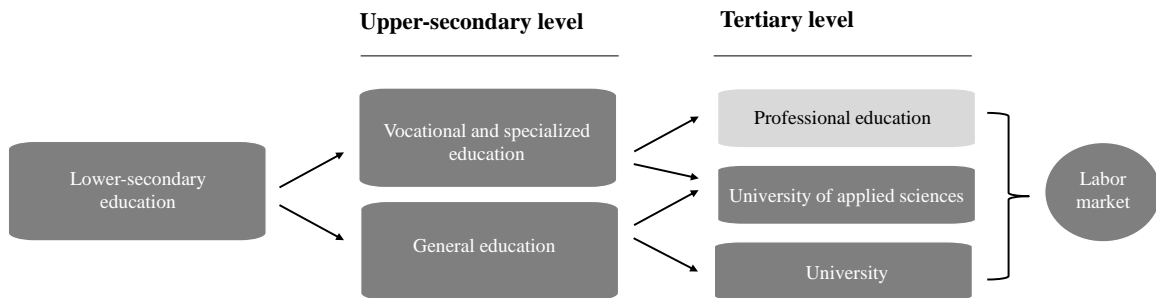


Figure A1: Swiss Education System

Note: The figure shows the Swiss education system with lower-secondary, upper-secondary and tertiary levels. Arrows show the most common choices given previous educational background.

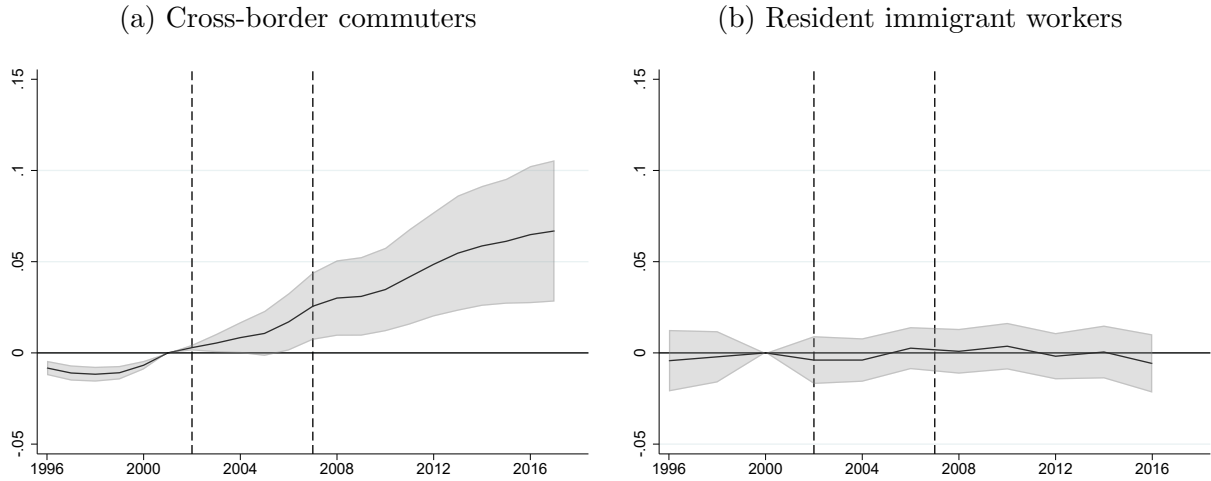


Figure A2: Exposure to Cross-Border Commuters and Resident Immigrant Workers

Sources: FSO, SESS.

Note: The figure shows difference-in-differences estimates using annual data at the commuting zone level for the period 1996–2017 in Subfigure (a) and biennial data at the commuting zone level for the period 1996–2016 in Subfigure (b). The reference year in Subfigure (a) is 2001 and in Subfigure (b) 2000. The vertical lines indicate the beginning of the transition period (2002) and the beginning of the post-reform period (2007). The dependent variable is the number of cross-border commuters divided by total employment in 1995 in Subfigure (a) and the number of resident migrant workers divided by total employment in Subfigure (b). Observations are weighed by total employment in 1995 in Subfigure (a) and total employment in 1996 in Subfigure (b). Standard errors are clustered at the commuting zone level; 95% confidence intervals are shown.

