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IZA DP No. 15679

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ISSN: 2365-9793

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ABSTRACT

The Geography of Occupational Choice: Empirical Evidence from the Swiss Apprenticeship Market*

This paper presents an empirical exploration of the geography of adolescents' occupational choices, using data covering a single cross-section of the population of all individual-level apprenticeship contracts in the canton of Bern in Switzerland. The unique feature of the data is that they cover both the training firm's location and the apprentice's domicile at a highly disaggregated level. Even though the geographic area covered by these data is small by any absolute standard, the data show that there are large and pervasive differences across different local apprenticeship markets. More specifically, the data show that apprenticeship positions are highly concentrated in a few local apprenticeship markets and that the same regions are also characterized by a larger number of distinct training occupations from which perspective apprentices may choose. Moreover, yet somewhat less obvious, there is also significant variation in the occupational task structure across local apprenticeship markets. These empirical regularities may have implications for various research questions in the context of adolescents' occupational choices.

JEL Classification: I21, J24, R12

Keywords: occupational choice, apprenticeship, geography, spatial heterogeneity, regional occupational structure

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* I thank Alexander Gehret, Filippo Pusterla, Jürg Schweri as well as participants at the first International Conference on the Economics of Vocational Education and Training in Zurich for many helpful comments and suggestions. I also thank Christoph Düby from the cantonal department of education of the canton of Bern for giving me access to the data on the apprenticeship contracts, and Sally Gschwend-Fisher for proofreading the manuscript.

1 Introduction

Occupational choice is tightly linked to individuals' opportunities and risks in the labor market, such as their earnings potential, their prospects for labor-market mobility, or their unemployment risk. Furthermore, it is a well-known feature of labor markets that there are large regional differences in economic activity, which are linked to and reflected in a region's educational and occupational structure (e.g. Behrens *et al.*, 2014; Gabe and Abel, 2012; Glaeser and Gottlieb, 2009; Moretti, 2011; Redding and Rossi-Hansberg, 2017). Moreover, a series of prominent empirical papers have shown that, for various potential reasons, the locality where an individual grows up in the US can have a substantial impact on his or her long-run economic and social advancement (Chetty and Hendren, 2018a,b; Chetty *et al.*, 2014, 2018). Against this broader background, it seems quite obvious to hypothesize that the spatial variation in the occupational structure across local labor markets directly – and almost necessarily – influences individuals' occupational choices. This could be especially relevant in a country like Switzerland, where a significant number of adolescents enter the apprenticeship system, most often directly after completion of mandatory schooling (SCCRE, 2018). Moreover, because apprentices are only about 16 years old when they start their apprenticeships, i.e. they typically start their apprenticeship immediately after completing compulsory schooling, the vast majority of them will continue to live with their parents during and until completing their apprenticeship training (in Switzerland, the legal age of majority is reached at the age of 18; thus adolescents usually stay with their parents until that age). This in turn implies that the availability of apprenticeship positions in adolescents' geographic proximity will almost certainly be a relevant factor when they choose their apprenticeship occupation – and likely more important than in the case of university-level students, who are quite a bit older on average and therefore arguably also geographically more mobile.

And indeed, previous empirical studies have established a few interrelated findings concerning how geography has an impact on individuals' educational and occupational choices. A first consistent finding from several studies covering different countries, and thus different educational systems and labor markets, is that the distance between an adolescent's domicile and the location of educational facilities, such as universities. For example, Spiess and Wrohlich (2010)

