Appendix for "Immigrant Inventors and Local Income Taxes: Evidence from Swiss Municipalities"

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Contents

Appendix to Section 2.1

Additional information on the Swiss system for work-based immigration

The Swiss system for work-based immigration distinguishes between EU/EFTA nationals and non-EU/EFTA nationals[21]. Prior to 2002, prospective employers of immigrants from either group had to initiate an admission process with labor market authorities. In the application process, employers had to prove that there was no suitable Swiss candidate for the vacant position. Furthermore, quotas capped the absolute number of visas that were issued. While the location of the employer determined which state had jurisdiction in this decision, the choice of the place of residence of the immigrant was not regulated, and the authorities in the state of residence were not involved in the admission process.

Following the enactment of the "Agreement on the Free Movement of Persons", which is a bilateral agreement between the EU and Switzerland, the hiring restrictions on EU/EFTA nationals were gradually eased and finally abolished in 2007. Exceptions were made for nationals from Romania and Bulgaria, who still

[21] Information presented in this section was taken from the homepage of the Swiss ministry of migration www.sem.admin.ch on April 20th 2019.

faced restrictions until 2019. In 2002, the requirement that EU/EFTA nationals could only be employed if there was no suitable Swiss candidate for the vacant position was abolished. Quotas were increased, starting in 2002, and removed in 2007.[22] From 2002 onwards, cross border workers from French, German, Austrian and Italian border regions were admitted to the Swiss labor market.[23] When a EU/EFTA national is hired by a Swiss employer, she obtains a 5-years residence permit ("B-permit") that is valid in all of Switzerland. To be clear, this means that the choice of where to take up residence in Switzerland is not constrained by the permit. The residence permit is not tied to the initial employer. If employment with the intial employers is discontinued, the worker has 6 month to find work with a different employer. After 5 years, EU/EFTA nationals are eligible for a permanent residence permit ("C-permit"). The exact requirements differ slightly by country of origin, but do not depend on the state of residence. Applicants must prove that they are economically self-reliant and demonstrate a minimal level of proficiency in one of the federal languages of Switzerland.[24] After 2011, it was also possible for EU/EFTA nationals to reside in Switzerland without an employment contract, as long as they were able show self-employed activity.

In contrast, access of non-EU/EFTA nationals to the Swiss labor market remains restricted. Aside from the requirement that suitable Swiss candidates must be given priority, the admission depends on whether "it is in the interest of the economy as a whole".[25] In a conversation with an official, it was emphasized to me that this is meant to restrict immigration to highly qualified managers and specialists. The decision rests with the authorities in the state in which the prospecitive employer is located. If admitted, the immigrant receives a "B-permit for non-EU/EFTA nationals" that places no restrictions on the place of residence. The permit must be renewed every year. Non-EU/EFTA nationals are eligible for a permanent residence permit after 10 years. In special cases, such as legal marriage with a Swiss citizen, the permanent residence permit can already be obtained after 5 years.

Additional information on the construction of the inventor dataset

The dataset is based on application data from PCT (Patent Cooperation Treaty) patents provided by Miguélez and Fink (2013). The crucial feature of this dataset is that it provides the nationality of inventors. In addition, the patent applications provide name and address of inventors.

I extract all inventors who reside in Switzerland and appear on at least one PCT patent application filed between 2005 and 2012. In addition, I collect address data for the the applicants listed on the PCT patent applications via Patentscope, the bibliographic database of the World Intellectual Property Organization. Since my aim is to match inventors to their Swiss employers, I only retain inventors that can be related to a

[22] see "Informationen zur Personenfreizügigkeit", Bundesamt für Migration, 2002.

[23] The effect of cross border workers on the Swiss labor market is studied in Beerli, Ruffner, Siegenthaler and Peri (2021). Cross border workers who took up residence in Switzerland and commuted on a weekly basis were treated the same as immigrants for tax purposes. Hence, there is no need to distinguish betweem cross border workers and immigrants in my sample.

[24] The language requirement does not apply to applicants from Germany, Belgium, Denmark, France, Liechtenstein, Greece, Italy, Austria, Portugal, Spain, Finland, UK, Ireland, Iceland, Luxembourg, Norway, Sweden.

[25] Federal Act on Foreign Nationals, 2005. Available at https://www.admin.ch/opc/en/classified-compilation/20020232/index.html.

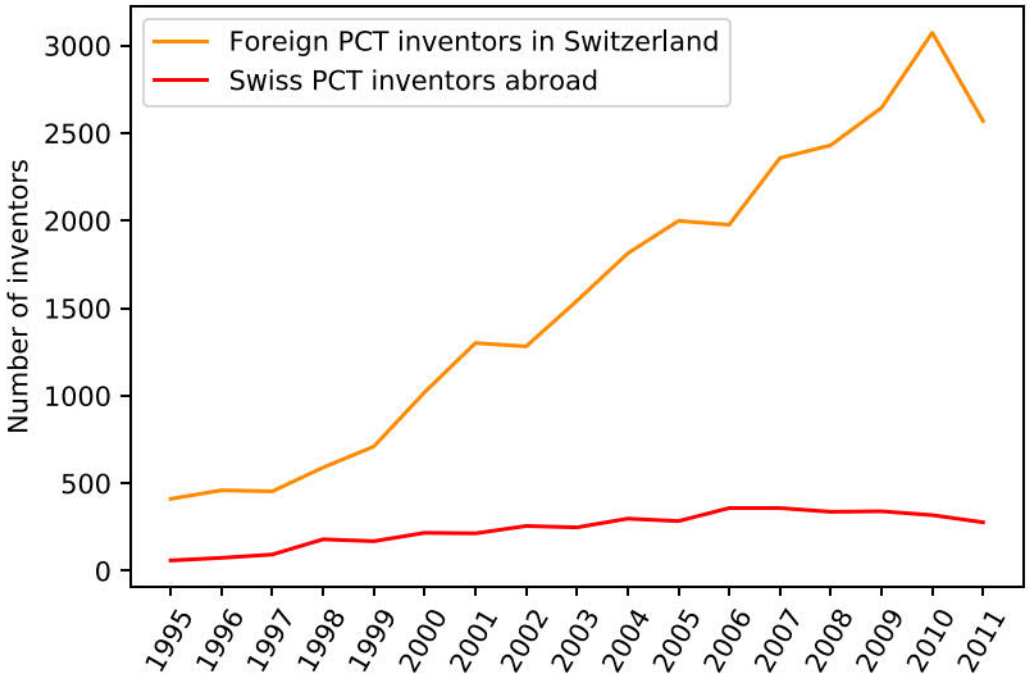
unique applicant with a Swiss address. To be clear, applicants with foreign addresses are completely ignored in this procedure. Around 65% of all PCT patents that were considered had exactly one applicant with a Swiss address listed.

I disambiguate inventors exactly by name and check manually for mistakes, such as switches in the order of first and last name or different conversions of specific German, French or Italian characters. Overall, I believe that the diversity of ethnical backgrounds facilitates an accurate disambiguation based on name, perhaps with the exception of the most common German names. I do not disambiguate by nationality to account for the possibility that foreign inventors eventually may have attained Swiss citizenship, which appears to have been the case in a handful of cases. I only retain inventors who have a non-Swiss nationality when they first appear in the dataset.

I geocode the address of the inventor and the address of the applicant at the municipality level, based on the geographical division of municipalities in the year 2010. In practice, there may be cases where the stated address of the patent applicant deviates from the place where the inventor performs research. With regards to the location of residence, a potential issue is that the address provided by the inventor may in fact not be the residential address of the inventor, but the work address. To reduce the likelihood of such instances, I eliminate inventors who provided a "c/o" address or an address that coincides with the address provided by the patent applicant (unless the patent applicant is the inventor herself or a venture founded by the inventor). This step reduces the number of inventors included in the sample from 5,261 to 4,922. For the remaining inventors, I check for a random sample of 100 inventors whether a firm with a similar name as the patent applicant had ever been registered under the address provided by the inventor and find no such instances.

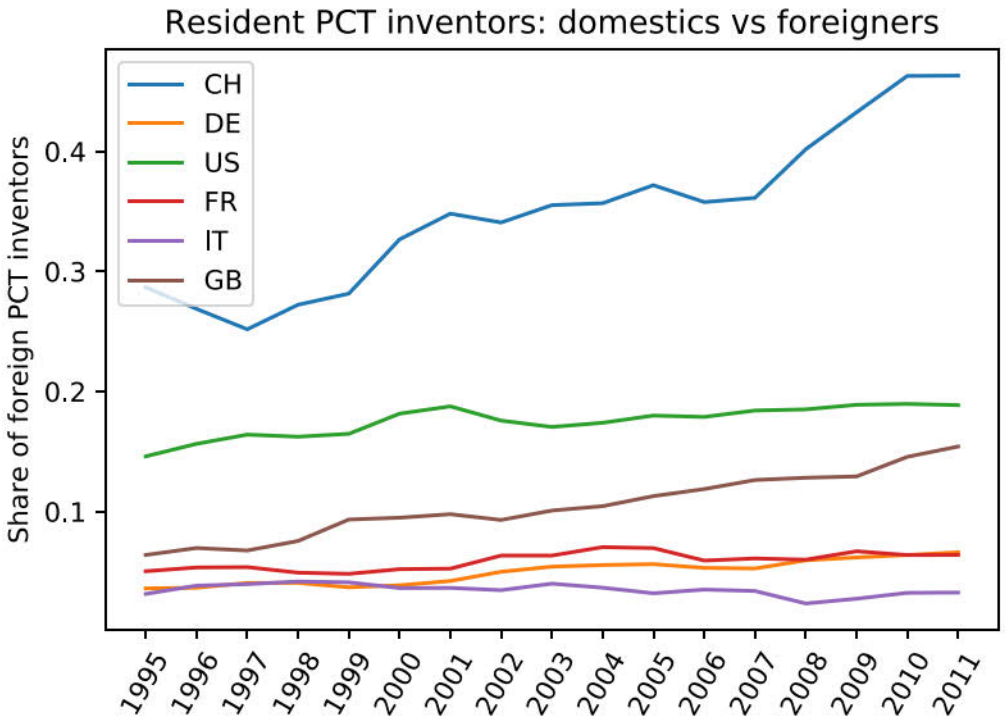
Additional figures

Figure S1: Number of foreign PCT inventors in Switzerland, and number of Swiss PCT inventors in the rest of the world, from 1995 to 2011