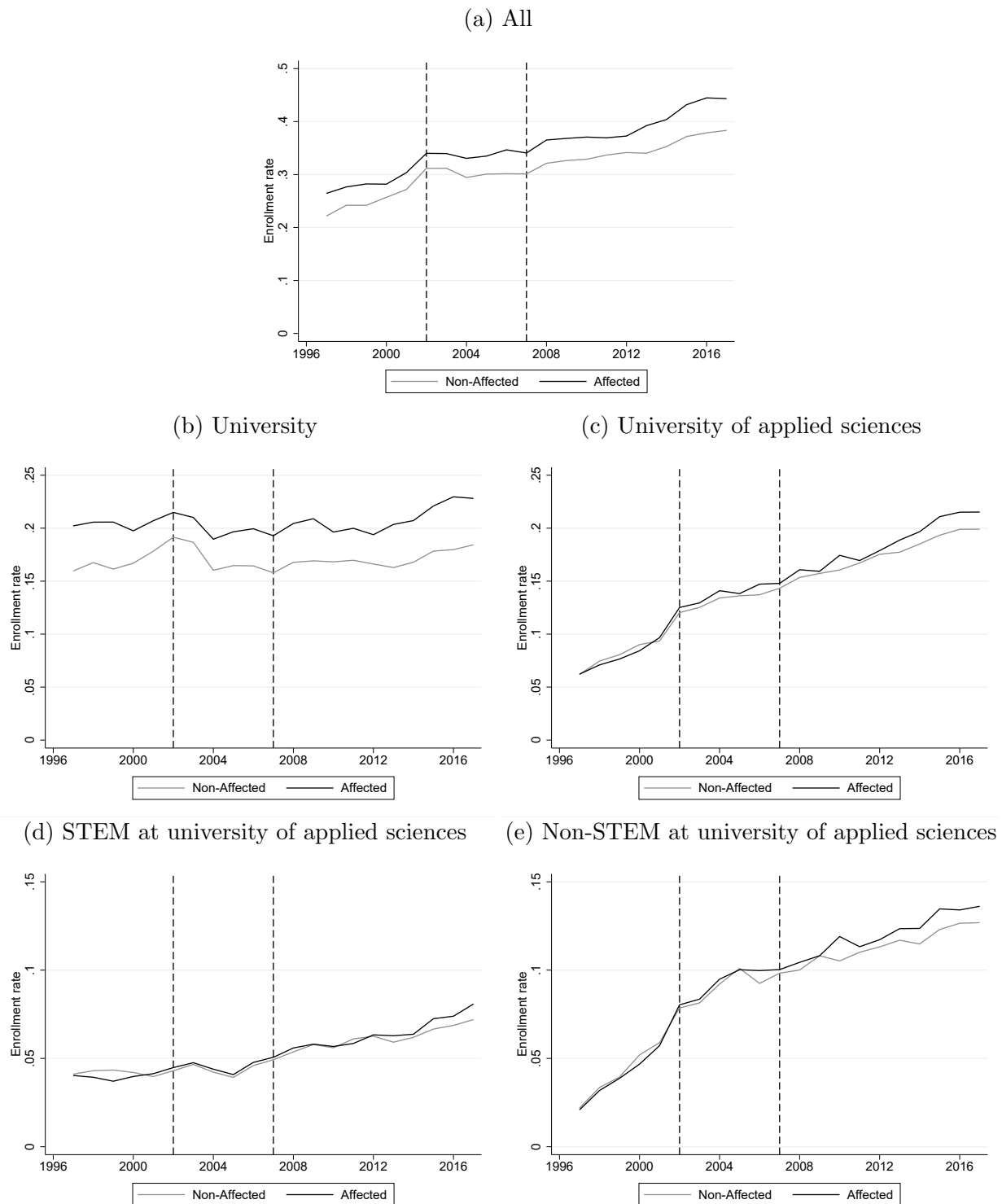


Figure A3: Raw Trends in Native Enrollment Rate by Institutional Type and Study Field
Source: SHIS-studex.

Note: The figure shows raw native first-year enrollment rates in affected and non-affected areas by institutional type and study field for the period 1997–2017. The vertical lines indicate the beginning of the transition period (2002) and of the post-reform period (2007).