document that the distance between an individual's domicile and the nearest university has a significant impact on the decision to attend a university. A similar result is reported by Denzler and Wolter (2010) for the Swiss case. This study shows that spatial proximity not only affects the decision to enter university-level education, but also the choice of field of study among those going to university. Qualitatively similar findings are reported for England (Gibbons and Vignoles, 2012), Norway (Falch *et al.*, 2013), Finland (Suhonen, 2014), and Canada (Frenette, 2006). A second consistent finding is that individuals living in different regions are faced with potentially widely different opportunities and restrictions, which may have an impact on their educational or occupational decisions – especially given the first finding that individuals tend to be subject to spatial restrictions when making these decisions. For example, a widely replicated empirical finding is that the local unemployment rate prevailing at the time of an educational transition, or the transition from the educational system into the labor market, has a relatively large short- to medium-run effect on individuals' wages (for a survey of this literature, see von Wachter, 2020). In this context, and going beyond the impact of the prevailing level of local unemployment, some papers have tried to classify regional labor markets along a variety of structural features, such as the industrial structure or the demographic composition (e.g. Bayard *et al.*, 2022; Glauser and Becker, 2016; Kleinert *et al.*, 2018). One feature that appears to consistently pop up in these studies is that there are large differences along a variety of variables between urban and rural areas, even in small geographic areas such as the canton of Zurich (Bayard *et al.*, 2022). Moreover, a few empirical studies have explicitly tried to relate these regional differences in the broader economic structure to individual-level educational decisions. For example, in their study on the Swiss labor market, Glauser and Becker (2016) show that these regional differences have an impact on educational decisions at the upper-secondary level (i.e. the decision between further general education and an apprenticeship). Using a similar approach, but focusing on the German labor market, Schuster and Margarian (2021) also relate local labor-market conditions to individual educational decisions (see also Flohr *et al.*, 2020; Weßling *et al.*, 2015, for similar analyses, also for the German case). Third and finally, there are many potential downstream effects of the fact that there is spatial variation in individuals' educational or occupational choice set. For example, two recent empirical studies have documented regional variation in gendered occupational choices (Malin and Jacob, 2019) as well as

in the residual gender gap in wages (Fuchs *et al.*, 2021) in the German labor market.

Against this background, the primary goal of this paper is to empirically document spatial variation in various variables describing different features characterizing local apprenticeship markets, such as their size or their composition. To this end, I use a combination of different data sources describing occupational choices among adolescents living in the canton of Bern, the second largest of the 26 (half-)cantons in the Swiss Federation, both in terms of its area and its population. Even though this particular region within Switzerland is small in absolute terms by any measure, such as its land area or the number of permanent residents, there is considerable heterogeneity in the occupational structure across municipalities, which in part directly reflects the underlying topography. I use unique, individual-level data on apprenticeship contracts from the cantonal educational administration of the canton of Bern, covering the population of apprenticeship contracts as of August 2014 of more than 36,000 individual contracts, to describe several empirical regularities of occupational choices specifically along the spatial dimension. Note that, because adolescents and firms must mutually and voluntarily agree on an apprenticeship contract, variables describing the spatial distribution of occupations, for example, reflect both variation in employers' offers and adolescents' decisions. What makes these data really unique is that they not only contain detailed information about the apprenticeship occupation, but also spatially disaggregated information on the location of both the training firm and the individual apprentice's domicile. These data allow me, for example, to describe the spatial distribution of specific occupations (e.g. a watchmaker or a funicular technician). Moreover, I can also back out the apprentices' actual commuting patterns from their homes to their training firms. This in turn allows me to spatially aggregate the data at the appropriate level (e.g. Meekes and Hassink, 2022). In the main part of the analysis, I show that there is significant variation in both measures of the size and the structure of local apprenticeship markets, which in turn are closely associated with the geographic features of the municipalities, suggesting that the spatial dimension is relevant for adolescents' occupational choices. Overall, however, note that the empirical analysis presented in this paper is mainly descriptive and explorative in nature, as I will try to lay out some interesting empirical regularities related to the spatial dimension of adolescents' occupational choices.

The empirical analysis presented in this paper also complements the available evidence on

the relevance of specific factors in the broader context of vocational education and training that vary inherently along the spatial dimension. This includes the risk of being poached by a competing employer (Mohrenweiser *et al.*, 2019; Muehlemann and Wolter, 2011), the influence of social norms describing the role of the state vis-à-vis private actors on firms' training decisions (Aepli *et al.*, 2021; Kuhn *et al.*, 2022), the substitution between training apprentices and hiring cross-border workers among employers (Aepli and Kuhn, 2021), variation in societal gender norms that may influence adolescents' occupational choices (Kuhn and Wolter, 2022a; Palffy *et al.*, 2021), as well as regional innovation spillovers from newly founded universities of applied sciences (e.g. Pfister *et al.*, 2021; Schlegel *et al.*, 2022).