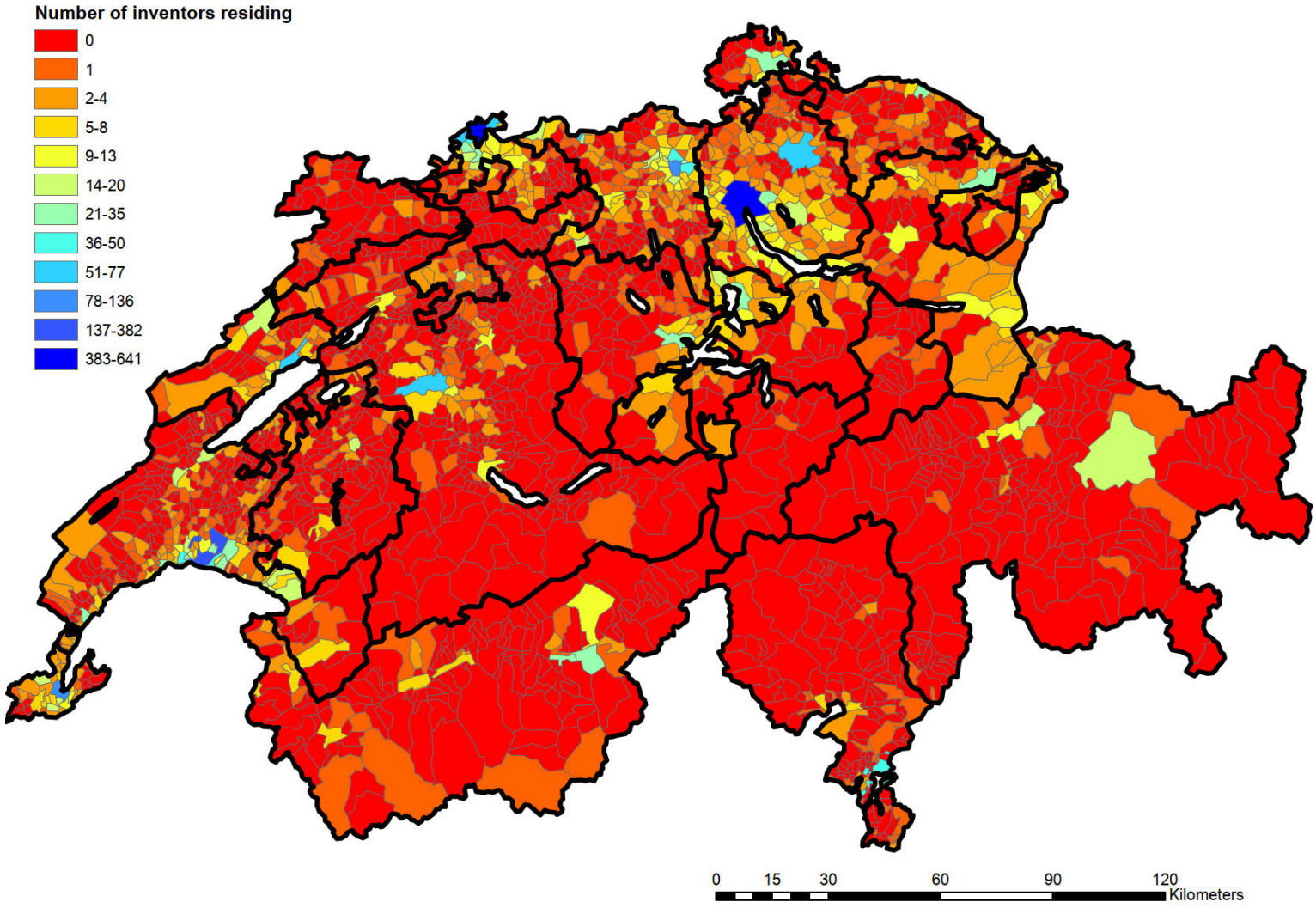
Note: Data from the inventor mobility database provided by Miguélez and Fink (2013). The number of foreign PCT inventors in Switzerland is given by the number of inventors listed on PCT patent applications who reside in Switzerland but are not of Swiss nationality. Inventors are not counted in years in which they do not patent, and, due to the lack of disambiguation, are double-counted in years in which they patent more than once. Analogously, the number of Swiss PCT inventors in the rest of the world is given by the number of inventors listed on PCT patent applications in a given year who do not reside in Switzerland but are of Swiss nationality.

Figure S2: Share of foreign PCT inventors in the total number of resident PCT inventors in Switzerland and other selected countries 1995-2011



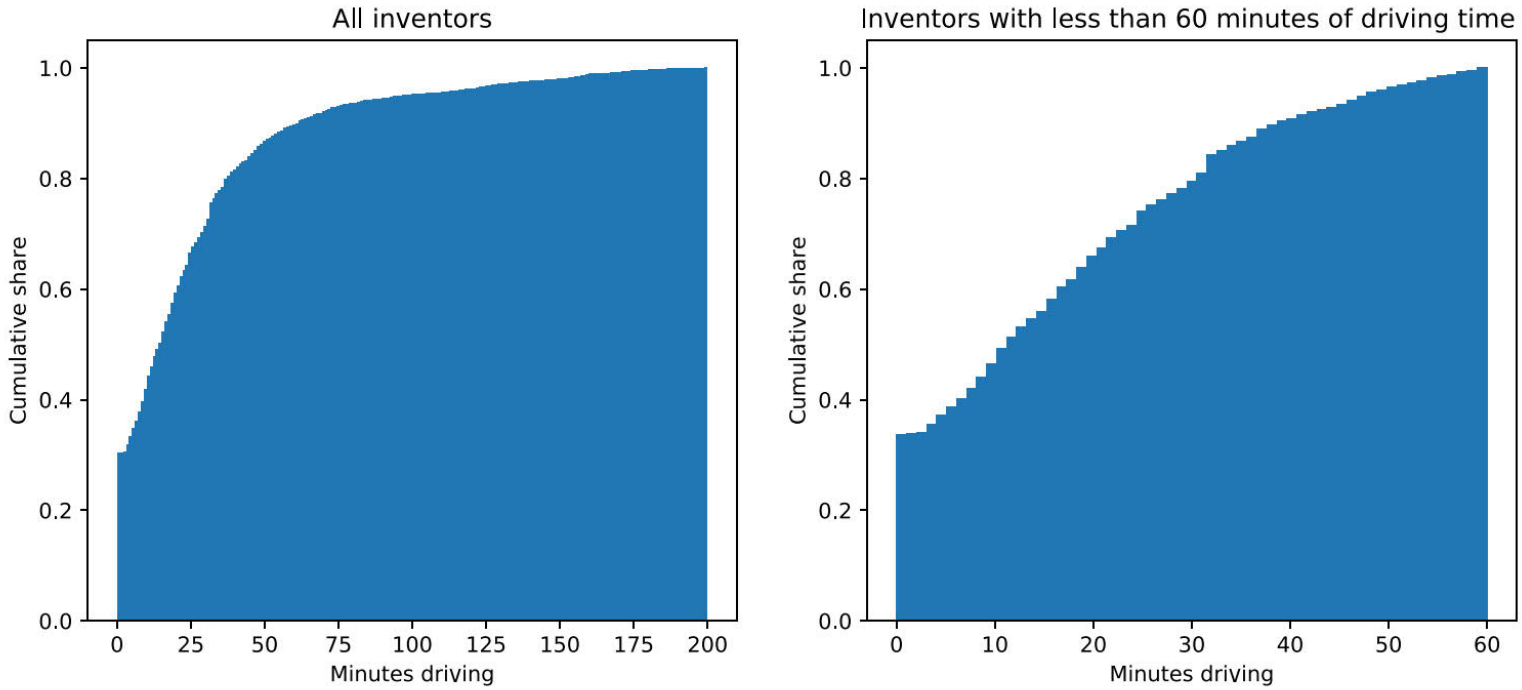
Note: Data from the inventor mobility database provided by Miguélez and Fink (2013). Countries shown: Switzerland ("CH"), Germany ("DE"), United States ("US"), France ("FR"), Great Britain ("GB") and Italy ("IT"). The share of foreign PCT inventors is given by the number of inventors listed on PCT patent applications who reside in the respective country but are of different nationality, divided by the number of inventors listed on PCT patent applications who reside in the respective country. Inventors are not counted in years in which they do not patent, and, due to the lack of disambiguation, are double-counted in years in which they patent more than once.