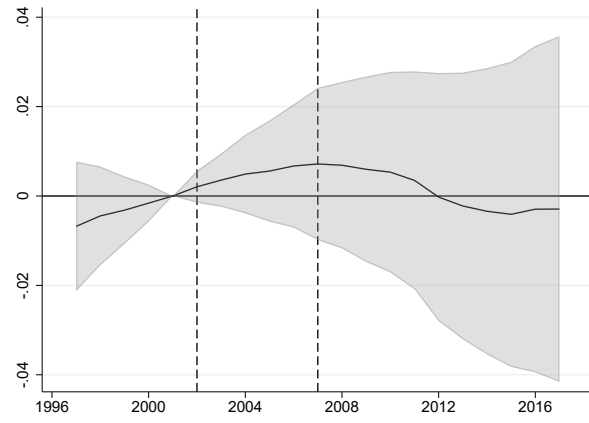


Figure A4: Native Population Size

Source: FSO.

Note: The figure shows difference-in-differences estimates using annual data at the commuting zone level for the period 1997–2017. The vertical lines indicate the beginning of the transition period (2002) and the beginning of the post-reform period (2007). The dependent variable is the Swiss population divided by the Swiss population in 1997. Observations are weighed by the Swiss population in 1997. Standard errors are clustered at the commuting zone level; 95% confidence intervals are shown.

3 Data

This Data Appendix provides an overview of the main datasets obtained from the Swiss Federal Statistical Office (FSO) and the sample construction. We take the municipality definitions from April 2018. We aggregate the data series available at the municipality level to commuting zones according to a concordance table provided by the FSO. Survey weights are used where such are provided.

Swiss Higher Education Information System (SHIS-studex)

The SHIS-studex dataset records all persons enrolled in tertiary education. Tertiary education includes studying at a UNI or UAS. Our dataset starts in 1990 for UNIs and 1997 for UAS. Information on received degrees are available for UNIs since 1990 and for UAS since 2000. The data on enrollment are reported yearly in the fall semester, and the degrees are shown by the date of graduation.

We take the following steps to build our sample. Because of our focus on undergraduate studies, we keep native (Swiss by nationality) first-year students in a diploma and diploma/licentiate program before the Bologna reform and in a bachelor's program in the period after.¹⁴ Furthermore, we take first-time enrollments and disregard subsequent enrollments. The place of residence at the time of obtaining the matura must be in Switzerland in order to allocate students to a commuting zone. We therefore drop natives who do not have an entry exam to tertiary education from a Swiss institution. We limit our sample to first-year students aged 18–30 following [Shih \(2017\)](#). We exclude those younger than 18 years because that is the minimum age of entering the tertiary level when following the ordinary path of education. We exclude students older than 30 years because of both our focus on undergraduate degrees and the long time gap between obtaining the matura and

¹⁴The structure of tertiary education changed after the Bologna Agreement was implemented in 1999. This declaration aimed to have a European higher education area with unified rules. The system changed from a comprehensive one-tier (diploma or licentiate) to a two-tier degree structure with separate undergraduate (bachelor's) and graduate (master's) levels.

being enrolled. UAS students are, on average, older than UNI students. Thus, more of the former are dropped by this limitation (6.3% of UAS students versus 3% of UNI students). We disregard enrollments from institutions that specialize in distance learning (Universitäre Fernstudien Schweiz and Fernfachhochschule Schweiz) as we cannot control for variation in their local supply during the study period. To define study fields, we use the ISCED-F 2013 codes (International Standard Classification of Education: Fields of Education and Training) from the UNESCO and merge them to the Swiss-specific study field definitions based on a matching scheme provided by the FSO.

Teacher education belongs to the tertiary level since 2001. Cantons, which are responsible for this type of education, have either set up independent universities of teacher education or integrated the study field into the UAS. The difference between the two types of institutions is only organizational. Throughout our study, we subsume all students enrolled in teacher education under UAS. This re-allocation also affects the University of Bern that offers subjects in teacher education.

Survey of Higher Education Graduates (EHA)

The EHA survey looks at graduates with a focus on their work and educational outcomes one and five years after graduating. It is conducted every second year in the autumn since 1981. Since 2009 it has been conducted mainly online. We have access to first-wave data from 2003 until 2017, while the first second-wave is from 2007. In the first-wave all graduates from a Swiss higher education (undergraduates, graduates, PhDs) receive the questionnaire; the response rate is around 60%. Only respondents in the first-wave can participate in the second-wave four years later with a response rate of around 65%. The survey is representative at the level of study fields and institutions.

Compared to the SHIS-studex dataset, where we only look at native first-year students in undergraduate programs, in our EHA sample we also include natives in graduate programs because most undergraduate students at universities continue on to a master's program.