Moreover, spatial patterns in occupational choices may also bear relevance on the issue of how to best parameterize the horizontal differentiation of occupational choices, especially when set in relation to the wage potential of different occupations (e.g. Eggenberger *et al.*, 2018; Rinawi and Backes-Gellner, 2021; Sander and Kriesi, 2019); to the analysis of differences in labor market outcomes across different occupations, such as differences in occupational mobility (e.g. Geel and Backes-Gellner, 2011; Geel *et al.*, 2011; Mueller and Schweri, 2015) or differences in labor income associated with different occupational paths (e.g. Balestra and Backes-Gellner, 2017; Grønning *et al.*, 2020); as well as to the more general literature on the determinants of occupational choice among adolescents (e.g. Bentolila *et al.*, 2010; Bonin *et al.*, 2007; Kooreman, 2009; Kuhn and Wolter, 2022b). In the concluding section of this paper, I will discuss some specific examples where the spatial variation in the occupational structure may interfere with more conventional explanations of phenomena in the context of adolescents' occupational choices (i.e. explanations that do not explicitly take the underlying spatial dimension in the data into account).

The remainder of this paper proceeds as follows. In the following section 2, I first discuss some background information related to the Swiss apprenticeship system as well as to specific features of the canton of Bern, such as its topography. In section 3 I discuss the three main data sources used in the empirical analysis. The empirical analysis itself is presented and discussed in section 4. In that section, I also discuss the potential implications of the documented empirical regularities for research questions in the context of occupational choices that do not specifically or explicitly focus on the spatial dimension. Section 5 discusses the main findings and concludes.

2 Background

I start with some background information on the Swiss educational system in general as well as on the Swiss apprenticeship system specifically.[1] I also give some background information on the canton of Bern, which is the geographic area covered by the data and thus the focus of the empirical analysis.

2.1 The Swiss educational system

The Swiss educational system is regulated at different administrative levels (i.e. the communal, cantonal, and national level), and for that reason, cantonal differences exist, for example, in the exact timing and structure of secondary-level schooling (e.g. the many different tracks at the secondary level of schooling). Moreover, there are also cantonal differences in regulation of access to schools offering baccalaureate degrees (SCCRE, 2018). For example, there is a mandatory entry exam in some cantons, while entry in others is regulated solely (or mainly) by teacher recommendations (as is the case for the canton of Bern, for example, from which the data of the analysis are drawn).

In general, however, children attend kindergarten for two years, followed by six years of primary schooling. Compulsory schooling ends with the completion of lower-secondary schooling; that is, after nine years of schooling. However, the vast majority of adolescents (currently about 90%, cf. SERI, 2021) enters either further general education or apprenticeship training at the upper-secondary level; sometimes only after completing a transitional option, such as a language exchange or a bridge year. Among those opting for further general education, the most frequent choice is baccalaureate school (*Gymnasium* in German, about equivalent to high school), which prepares for and gives access to university-level education upon successful completion (in almost all fields of study and at all universities without additional entry exams). The more popular choice at this stage, however, is to enter the apprenticeship system.

[1] See SCCRE (2018) for additional background information as well as appendix figure A.1 for a schematic illustration of the Swiss educational system. See also Wettstein *et al.* (2017) for a comprehensive review of the Swiss system of vocational education and training, including the different options available at the tertiary level.

2.2 The apprenticeship system

Indeed, the apprenticeship system remains the main pillar of the Swiss educational system at the upper-secondary, post-mandatory level. Among the most recent incoming cohorts, close to two-thirds eventually take up some kind of apprenticeship training (SERI, 2021). Among those adolescents opting for apprenticeship training, a large majority takes up a dual apprenticeship, which combines vocational schooling with practical training and work directly with the employer, while a minority decides for full-time vocational school (which is available for a restricted set of occupations only). There currently are about 240 distinct learnable occupations (SERI, 2021), ranging from traditional craftsmanship (e.g. a carpenter or a stone sculptor) and technical occupations (e.g. a mechanical engineer) to occupations in the care system (e.g. a healthcare assistant), the services sector (e.g. a specialist in restaurant service, a retail assistant, or a commercial employee) or the ITC sector (e.g. an information technician or a mediamatics technician).[2] Regular apprenticeships last either three of four years, but there are also shorter, two-year apprenticeships which were created for academically weaker adolescents (Fuhrer and Schweri, 2010; Kammermann *et al.*, 2011). Once successfully completed, most apprenticeships, including the two-year apprenticeships, open up further educational options and possibilities (see appendix figure A.1 again).