Figure S3: Spatial distribution of immigrant inventor residences across Swiss municipalities



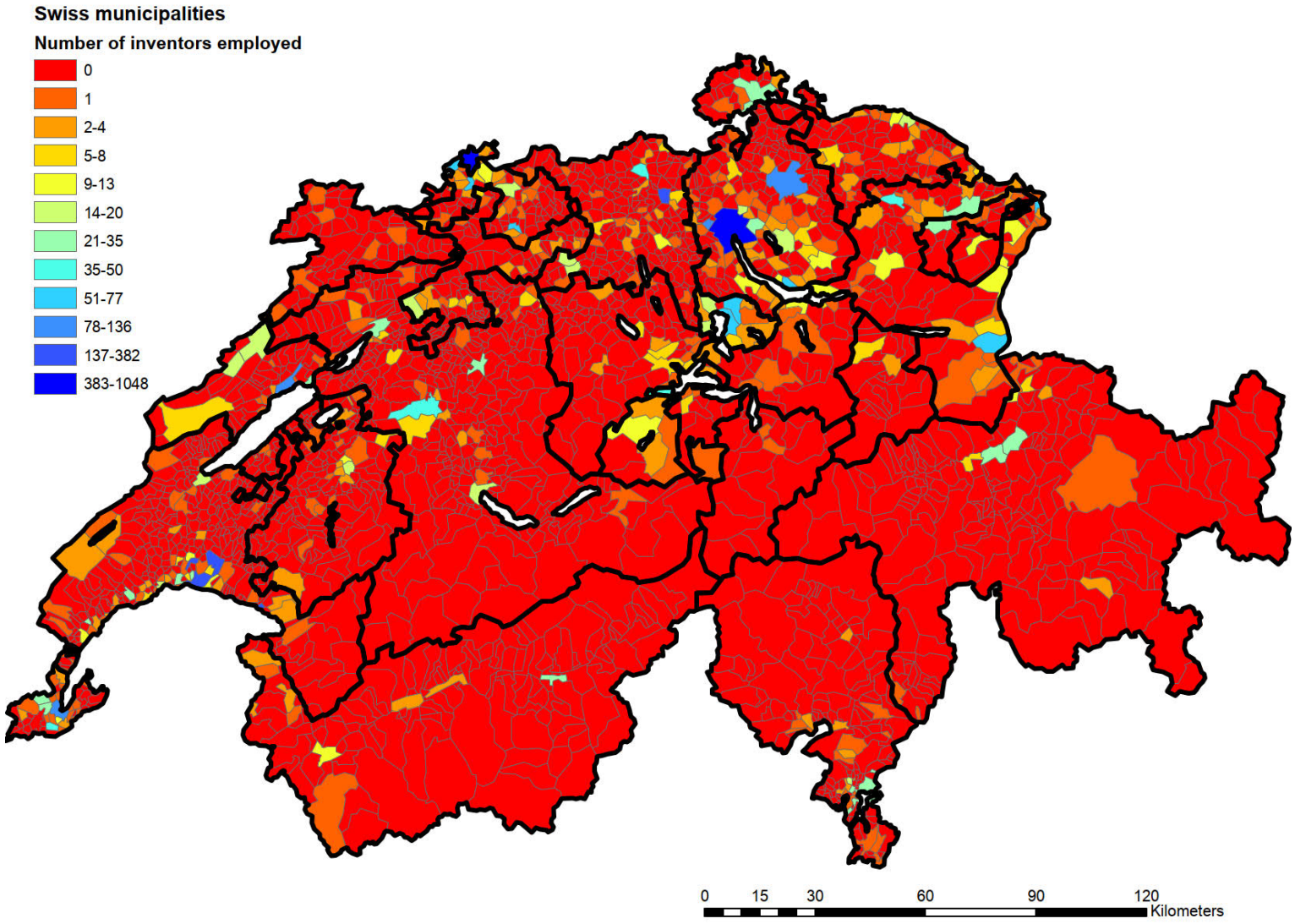
Note: Included inventors are inventors listed on at least one PCT patent filed between 2005 and 2012. State borders appear as thick lines, municipality borders appear as thin lines. Swiss municipalities as of 11-21-2010.

Figure S4: Distribution of driving times (one-way) between municipality of residence and municipality of workplace for immigrant inventors



Note: Graphs depict cumulative distribution of driving time between the municipality of residence and the workplace for inventors. A driving time of 0 minutes indicates that residence and workplace lie in the same municipality. Municipality of residence and workplace are inferred from information provided on PCT patent applications. Driving time is calculated by the Google Maps Directions API.

Figure S5: Spatial distribution immigrant inventor workplaces



Note: Swiss municipalities as of 11-21-2010. Included inventors are inventors listed on at least one PCT patent filed between 2005 and 2012. State borders appear as thick lines, municipality borders appear as thin lines.

Additional information on matching of immigrant inventors to startups and VC deals

I match all immigrant inventors in my sample to the founders of newly incorporated firms between 2005 and 2012, using the online versions of the commercial registers of Swiss states ("Handelsregisterämter). A list of the commercial registers of all states can be found at www.zefix.ch/de/hra. The register provides information on address and legal form, as well as histories of the ownership structure and important legal events, and directories of all current and former partners of the companies along with their nationalities. It also covers dissolved companies. In addition, the register provides a short description of the purpose of businesses.

For a successful match, I require that the name and the nationality of the inventor exactly matches the name and the nationality of one of the partners when the firm is first incorporated. Furthermore, I require that the description of the purpose of the business contains one of the keywords, or word stems, that indicates a research- or technology-orientation of the firm. The list of keywords and word stems is "science", "scient", "research", "develop", "R&D", "patent", "innovativ", "technolog", "novel", "licens" and all of their German, French and Italian translations.

In addition, I connect the matched firms to Swiss firms that received venture capital between 2005 and 2014 according to Crunchbase.com, a website that collects information on venture capital deals. I query the API of the website with the name of the firm and verify the accuracy of all matches manually. Information was retrieved in January 2019.

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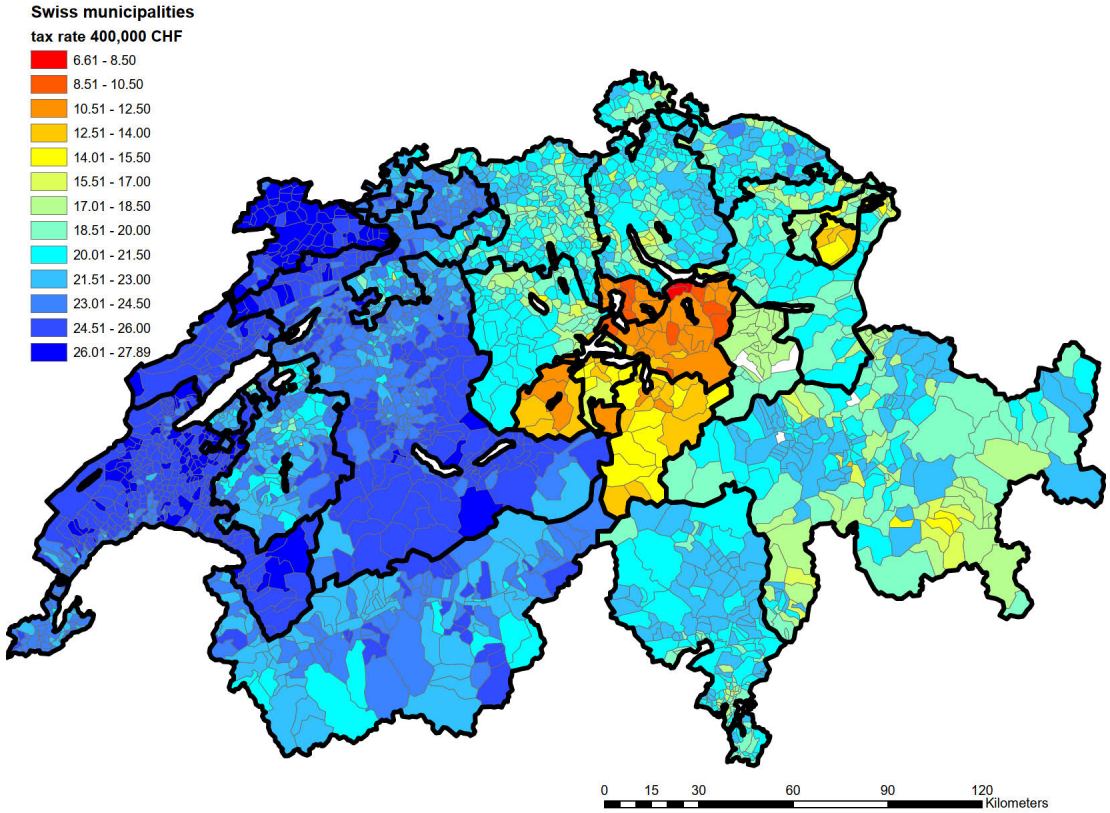
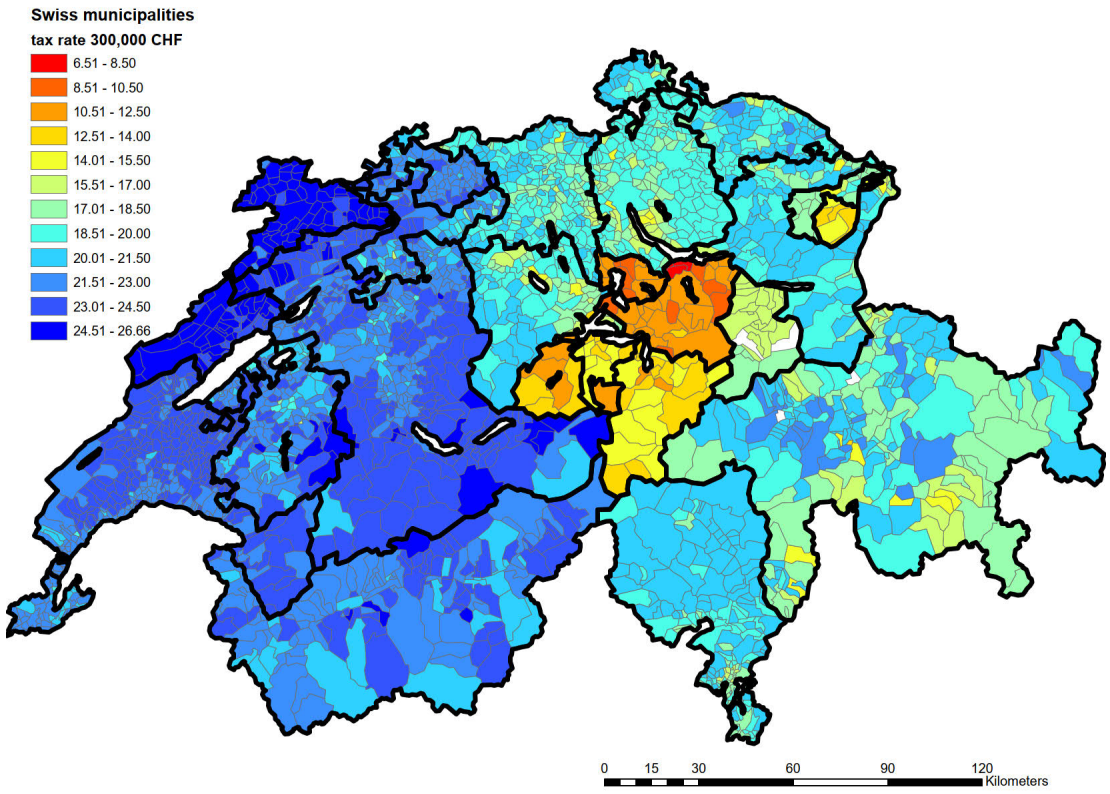
Figure S6: Tax burden in percent of the gross income levied by the state and the municipality, excluding the federal income tax, for an unmarried single-income earner with no children earning 400,000 CHF annually.