Similar to the SHIS-studex data, we take the sample of Swiss students by nationality and with a place of residence in Switzerland when obtaining the matura. We further limit the sample to native graduates who reside in Switzerland at the time at which the survey is conducted and with available information on their occupation. We keep graduate students aged 21–35 to reflect the first-year students’ age, which we limit to 18–30, and the approximate length of a study. Since the first-wave survey is conducted one year after graduation, the respondents of interest are aged 22–36. For our analysis, we merge the FSO-specific study fields to the ISCED-F 2013 codes analogous to the SHIS dataset. The study field security services appears in the SHIS-studex data, but not in the EHA, leaving us with a total of 22 fields of study.

Occupations are reported according to the ISCO-08 classification. Using a concordance table provided by the FSO, we construct the older ISCO-88 occupation labels. This is a necessary step to make the results comparable to the occupation data from other FSO sources. In the Swiss context, occupations in levels 1 and 2 of ISCO-08 typically require a bachelor’s degree or graduate-level education. There are four occupations in level 1 (chief executives, senior officials, and legislators; administrative and commercial managers; production and specialized services managers; and hospitality, retail, and other services managers) and six occupations in level 2 (science and engineering professionals; health professionals; teaching professionals; business and administration professionals; information and communications technology professionals; and legal, social, and cultural professionals).

We use the link between the fields of study and occupations to build a supply shock measure at the field level. We use data from the first-waves of the EHA survey and combine it with information on the distribution of cross-border commuters and resident workers across occupations from the years 1999 and 2000. We take the distribution of cross-border commuters in 1999 from administrative data provided by the FSO, while census data from 2000 offer information on all resident employees in Switzerland. We focus on occupations held by workers residing in the border area to control for potential differences in the industrial

structure of places where cross-border commuters and resident employees work.

Swiss Earnings Structure Survey (SESS)

The SESS has been conducted at the firm level in October every second year since 1994, and it covers the secondary and tertiary sectors. The survey covers firms with at least three employees from both the private and the public sectors (the cantonal public sector was added in 2000, and the municipal public sector was added in 2006). Participation in the survey is mandatory. Companies provide information on a random subset of employees; the number of workers covered depends on the firm size, with data for at least one-third of all workers. In 2016, around 37,000 firms with 1.7 million employees were surveyed. We identify cross-border commuters by their G-permit, and natives are defined as Swiss by nationality. When splitting the data by highest education attained, we exclude professional degrees that are also considered tertiary. This is a necessary step to relate the relevant wage changes to the tertiary degrees we focus on in the enrollment analysis.

We restrict the sample in the main specification to employees aged 18–40 and in the robustness checks to employees aged 18–65, with available commuting zone of work, permit type, gender, education, and wage. The industry classification follows the NOGA (General Classification of Economic Activity) framework. We use the 2008 classification and convert survey years using the 2002 NOGA classification with the help of concordance tables.

We construct the gross hourly wage rate in Swiss francs (CHF) based on the standardized gross wage variable. The gross wage includes social contributions and compensation for working on a Sunday or at night. Additionally, 1/12 of the 13th salary and other non-periodic payments are added while excluding overtime pay. This sum is divided by weekly working hours and is multiplied by 40, which is the standardized number of working hours per week. We calculate the real values using Consumer Price Index data from the FSO that is indexed to December 2015. Finally, we drop outlier observations with an hourly wage above the 99th percentile of the wage distribution by year.

We investigate wages for different education levels and types of occupations. Occupations are reported in a Swiss-specific classification up to 2010, and according to ISCO-08 in the period 2012–2016. For the first period, we split the occupations into STEM and non-STEM based on the broad descriptions in the SESS handbook.¹⁵ Since the Swiss-specific classification is not directly related to ISCO, we conduct the wage analysis by occupation only up to 2010.

¹⁵STEM occupations include the following: manufacturing and processing of product; construction activities; installation, operating and maintaining; restoration, handicrafts; research and development; analyzing, programming, operating; and planning, constructing, drawing, and realizing. Non-STEM occupations include the following: strategic management; accounting, personnel management; secretarial, clerical work; other commercial and administrative act; logistics, staff tasks; assessing, advising, certifying; purchase and sale of commodities and capital goods; sale of consumer goods and retail services; transport of people and goods, communication; security and surveillance services; medical, social, and care activities; personal and clothing care; educational activities; accommodation, food and domestic activities; culture, information, entertainment, sports; and cleaning and public hygiene.