In so-called dual, firm-based apprenticeships, the apprentice usually spends one day per workweek, in some cases two days per week, in vocational school and the remaining time in the workplace of his or her employer. The employer and the apprentice (or his/her parents on behalf of the apprentice, in case he/she is underage at the time) sign an apprenticeship contract for the duration of training. The contract ends once the training is complete, and there is no obligation for the employer or the apprentice to continue employment beyond the training period. Many employers do retain at least part of their apprentices, suggesting that apprenticeship training partially serves as a screening device. Apprentices receive a wage during their training period, but apprentices' wages are considerably lower than the wages of fully trained workers in the same occupation (e.g. Gehret *et al.*, 2019; Muehlemann and Wolter, 2014). Firms have no legal obligation to train apprentices, and employers in general do not get public subsidies for their

[2]See https://www.becc.admin.ch/becc/public/bvz/beruf/grundbildungen for a full list of learnable occupations. Where available, I use the official English translation of the occupational title (also provided on the mentioned website).

provision of training positions. In contrast, however, vocational schools are financed publicly.[3]

Note that the apprenticeship system, in contrast to general education, is regulated at the federal level. Therefore, the training content in a particular apprenticeship occupation is, in principle at least, the same across the country, both in vocational school and in the training firm.[4] At the same time, the structure of lower-secondary schooling, including the access to baccalaureate schools, may and actually does vary across regions due to the fact that cantons have considerable leeway in how they set up the parameters of the educational system; for example, the proportion of adolescents in baccalaureate school varies strongly across cantons – which may in turn have impacts on the apprenticeship market, both in terms of its size and its composition (e.g. Jaik, 2020; Zwingenberger and Obrecht, 2016).[5] After successful completion of their apprenticeship, i.e. after passing their final apprenticeship examination, apprentices receive a nationally recognized certificate (a Federal Diploma of Vocational Education and Training, *"Eidgenössisches Fähigkeitszeugnis (EFZ)"* in the case of a regular apprenticeship; and a Federal Certificate of Vocational Education and Training, *"Eidgenössiches Berufsatttest (EBA)"*, in the case of a two-year apprenticeship), which is recognized across the whole country. Moreover, there are also various options for further vocational education and training at the tertiary level in most occupations (again, see appendix figure A.1) once an apprenticeship has been successfully completed (see Wettstein *et al.*, 2017, for additional details).

2.3 The canton of Bern

The main data source covers only, or primarily, apprentices from the canton of Bern, and thus the empirical analysis will necessarily be restricted to this area. Bern is one of the 26 (half-)cantons which make up the Swiss Federation in its current constitution, and it hosts the Swiss

[3]However, some public employers (e.g. most hospitals) are expected to train a given number of apprentices. Moreover, vocational training funds exist (*"Berufsbildungsfonds"*) in some occupations (more precisely, usually in some narrowly defined industries). If in place, all firms covered by such a fund must contribute to these funds, which in turn are used to partially compensate those firms that train apprentices in the sector and region covered by the funds.

[4]There is a standardized training curriculum for each training occupation, which in detail defines the training content to be provided by the employer as well as the vocational school. See, for example, Schweri *et al.* (2021) for additional details.

[5]In the year 2016, the share of adolescents attending baccalaureate schools varied between a minimum of 11% in the canton of *Obwalden* and a maximum of 29.6% in the canton of *Basel-Stadt* (SCCRE, 2018). Moreover, there is also considerable variation in this variable across regions within the same canton. Overall, about 18% of adolescents currently attend a baccalaureate school at the upper-secondary level in the canton of Bern.

capital, the city also named Bern, as well as the Federal Assembly (i.e. the national parliament), the Federal Council (*"Bundesrat"*, the executive body at the federal level) along with much of the Federal Administration. The smallest administrative-political unit with some autonomy, for example in educational policy, is the municipality (*"Gemeinde"*). In the year 2014, the year to which the data on the apprenticeship contracts refer, the canton of Bern consisted of 362 municipalities (by the year 2022, the number had already decreased to 338 municipalities due to municipal mergers).