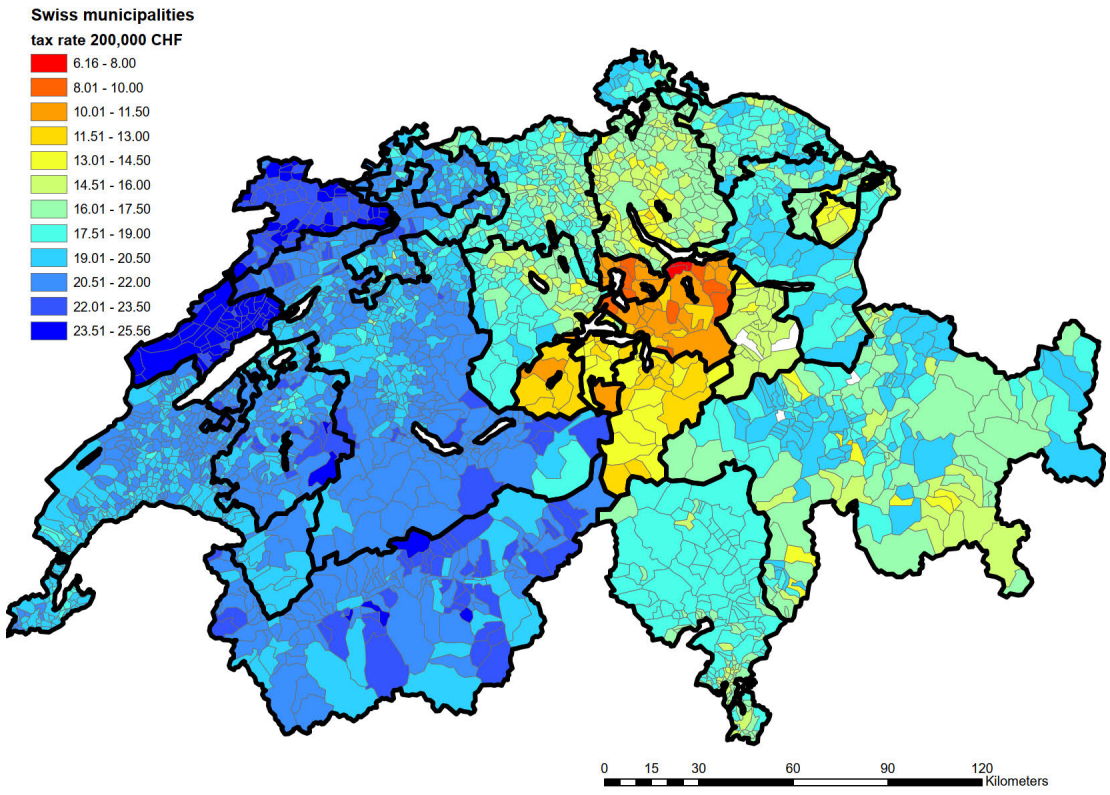
Note: Swiss municipalities as of 11-21-2010. Tax rates as of 01-01-2010. Tax rates missing for 4 out of 2584 municipalities (Matt, Luchsingen, Felsberg, Mundaun).

Figure S7: Tax burden in percent of the gross income levied by the state and the municipality, excluding the federal income tax, for an unmarried single-income earner with no children earning 300,000 CHF annually.



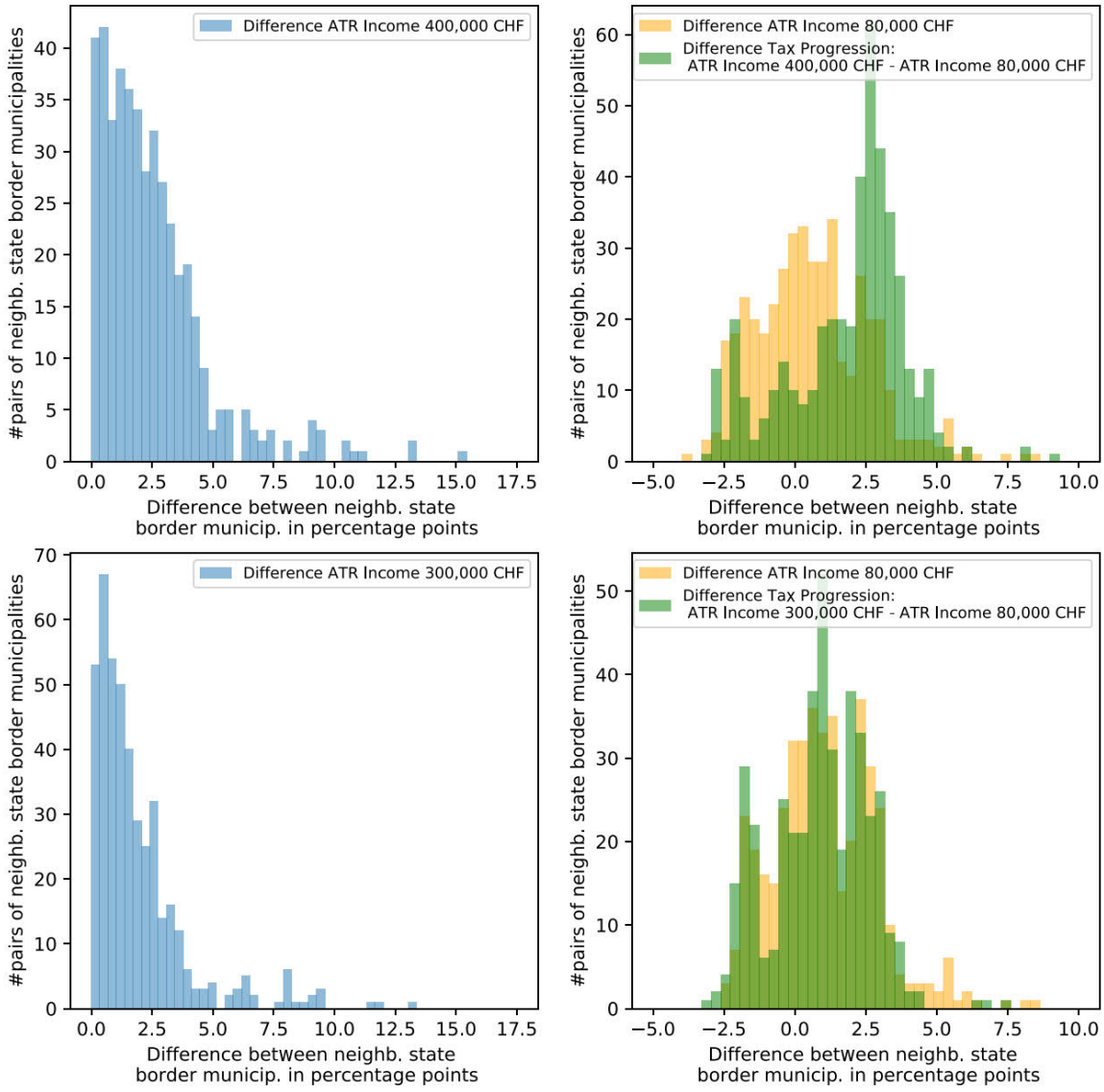
Note: Swiss municipalities as of 11-21-2010. Tax rates as of 01-01-2010. Tax rates missing for 4 out of 2584 municipalities (Matt, Luchsingen, Felsberg, Mundaun).