Moreover, the canton of Bern is one of three bilingual cantons in Switzerland, with a large majority of German-speakers (83,7%) and a minority of French-speakers of about 11% of its population.[6] The French language regions are located in the northwestern part of the canton, bordering the French language cantons of Neuchâtel and Jura). The cantons have considerable autonomy in various policy areas, such as taxation or education but, as noted above, the apprenticeship system and vocational education and training more generally are regulated at the federal level (i.e. there is a federal law on vocational education and training, *"Berufsbildungsgesetz"*, which first came into force in 1930; currently, the fourth revision of the law from the year 2004 is now valid).

Figure 1

Figure 1 highlights the size and the position of the canton of Bern within the borders of Switzerland. Bern is the second largest canton, both in terms of its area and its population. It covers about 14.4% of the total area of the country. In terms of resident population, the canton of Bern hosts around 12.1% of the total population. Moreover, because the canton is relatively large by Swiss standards, and because the canton stretches from the rather sparsely populated, mountainous regions to the more densely populated regions in the lowlands, it is quite representative of the whole country overall (in contrast to many other cantons that are either clearly urban or rural). In absolute terms, the canton of Bern is small, however, covering a total area of 5,959 km^2 (i.e. about 77 km $\times$ 77 km) and hosting a population of about 1,04 million residents. One of the features that make the canton of Bern especially interesting for

[6]The numbers in this paragraph are taken from the following website of the Federal Statistical Office (FSO): https://www.bfs.admin.ch/bfs/de/home/statistiken/regionalstatistik/regionale-portraets-kennzahlen/kantone.html

the analysis of regional variation in occupational choices is its rugged topography, as I will discuss next.

The topography of the canton of Bern

Figure 2 illustrates the topography of the canton, by mapping the median elevation, in meters above sea level, for each municipality within the cantonal borders. Darker (lighter) shaded areas correspond to municipalities at a higher (lower) median elevation. The range in the median elevation is large, ranging from 420 meters in the municipality of *Wangen an der Aare*, located in the basin of the river *Aare* in the northeastern part of the canton, to 2,445 meters in the municipality of *Guttannen*, located in the southeastern, mountainous part of the canton (at the source of the river *Aare*). The lowest point of the canton lies in the municipality of *Wynau* at 399 meters, also located in the *Aare* basin, while the highest point is the peak of the *Finsteraarhorn* at 4,274 meters, located in the municipality of *Guttannen*, at the border to the canton of Valais. Note that these two places are, measured at linear distance, only about 87 kilometers apart from each other. This nicely illustrated the roughness of the topography of the canton of Bern, as well as of Switzerland in general.

Figure 2

The southern part of the canton is located in the Bernese Alps, which are part of the Main Alpine Ridge (*"Alpenhauptkamm"*), stretching basically from West to East across the whole country (see appendix figure A.3). The northwestern, French language part of the canton is also mountainous and part of the sub-alpine Jura Mountains (*"Juragebirge"*), which basically stretch from the Rhone to the Rhine basin, i.e. from Geneva to Basel (again, see appendix figure A.3).[7] Not surprisingly, the larger cities of the canton are located in the lowlands, often close to rivers or lakes, such as Bern, Biel/Bienne, and Thun (these are the three largest municipalities in the canton of Bern; but the same is true for most of the other larger cities within the cantonal borders, and in fact for the country at large). Fittingly, this area at a relatively lower elevation is called the *Mittelland* in German (i.e. the lowlands in between the two mountain ranges).

[7]As an interesting side-note, the French language canton of Jura only split off from the canton of Bern in the year 1979, and only after a long history of societal and political, and at times violent, dispute (e.g. Siroky *et al.*, 2017).

The canton's topography is of specific interest in the context of this study because it seriously impacts the travelling times from one municipality to another. More interestingly, these differences in travelling times may have an influence on individuals' occupational choices because they will indirectly restrict the set of apprenticeship positions that are reachable within a given amount of time, as I will show later on (see section 4.2 below). Indeed, one immediate implication of the canton's rough geography is that travelling times differ substantially across the different regions of the canton, in the sense that travelling a given linear distance takes more time in the more mountainous regions because the infrastructure (i.e. roads and railway tracks) must follow the prevailing features of the terrain. For example, roads and railroad tracks must necessarily run along serpentines or in loop tunnels when the terrain is steep, which makes travelling in this terrain much slower than in flat and/or obstacle-free terrain for the same linear distance covered.[8]

3 Data

I next describe the different data sources used for the empirical analysis.

3.1 Apprenticeship contracts in the canton of Bern

The first and main source of data covers a one-time snapshot of the population of individual-level apprenticeship contracts in the canton of Bern as of August 2014, taken from the statistics of basic vocational education and training (*"Statistik der beruflichen Grundbildung"*). The data cover all individual-level apprenticeship contracts from employers located in the canton of Bern as well as all apprentices residing in the canton of Bern with a contract with an employer located in another canton.[9] Importantly, note that the observed number of apprenticeship contracts must be understood as an equilibrium outcome, representing both the demand for apprenticeship training by adolescents as well as the supply of certain training positions by

[8]On the role of railway construction in the course of the industrialization of Switzerland in the 19th century, see for example Büchel and Kyburz (2020) or Jung (2019).

[9]The cantonal administration must approve each contract between an apprentice (or his parents, in case he/she is underage; which is true for most apprentices when they start their training) and the training firm. The cantonal administration is also involved if an apprenticeship contract is terminated prematurely, for whatever reason, and is responsible for issuing training authorizations for employers willing to train apprentices.

employers (i.e. a contract can only be signed if there is a match between an apprentice and an employer).

Among other things, the data record the detailed apprenticeship occupation (e.g. an optometrist or a bricklayer) according to the official classification used by State Secretariat of Education, Research and Innovation, the federal authority responsible for the apprenticeship system, the apprentice's domicile (i.e. the place of residence of his/her parents in most cases) as well as the location of the training firm. The place of residence and the location of the training firm are both available at the level of postal codes, which I map onto municipalities in order to merge additional data from additional administrative sources, which are usually available at the level of the municipality.[10]

Apprenticeship occupations and the distribution of apprenticeship contracts across occupations

For the purposes of this study, I focus on the major subset of apprenticeship contracts involving training firms located within the canton of Bern because the main focus is on the supply-side of the apprenticeship market (i.e. the firms offering apprenticeship positions). Thus I eliminate a relatively small number of contracts between adolescents residing in the canton of Bern, but with an employer located outside the canton from the data. In contrast, apprentices from other cantons who sign a contract with a firm located in the canton of Bern remain in the analysis data (contracts with adolescents from outside the canton of Bern make up about 8.5% of all contracts used in the analysis). Not surprisingly, the large majority of these adolescents live in one of the neighboring cantons.[11] Further eliminating entries with missing information on any of the key variables leaves me with 36,377 individual-level observations/contracts. In a further preliminary step, I also standardize the occupational descriptions used in the data, resulting in a set of 199 distinct occupations.[12]

[10]The Swiss Post introduced postal codes (*"Postleitzahlen"*) in 1964; they have no further administrative or political meaning. Municipalities, in contrast, are administrative and political units. Unfortunately, there is no one-to-one mapping from one classification to the other because postal codes may cross existing administrative borders.

[11]Specifically, about 90% of these adolescents live in one of the following cantons: Solothurn, Fribourg, Luzern, Jura, Aargau, Neuchâtel, or Valais.

[12]According to the State Secretariat for Education, Research and Innovation (SERI), the federal authority in charge of vocational education and training, there are currently about 240 different learnable occupations (the exact number changes from year to year, as new occupations are created and existing ones merge with other

Table 1

Based on the processed data, table 1 lists the thirty most popular occupations in the canton of Bern as of the year 2014. It is immediately evident from this table that the distribution of apprentices across occupations is highly asymmetric, with a few very popular occupations and many occupations that are only rarely chosen in any given year. For example, the ten (twenty, thirty) most popular occupations represent about 50% (66%, 76%) of all apprenticeship contracts – which for example implies that the remaining 169 occupations account for the remaining 24% of the apprenticeship contracts.[13] The five most popular occupations – commercial employee, healthcare assistant, retail assistant, information technician, and certified social care worker – alone combine more than a third (36,7%) of all apprenticeship contracts signed in the canton of Bern. The heavy skewness in the number of apprenticeship positions by occupation may also have further implications, beyond the obvious fact that there are large differences in the number of apprenticeship positions available across the various occupations.[14] For example, apprentices in rarely chosen occupations must likely travel longer to the vocational school where they receive general and specialized lessons.[15] Obviously, for reasons of cost, the number of vocational schools which provide occupation-specific teaching tends to be lower, the smaller the overall number of apprentices in a given occupation.