Figure S8: Tax burden in percent of the gross income levied by the state and the municipality, excluding the federal income tax, for an unmarried single-income earner with no children earning 200,000 CHF annually.

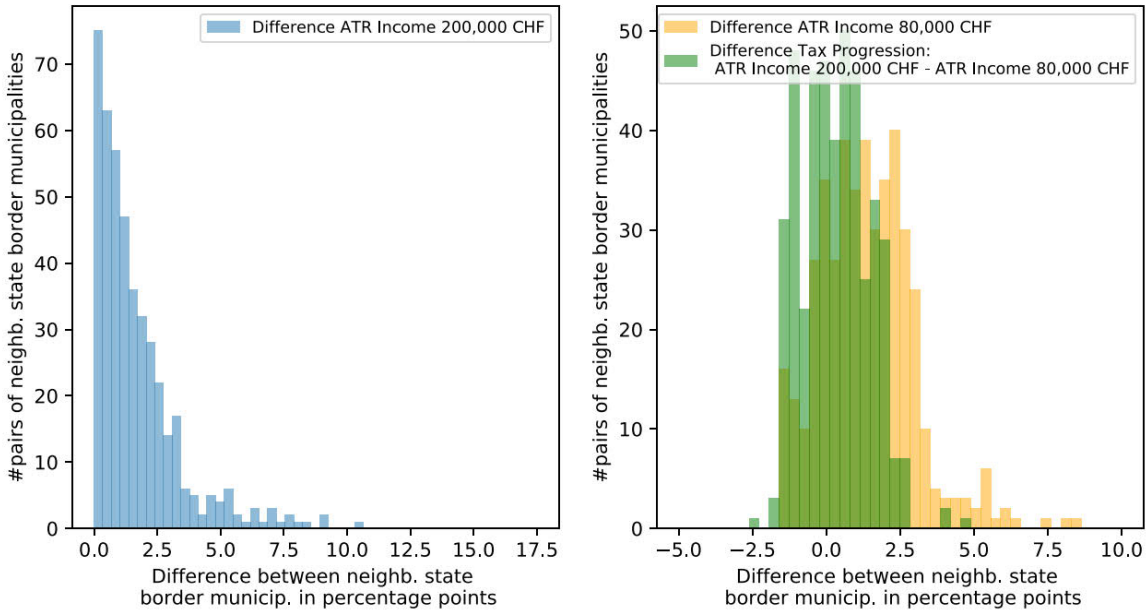


Note: Swiss municipalities as of 11-21-2010. Tax rates as of 01-01-2010. Tax rates missing for 4 out of 2584 municipalities (Matt, Luchsingen, Felsberg, Mundaun).

Figure S9: Distribution of difference in local income tax rates that apply to annual income levels of 200,000 CHF to 400,000 CHF and local income tax progression between neighboring state border municipalities



(Continued) Figure S9: Distribution of difference in local income tax rates that apply to annual income levels of 200,000 CHF to 400,000 CHF and local income tax progression between neighboring state border municipalities



Note: Left graph shows the distribution of the difference in income tax rates that apply to annual incomes of 200,000 - 400,000 CHF (in percentage points) between neighboring municipalities across state borders. Pairs of municipalities are required to lie within 5 km of (straight-line) distance and are sorted such that difference in income tax rates is positive. Right graph decomposes the difference in income tax rates into the difference in median income tax rates, which apply to annual incomes of 80,000 CHF, and into the difference in income progression. All figures were produced analogous to Figure 4; see notes there for more details.

Appendix to Section 2.3

In this section, I provide information on the data described in section 2.3. Data was obtained from the homepage of Swiss Statistical Office (www.bfs.admin.ch) in June 2018, from the homepage of the Swiss Financial Administration (www.efv.admin.ch) in June 2019 and from Google Maps in January 2019. Because the set of municipalities changes over time, as villages are combined to form new municipalities or are reassigned to existing municipalities, I match all municipal data, whenever possible, to the set of municipalities as of 11-21-2010. If a municipality in 2010 corresponds to a combination of multiple municipalities in a different year, I impute the average across the respective municipalities. Conversely, if multiple municipalities in 2010 correspond to one municipality in a different year, I assign the value of the municipality to all corresponding municipalities in 2010.

Main control variables:

- Commute: Driving time between the municipality of residence and the workplace of the inventor. Driving time was calculated by Google Maps Directions API on January 10th 2019 for a future trip on Monday February 4th 2019 at 8:00 AM. According to Google Maps, the driving time is given by the historic average of driving times between the two municipalities, given typical traffic conditions. Source: Google Maps.
- Municipality population size: population of the municipality in 2010. Source: Swiss Statistical Office.
- Distance to the national border: straight-line distance from the centroid of the municipality to the closest line segment of the national border. Source: Swiss Statistical office, own calculations in ArcGIS.
- Lakefront: binary indicator that takes value 1 if the municipality possesses a lakefront. Source: Swiss Statistical Office, own calculations in ArcGIS.
- French municipality: binary indictor that takes value 1 if more than 80% of the general population in the municipality named French as their primary language in 2000. Source: Swiss Statistical Office.
- German municipality: binary indictor that takes value 1 if more than 80% of the general population in the municipality named German as their primary language in 2000. Source: Swiss Statistical Office.
- French speaking inventor: binary indictor that takes value 1 if inventor is of French nationality. Source: PCT patent application data by Miguélez and Fink(2013).
- German speaking inventor: binary indictor that takes value 1 if inventor is of German or Austrian nationality. Source: PCT patent application data by Miguélez and Fink(2013).

Additional public service and public spending controls:

- School graduation rate: district-level share of 19-year olds who attained the degree "Gymnasiale Maturität", which is a requirement for university studies, in 2012. Districts are intermediate geographical

units in between municipalities and states. In 2010 and 2012, there were 148 districts. A discussion of the Swiss school system can be found in the Appendix to section 4.3. Source: Swiss Statistical Office.

- Crime rate: number of violent and non-violent crimes per thousand population in the municipality in 2010. Source: Swiss Statistical Office.
- Public transport usage: district-level share of workers who commuted by public transport in 2010. Source: Swiss Statistical Office.
- Public spending per-capita: all public state spending divided by number of state residents in 2010. Source: Swiss Financial Administration and Swiss Statistical Office.
- Spending compulsory schools per-student: public state spending on compulsory schools divided by number of students enrolled in compulsory schools in 2010. Source: Swiss Financial Administration and Swiss Statistical Office.
- Spending secondary schools per-student: public state spending on secondary schools (academic plus vocational) divided by number of students enrolled in secondary schools in 2010. Source: Swiss Financial Administration and Swiss Statistical Office.
- Spending public transport per-capita: public state spending on public transport divided by number of state residents in 2010. Source: Swiss Financial Administration and Swiss Statistical Office.
- Spending police per-capita: public state spending on police divided by number of state residents in 2010. Source: Swiss Financial Administration and Swiss Statistical Office.

Housing Prices

- Rental price median: median per-square meter rental price (apartment or single-family house) in the municipality in the year 2010. Source: Wüest Partner AG
- Rental price 90th percentile: 90th percentile of the per-square meter rental price distribution (apartment or single-family house) in the municipality in the year 2010. Source: Wüest Partner AG
- House sale price median: median per-square meter house sale price (single-family house) in the municipality in the year 2010. Source: Wüest Partner AG
- House sale 90th percentile: 90th percentile of the per-square meter house sale price distribution (single-family house) in the municipality in the year 2010. Source: Wüest Partner AG

Other tax rates

- Wealth tax rate: tax rate on wealth value of 1 Mio. CHF or 5 Mio. CHF in the municipality. Source: Parchet (2019)
- Corporate income tax rate: tax rate levied on annual profit 400,000 CHF, assuming capital stock of 2 Mio. CHF in the state capital of the corresponding state. Source: Swiss Statistical Office.

Appendix to Section 3.4

Table A1: Capitalization of income tax rates in housing prices

Dependent variable	Housing price difference (per square meter) between pairs of neighboring state border municip. (< 5 km apart)			
Model	Municipality model (OLS)			
Housing type/Price percentile	Rental (appt. or house)		Property sale (house)	
	50th perc.	90th perc.	50th perc.	90th perc.
	(1)	(2)	(3)	(4)
Top log net-of-tax rate (ATR 500,000 CHF)	0.271	0.120	0.617***	0.785***
	[-0.063, 0.606]	[-0.229, 0.469]	[0.172, 1.062]	[0.187, 1.383]
	[[-0.243, 0.785]]	[[-0.366, 0.605]]	[[0.030, 1.294]]	[[-0.005, 1.574]]
Median income log net-of-tax rate (ATR 80,000 CHF)	1.650***	1.900***	2.092***	2.630***
	[1.111, 2.188]	[1.231, 2.569]	[1.247, 2.936]	[1.656, 3.604]
	[[0.808, 2.492]]	[[0.777, 3.022]]	[[0.856, 3.327]]	[[1.322, 3.938]]
Top log net-of-tax rate (ATR 500,000 CHF)				
− Median income log net-of-tax rate (ATR 80,000 CHF)	-0.217	-0.455**	0.016	0.029
	[-0.580, 0.145]	[-0.832, -0.079]	[-0.486, 0.519]	[-0.601, 0.659]
	[[-0.830, 0.396]]	[[-1.140, 0.229]]	[[-0.772, 0.804]]	[[-0.922, 0.981]]
Top log net-of-tax rate (ATR 500,000 CHF)				
− log net-of-tax rate (ATR 200,000 CHF)	-0.314	-0.551***	-0.018	-0.063
	[-0.720, 0.092]	[-0.967, -0.135]	[-0.595, 0.559]	[-0.777, 0.652]
	[[-0.941, 0.314]]	[[-1.294, 0.192]]	[[-0.854,0.818]]	[[-0.988,0.862]]
Municipal controls	YES	YES	YES	YES
Observations	576 Mun.	576 Mun.	576 Mun.	576 Mun.