3.2 Travelling times between municipalities

The second data set used for the analysis contains travelling times between all pairs of Swiss municipalities, provided and made available by the Swiss Federal Office for Spatial Development

occupations or become obsolete altogether). In the raw data, there are 397 unique occupational descriptions, but after tidying up the occupational descriptions, only 199 distinct occupations remain. The main reason for the large reduction is that the names of occupations differ for males in females in German (for example *"Elektriker"* for a male electrician and *"Elektrikerin"* for a female electrician), and both designations appear in the raw data. In a few cases, I also merged similar occupations into one and the same occupation (for example, there are different specializations in some occupations, such as for a retail assistant or a commercial employee). Thus, as of August 2014, most of the occupations available for training were chosen by one or more apprentices in the canton of Bern.

[13] In contrast, examples of rarely chosen occupations are a boatbuilder, a violinmaker, a goldsmith or a funicular technician (more on this last occupation below).

[14] See also appendix figure A.2, which graphically illustrates the skewness in the number of contracts across the different occupations. Interestingly, the frequency distribution of apprentices across occupations appears to approximately follow a power law (see Gabaix, 2016, on the pervasiveness of power laws).

[15] A list of all vocational schools located within the canton of Bern is available here: https://www.bkd.be.ch/de/start/themen/bildung-im-kanton-bern/berufsbildung/berufsfachschule/berufsfachschulen-im-kanton-bern.html

(*"Bundesamt für Raumentwicklung"*). These data combine information from various sources, such as data from mobile phones, and they are used for the official traffic planning by the federal government, though in a much more detailed form (see ARE, 2010, for details). The data that are available for research purposes contain average effective travelling times on a weekday as well as average travelling distances (i.e. not Euclidean distances, but effective distances when travelling along roads and/or railroads, in the case of using public transportation) between any pair of municipalities.[16] Because my focus is exclusively on apprentices, usually aged about 16 years when starting their apprenticeship training, I focus on travelling times using public transport, thereby assuming that most apprentices travel by public transportation.[17]

Figure 3

Within the canton of Bern, the typical (i.e. mean) travelling time by public transport from one municipality to any other municipality equals about 101 minutes, but there is large variation across municipalities. This is again graphically illustrated in figure 3, which maps the mean travelling distance from a given municipality to any other municipality within the cantonal borders. Not surprisingly, the map closely mirrors the topography of the canton: the shortest average travelling times are found in the more densely populated areas, such as in the area around the city of Bern, which in turn tend to be located in the areas at lowest elevation (cf. figure 2 above).[18]

3.3 The cognitive requirements and the task content of the different apprenticeship occupations

Moreover, I also use data from an information website called *"Anforderungsprofile"* in German, which describes the cognitive requirements in the different apprenticeship occupations in the four main school subjects covered during vocational school (i.e. native and secondary languages, mathematics, and natural sciences). The resulting profiles are publicly available on a website

[16]Moreover, note that the travelling times within the same municipality is not equal to zero, but strictly positive, because the data also cover travels from one location to another within the same municipality.

[17]To be allowed to drive a car or a motorbike in Switzerland, one must be 18 years or older.

[18]Indeed, a simple regression of the mean travelling time on the median elevation of a municipality yields an R-squared of 0.52.

(www.anforderungsprofile.ch) and they are intended for use by both prospective apprentices, their parents and teachers, as well as vocational counselors. The underlying data are used and described in more detail in Kuhn and Wolter (2022b), for example, in their study on gender differences in occupational choices of adolescents.