Note: Table shows estimates of the OLS model $\Delta \log(price_m) = \tilde{\alpha}\Delta \log(1-\tau_m) + \tilde{\beta}\Delta X'_m + \epsilon_m$ for pairs of neighboring state border municipalities. Results in all panels are obtained from separate estimations. Upper two panels show the elasticity of the housing price with respect to the net-of-tax rate that applies to an annual income of 500,000 CHF or 80,000 CHF respectively. Lower two panels show the elasticity of the housing price with respect to the ratio of net-of-tax rates that apply to annual incomes of 500,000 CHF and 80,000 CHF, or to annual incomes of 500,000 CHF and 200,000 CHF respectively. Columns 1 and 2 use the median and the 90th percentile in per-square meter rental price in the municipality in 2010 (for appartments or single-family houses). Columns 3 and 4 use the median and the 90th percentile in per-square meter sale price for single-family houses in the municipality in 2010. Standard errors are estimated from the fixed effects specification of the model. I report 95-% CIs that are based on standard errors which are clustered at the muncipality level (in single brackets) or at the border region$\times$ state level (in double brackets). Reported significance levels are *** p<0.01, ** p<0.05, * p<0.1.

Appendix to Section 4.1

Table A2: Average local tax elasticity by region

Border region	Predicted average local tax elasticity (ATR 500,000 CHF)
Zürich/Schwyz	2.45
Zürich/Zug	2.62
Zürich/Schaffhausen	2.59
Zürich/St. Gallen	1.32
Zürich/Aargau	3.73
Zürich/Thurgau	3.33
Bern/Freiburg	3.83
Bern/Solothurn	3.80
Bern/Neuenburg	3.45
Bern/Jura	3.06
Luzern/Schwyz	2.37
Luzern/Nidwalden	2.42
Luzern/Zug	1.13
Luzern/Aargau	3.65
Uri/Schwyz	2.38
Schwyz/Glarus	1.68
Schwyz/Zug	1.03
Schwyz/St. Gallen	3.00
Glarus/St. Gallen	2.23
Zug/Aargau	1.31
Freiburg/Waadt	3.72
Solothurn/Basel Land	3.76
Solothurn/Aargau	3.65
Solothurn/Jura	2.30
Basel Land/Aargau	3.63
Basel Land/Jura	2.74
Schaffhausen/Thurgau	3.14
Appenzell AR/Appenzell IR	3.19
Appenzell AR/St. Gallen	0.73
St. Gallen/Thurgau	3.53
Graubünden/Tessin	2.86
Waadt/Wallis	3.23
Waadt/Neuenburg	3.26
Waadt/Genf	3.18

Table A3: Income tax rates and local within-region choices: different income tax rates

Dependent variable	Choice between pairs of neighboring state border municip. (< 5 km apart)					
Model	Inventor model Conditional Logit			Municipality model Weighted LS		
ATR Income CHF	400,000	300,000	200,000	400,000	300,000	200,000
	(1)	(2)	(3)	(4)	(5)	(6)
Log net-of-tax rate						
Coefficient α/θ	3.694^{**}	2.647	1.040	5.600^{***}	5.801^{***}	4.973^{*}
	[0.13, 7.17]	[-1.22, 6.20]	[-3.42, 5.16]	[2.45, 8.75]	[1.88, 9.74]	[-0.13, 10.08]
				[[1.69, 9.51]]	[[0.78, 10.82]]	[[-1.36, 11.31]]
Average local tax elasticity	2.921	2.095	0.824	4.909	5.081	4.355
Tax progression: Log net-of-tax rate - median income log net-of-tax rate						
Coefficient α/θ	5.278^{*}	4.851	-1.225	5.075^{*}	6.939^{**}	6.306
	[-0.04, 10.32]	[-2.00, 11.14]	[-11.44, 6.24]	[-0.02, 10.17]	[0.01, 13.87]	[-4.10, 16.71]
				[[-1.70, 11.85]]	[[-2.23, 16.10]]	[[-6.10, 18.72]]
Average local tax elasticity	4.173	3.838	-0.972	4.452	6.079	5.523
Inventor controls	YES	YES	YES			
Municipal controls	YES	YES	YES	YES	YES	YES
Observations	1090 Inv.	1090 Inv.	1090 Inv.	576 Mun.	576 Mun.	576 Mun.
Border regions	34 Reg.	34 Reg.	34 Reg.	34 Reg.	34 Reg.	34 Reg.

Note: Maximum likelihood estimates of the residential location choice model in columns 1-3 and weighted least squares estimates of the location choice model at the municipality level are reported in column 4-6. Reported significance levels are p<0.01, ** p<0.05, * p<0.1. Significance level for the average local tax elasticity is identical to the significance level of the corresponding coefficient.

Appendix to Section 4.2

Table A4: Top income tax rate and local within-region choices: robustness

Dependent variable	Choice between pairs of neighboring state border municip. (< 5 km apart)						
	Controlling for public spending	Controlling for public services	Controlling for wealth taxes 1 mio. value	5 mio. value	Excluding heavily populated border regions or central states		
	ATR 500,000 (1)	ATR 500,000 (2)	ATR 500,000 (3)	ATR 500,000 (4)	ATR 500,000 (5)	ATR 500,000 (6)	ATR 500,000 (7)
Inventor model (Conditional Logit)							
Log net-of-tax rate: Coefficient α/θ	4.416^{***}	4.330^{**}	4.063^{**}	3.998^{**}	4.339^{**}	2.643	2.444
	[0.671, 7.473]	[0.373, 8.306]	[0.554, 7.404]	[0.462, 7.414]	[0.828, 7.940]	[-1.524, 6.417]	[-2.755, 8.520]
Average local tax elasticity	3.338	3.273	3.208	3.157	3.532	2.223	1.977
Observations	1090 Inv.	1090 Inv.	1090 Inv.	1090 Inv.	749 Inv.	715 Inv.	966 Inv.
avg. McFadden R-squared	0.308	0.320	0.305	0.305	0.327	0.311	0.296
Municipality model (Weighted LS)							
Log net-of-tax rate: Coefficient α/θ	5.110^{***}	4.576^{***}	5.960^{***}	7.003^{***}	5.152^{***}	4.919^{***}	7.361^{**}
	[1.376, 8.844]	[1.939, 7.212]	[2.846, 9.073]	[3.467, 10.539]	[2.212, 8.093]	[1.537, 8.301]	[1.348, 13.373]
	[[0.795, 9.425]]	[[1.676, 7.474]]	[[2.210, 9.710]]	[[3.125, 10.882]]	[[2.183, 8.122]]	[[1.473, 8.364]]	[[-0.44, 14.766]]
Average local tax elasticity	4.494	3.986	5.234	6.155	4.372	4.348	6.685
Observations	576 Mun.	576 Mun.	576 Mun.	576 Mun.	453 Mun.	469 Mun.	528 Mun.
R-squared	0.553	0.622	0.558	0.559	0.696	0.667	0.532

Note: Maximum likelihood estimates of the residential location choice model in upper panel and weighted least squares estimates of the location choice model at the municipality level in the lower panel. Reported significance levels are p<0.01, ** p<0.05, * p<0.1. Column 1 includes controls for state level spending on comp. schooling, secondary schooling, police and public transport. Column 2 includes controls for school graduation rate, crime rate, share of commuters by public transport commuters. Columns 3 and 4 control for municipal wealth taxes. Column 5 excludes the border regions AR/AI , AR/SG, SG/TG, BL/SO. Column 6 excludes AR/SG, ZG/ZH, BL/SO, SH/ZH. Column 7 excludes all regions around ZG, SZ, UR, OW and NW. Significane level for the average local tax elasticity is identical to the significance level of the corresponding coefficient.

Table A5: Alternative specifications for the municipality level model

Dependent variable	Pairs of neighboring border municip. (<5 km apart)	
Model	Municipality model (Poisson)	Municipality model (Weighted LS)
		Number of inventors in mun. incremented by 1
	(1)	(2)
Top log net-of-tax rate (ATR 500,000 CHF)		
Coefficient	5.223^{***}	3.794^{***}
	[1.332, 9.114]	[1.637, 5.952]
	[[0.930, 9.516]]	[[1.203, 6.386]]
Top log net-of-tax rate (ATR 500,000 CHF) - Median income log net-of-tax rate (ATR 80,000 CHF)		
Coefficient	3.579^{*}	3.047^{*}
	[-0.349, 7.508]	[-0.140, 6.233]
	[[-0.048, 7.207]]	[[-1.011, 7.105]]
Top log net-of-tax rate (ATR 500,000 CHF) - log net-of-tax rate (ATR 200,000 CHF)		
Coefficient	3.403	3.771^{*}
	[-0.879, 7.685]	[-0.492, 8.033]
	[[-1.026, 7.832]]	[[-1.717, 9.259]]
Municipal controls	YES	YES
Observations	576 Mun	576 Mun
Border regions	34 Reg.	34 Reg

Note: Column 1 presents Poisson estimates, using the number of inventors in the municipality as dependent variable. Column 2 presents weighted least squares estimates of the location choice model at the municipality level, but increments the inventor population by one before computing inventor population shares. 95-% CIs that are (based on standard error which are) clustered at the municipality level are reported in single brackets and 95-% CIs that are clustered at the border region$\times$ state level in double brackets. Reported significance levels are *** p<0.01, ** p<0.05, * p<0.1.

Additional information on local public spending and public services

Data on public spending by states and municipalities is obtained from the homepage of the Swiss Financial Administration. [26] The spending items (by function) and their average share in spending across all states in the year 2010 was as follows:

- General administration: 8.18%
- Public Safety: 8.56%
  - Police: 3.59%
  - Rest (Judiciary, prisons,..): 4.97%
- Education: 27.18%
  - Compulsory schooling: 13.02%
  - Universities: 5.58%
  - Secondary schooling (academic): 2.16%
  - Secondary schooling (vocational): 3.40%
  - Rest: 3.02%
- Culture and Sports: 4.25%
- Health: 10.15%
  - Hospitals and nursing homes: 8.16%
  - Rest: 1.99%
- Social Transfers: 18.24%
  - Disabled: 7.43%
  - Old age and survivors' insurance: 3.02%
  - Youth welfare: 1.80%
  - Social welfare and other transfers: 5.99%
- Transport infrastructure: 9.41%
  - Roads: 6.34%
  - Public transport: 3.07%
- Environmental protection and landscape management: 4.90%
- Agriculture and energy: 3.04%

[26] https://www.efv.admin.ch/efv/de/home/themen/finanzstatistik/daten.html, accessed on June 15th 2019

- Debt service and other financial transfers: 3.61%

Public schools are administered by states and students are allocated based on municipality of residence. Private schools are exempted from this allocation rule. In Switzerland, there are eleven years of compulsory schooling, which includes 2 years of kindergarten, 6 years of primary school and 3 years of preparatory secondary school.[27] After completing primary school, pupils are separated according to their academic performance and aspirations into different preparatory secondary schools ("Sekundarstufe I"). Swiss pupils complete compulsory schooling at the age of 14 or 15. Secondary school education ("Sekundarstufe II") is split between schools with academic focus and schools with vocational focus. Admission to a secondary school with academic focus, called "Gymnasium", depends on prior school performance in preparatory secondary schools and, in some cases, admission exams. This school type concludes with a degree called "Gymnasiale Maturität", which is a requisite for university studies. Students who attain this degree are eligible to attend any university in Switzerland, although some universities have additional entry exams for some subjects. Overall, only 20% of 19-years olds attained this degree in 2010. The attainment rate ranges from 7% in rural Kulm (Aargau) to 42% in Lavaux-Oron (Waadt) near Lausanne. Because of the early performance-based selection of pupils into preparatory secondary schools at the age of around 11, and the additional selection into secondary schools at the age of around 14, students (and parents) who aspire for an academic career must choose schools carefully from an early age on.

Basic health insurance is mandatory in Switzerland and all states are required to offer insurance for all state residents. Federal regulation ensures that insurance benefits are very similar in all of Switzerland. The cost of health insurance differs slightly by state. The average cost of health insurance (in the state) ranges between around 4100 CHF annually in Appenzell Inerrhoden and 6800 CHF in Basel Stadt annually in 2017.[28] The basic state health insurance contract typically stipulates the hospital, or the set of hospitals, that is responsible for particular health services, which is usually located in the state of residence. However, either by paying a small fee or by acquiring additional insurance, patients can seek treatment in out-of-state hospitals. Given my focus on top income earners, and based on conversations with high-income foreigners in the Zürich-area, I believe that differences in health services across states are of negligible importance.

The main railway system of the Swiss Federal Railways (SBB) is funded federally, although some states have additional state-funded railways.[29] Inspection of the railway maps suggests that state border do not appear to act as barries for train services. Similarly, state border do not act as border for highways or other long-distance roads.

Social transfers in Switzerland are aimed at low-income individuals in need and retirees.[30] The potentially most relevant categories of transfers for high-income earners is early childhood education and care, which

[27] Information based on www.bildungssystem.educa.ch/de.

[28] "Krankenkasse: Prämienregionen 2017", available at www.bfs.admin.ch

[29] "Bahninfrastruktur: Unterhalt und Finanzierung kurz erklärt.", available at https://www.sbb.ch/files/infrastruktur/sbb_themenlandschaft/files/SBBInfraBroschuere_de.pdf

[30] See www.economiesuisse.ch/sites/default/files/dossier_pdf/dosspol_AGK_Sozpol_20061113.pdf

is largely private in Switzerland. Differences in subsidies and public support for early childcare may exist, but are at such a low level that it seems reasonable to assume that they hardly affect the location choices of top income earners. Also, subsidies primarly appear to benefit low-income families.

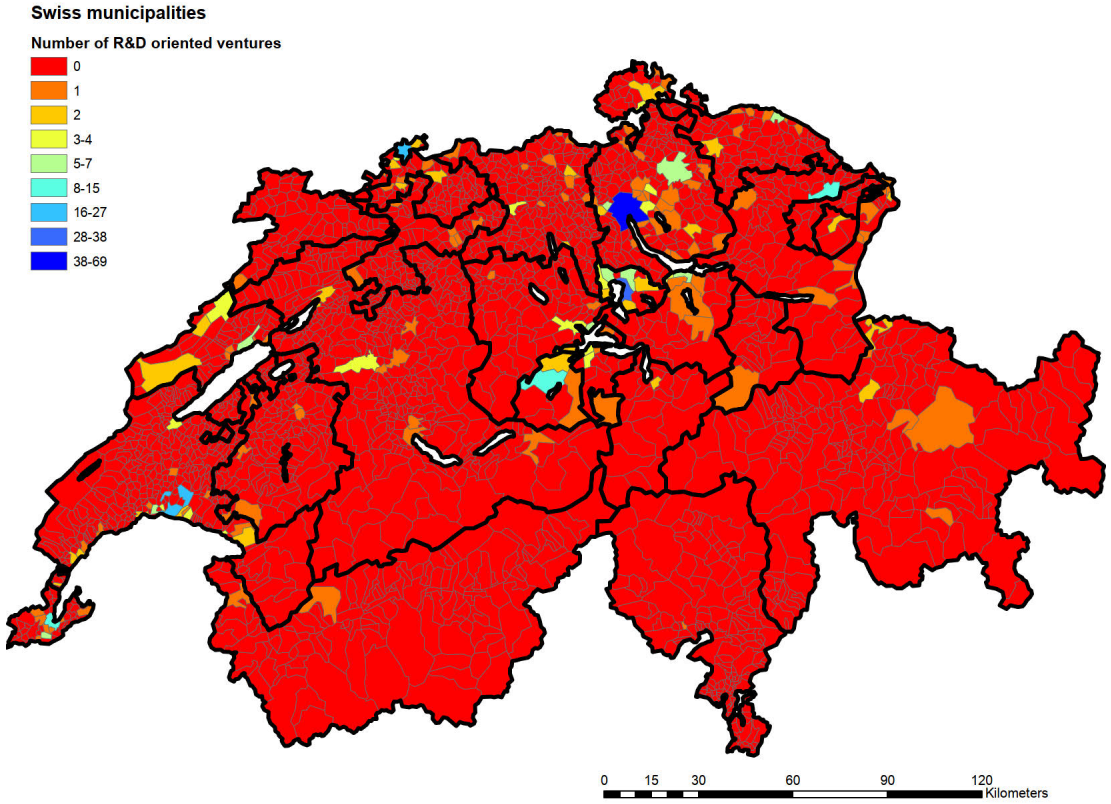
State police, state judiciary and state law enforcement are financed by states. However, overall, it appears that public safety is not a prominent concern in Switzerland when compared to, for example, the US[31]. Local differences in crime rates reflect population density and urbanity of the municipality[32].

[31] see www.nationmaster.com/country-info/compare/Switzerland/United-States/Crime

[32] https://www.nzz.ch/schweiz/deutlich-weniger-straftaten-in-der-schweiz-kriminalstatistik-1.18269192

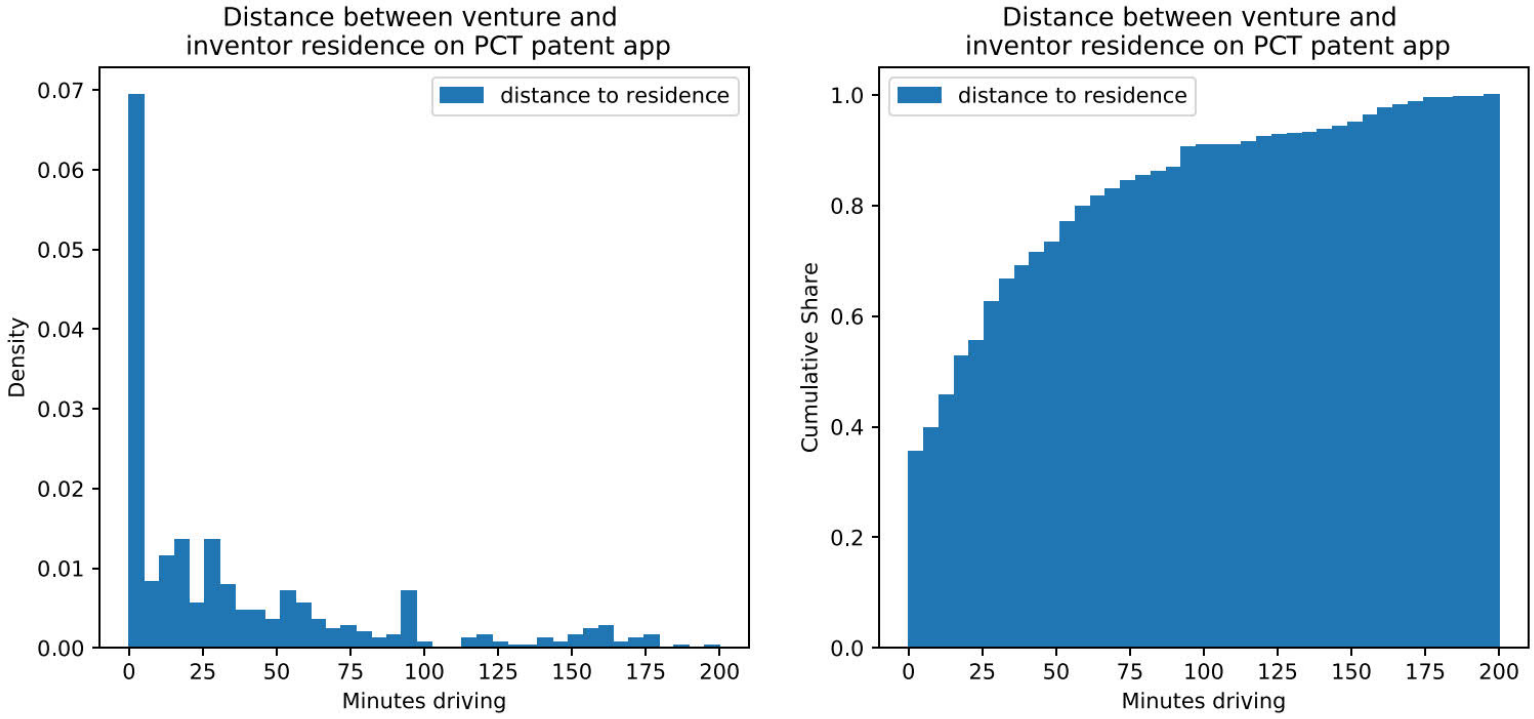
Appendix to Section 5.1

Figure S10: Spatial distribution of R&D-oriented ventures founded by immigrant inventors



Note: Swiss municipalities as of 11-21-2010. Included R&D-oriented ventures were founded between 2005 and 2012 by an immigrant inventor. Included inventors are inventors listed on at least one PCT patent filed between 2005 and 2012.

Figure S11: Distribution of distance between the inventor's residence and the inital registered location of the new R&D-oriented venture



Note: Left figure shows the density of the distance measured in minutes of driving time between the inventor's municipality of residence, according to the PCT patent application that is closest (in time) to the registration date of the venture founded by the inventor, and the municipality where the R&D-oriented venture of the inventor was registered (initially). Right figure shows cumulative distribution. Note that the innovative activity captured by the PCT patent application is not necessarily related to the venture. Graph is based on the location of 471 different startups which were founded between 2005 and 2012. Inventors with multiple startups and startups with multiple inventors as founders are represented multiple times.

Table A6: List of startups of immigrant inventors backed by VC

Name of firm	Sum VC raised in Mio. Euro 2005-2014 if disclosed	Municipality	State	Year of incorporation
BioVersys GmbH	7.5*	Obersiggenthal	AG	2008
EULITHA GmbH	0.25	Villigen	AG	2006
Memo Therapeutics AG	7.3	Basel	BS	2012
SpiroChem AG	undisclosed	Zürich	ZH	2011
PIQUR Therapeutics AG	85.8	Basel	BS	2011
NBE-Therapeutics GmbH	23*	Basel	BS	2012
Advanced Osteotomy Tools - AOT AG	12.6*	Basel	BS	2010
CoreMedic AG	undisclosed	Biel	BE	2006
GenKyoTex SA	80.45	Plan-les-Ouates	GE	2006
ObsEva SA	92	Cologny	GE	2012
PregLem SA	68	Genève	GE	2006
TVP Solar SA	12.5	Genève	GE	2008
SPINETIX SA	undisclosed	Hergiswil	NW	2006
Saiba GmbH	0.29	Zell	ZH	2012
IPST GmbH	undisclosed	Neuhausen am Rheinfall	SH	2007
Diagnoplex SA	9.6	Lausanne	VD	2005
Asceneuron SA	30*	Lausanne	VD	2012
Abionic SA	25.8*	Lausanne	VD	2010
Lemoptix SA	undisclosed	Mont-sur-Rolle	VD	2008
Aleva Neurotherapeutics SA	52.5	Renens	VD	2008
Sensima Inspection Sàrl	3	Ecublens	VD	2009
SWISSto12 SA	0.13*	Lausanne	VD	2011
DistalMotion SA	0.13*	Lausanne	VD	2012
KB MEDICAL SA	6.5	Lausanne	VD	2012
Rheon Medical SA	undisclosed	Préverenges	VD	2010
nViso SA	0.7	Lausanne	VD	2005
Fontself SA	3.7	Renens	VD	2008
Yourehab AG	undisclosed	Zürich	ZH	2010
CLIMEWORKS GmbH	33.5	Zürich	ZH	2009
Virometix AG	6.2*	Zürich	ZH	2009

Zurich Instruments AG	0.13	Zürich	ZH	2008
InSphero AG	33.74	Zürich	ZH	2009
Redbiotec AG	1.71	Zürich	ZH	2006
ProteoMediX AG	17	Zürich	ZH	2010
Aeon Scientific AG	4.3*	Zürich	ZH	2010
Koubachi GmbH	undisclosed	Zürich	ZH	2009
BiognoSYS AG	9	Zürich	ZH	2008
Malcisbo AG	undisclosed	Zürich	ZH	2010
Sonetik AG	undisclosed	Bern	BE	2007

* firms had additional venture capital deals of undisclosed amounts

Notes: List of VC-backed startups that were founded by immigrant PCT inventors in my sample between 2005 and 2012. Venture capital deals between 2005 and 2014 are considered. VC data stems from Crunchbase. Startups were identified by matching inventors to firm founders in state company registries, based on name and nationality. The reported municipality is based on the initial registered address of the company. Companies that were later dissolved are included.

Firm location model

I focus on R&D-oriented ventures in municipalities which are located within 5 km of distance of a state border. I find 85 R&D-oriented ventures in 52 distinct state border municipalities which were founded by immigrant inventors in my sample between 2005 and 2012.

The reduced-form model at the municipality level is similar to the model described in section 3.3: I match every state border municipality to the (geographically) closest neighbor and obtain 439 distinct pairs. If a municipality appears in more than one pair of border municipalities, I include it multiple times in the dataset and cluster its standard errors. I regress the number of R&D-oriented ventures founded by immigrant inventors in my sample between 2005 and 2012 in the municipality on tax rates, a full set of border-pair fixed effects and municipality population size. The location of the venture is given by the municipality in which it is initially registered. I report average marginal effects from the Poisson specification.

The location choice model at the venture level is estimated in the same way as the residential location choice model for inventors presented in Section 3.2. The dependent variable is the municipality in which the venture is initially registered. Estimation is based on relative choices between pairs of neighboring state border municipalities that lie no further than 5 km apart. Each municipality is (randomly) assigned a counterfactual municipality within 5 km of distance in a different state. In this model, I include the distance from the municipality of residence of the founding inventor (average distance in the case of multiple founders) to the counterfactual startup location, in minutes of driving time.

As in the residential location choice model, the top personal income tax rate is the synthetic income tax rate of the municipality, given by the average top income tax rate in the state excluding municipalities that lie within 5 km of distance of the municipality under consideration. It is based on tax rates that apply to an annual income of 500,000 CHF (for a single income earner without children). The corporate income tax rate is given by the average tax rate levied on an hypothetical annual profit of 400,000 CHF, assuming a capital stock of 2 Mio. CHF.[33] I assign the tax rate of the state capital of the corresponding state, since I do not have corporate income tax rates for all Swiss municipalties available. The extent to which corporate income tax rates depend on different levels of profits and capital stocks appears minor and the exact choice of profit and capital stock is likely inessential.[34]

[33] In the reduced-form model, I assign tax rates from the year 2010. In the venture location choice model, I assign tax rates from the year in which the veture was incorporated.

[34] Unreported robustness checks for different profit/capital stock choices yield very similar results.

Appendix to Section 5.2

Additional information on patent citation data

I match PCT patent applications and inventors in my dataset to PATSTAT (version Spring 2020). PATSTAT is a comprehensive international patent database maintained by the European Patent Office (EPO). I focus on citations by patent applications at the European Patent Office (EPO).

I geocode the coordinates of all inventor addresses, which were graciously provided by Felix Pöge, at the municipality level. As discussed in Section 5.2, I then calculate the straight-line distance between the (centroids of the) residential municipalities of inventors. In order to exclude self-citations by immigrant inventors, and to track the subsequent patents of domestic co-inventors, I retrieve the inventor disambiguation provided in the Icrios database.[35] Because Icrios only covers patent applications until 2016, I only track citations until 2016. To increase the chance of detecting self-citations, I use the "recall-oriented" version of the disambiguation. This allows me to compare the identity of inventors on cited and citing patents.

To detect instances in which the patent applicant is the same on cited and citing patent, I use the OECD HAN patent applicant name disambiguation provided by PATSTAT.

[35] Available at https://www.icrios.unibocconi.eu/wps/wcm/connect/cdr/icrios/home/resources/databases/patents-icrios+database.