For the analysis at hand, I focus on the overall cognitive requirements of an occupation as well as on the broad task content of an occupation along the things-versus-people orientation, which broadly distinguishes between occupations that focus more on working with inanimate things, such as a mechanical engineer or a carpenter, or rather on interacting with other people, e.g. a healthcare assistant, a hairdresser or a bookseller.[19] Both variables are derived from a simple principal-components analysis based on the four variables describing the cognitive requirements in the four main school subjects (again, see Kuhn and Wolter, 2022b, for details). These additional variables allow me to map the many different occupations on two dimensions of main interest, considerably simplifying the empirical description of the spatial variation in the occupational structure across the different municipalities.

One downside of these data, however, is that the information on occupations' cognitive requirements and task content is available for most, but not all occupations; specifically, the data cover 133 occupations (about 67% of the total of 199 occupations). However, because they are available for almost all of the more popular occupations and because there is such a heavy skewness in the distribution of apprentices across occupations, these occupations do in fact cover a relatively large part of the apprenticeship contracts observed in the canton of Bern. For the sample of apprenticeship contracts at hand, I am able to match information on the demand level and the task content for about 81,7% of the individual-level contracts. Still, there is a non-negligible fraction of contracts for which this information is missing; this has to be kept in mind when interpreting the results based on these two specific variables.

3.4 Additional variables at the municipality level

Finally, I also use several control variables at the municipality level that are, for the most part, directly available from the Federal Statistical Office. These include several variables describing

[19] Many occupations are clearly tilted towards working either with things (e.g. a mechanical engineer) or with other people (e.g. a healthcare assistant). However, there are also occupations that combine both tasks to a certain degree, such as a commercial employee or a retail assistant.

topographical features, such as the median elevation above sea level by municipality, as well as socio-demographic variables such as the number of permanent residents in a municipality. Data on per-capita income (e.g. median and mean per-capita income, as well as on the distribution of individual income within the municipality) by municipality are taken from the Federal Tax Authority. Finally, I also merge several municipality-level results from national-level referenda or popular votes, which have been used in the past to approximate different prevailing norms (for example, gender norms). The full list of control variables is given in appendix table A.1.

4 Empirical analysis and results

The empirical analysis proceeds in several consecutive steps.

4.1 Spatial variation in the occupational structure

To start with, I use the data on the apprenticeship contracts to empirically describe the spatial variation in the occupational structure across the different municipalities of the canton of Bern. There are two different, but complementary ways to illustrate this heterogeneity across municipalities.

Spatially bound and spatially dispersed occupations

A first perspective is from the viewpoint of a given occupation, i.e. one may ask whether training positions in a given occupation are spatially clustered in a few municipalities, or whether the training occupation is more or less equally spread across the various municipalities.

Figure 4

The general idea is illustrated in figure 4, for four different apprenticeship occupations. The first two occupations are, for more or less obvious reasons, regionally clustered: namely a funicular technician (*"Seilbahn-Mechatroniker"*) and a watchmaker (*"Uhrmacher"*). In the first case, it is obvious that training in this occupation is conditional on the existence of a nearby funicular; which in turn is generally only found in mountainous regions.[20] In the case of a

[20]The occupation of a funicular technician was only established in the mid-2000s. See Strebel (2021) for a detailed account of the institutional process that eventually led to the creation of this new training occupation.

watchmaker, the regional clustering is primarily due to the historical evolution of the industry in Switzerland (e.g. Glasmeier, 2000). For that reason, most apprenticeship positions in this case are located in the northwestern part of the canton.

Of course, there are also occupations that are not regionally bound, or to a much lesser extent so, especially those that are frequently trained. Examples for such occupations are the two popular occupations of a healthcare assistant (*"Fachmann Gesundheit"*) or a commercial employee (*"Kaufmann"*). These two occupations are spread across almost all municipalities in the canton of Bern, as shown in panels (c) and (d) of figure 4.

The size and occupational diversity of local apprenticeship markets

A different perspective is to determine the number of different occupations that are trained in a specific municipality. That is, one may ask from this perspective whether the training firms in a given municipality train only a small and specific set of occupations, or whether they train across a large set of different occupations. Quite obviously, this will in part directly depend on the total number of training positions available in a specific municipality, and thus on the size and structure of the local labor market and the local economy in general.

Figure 5

This is graphically illustrated in figure 5, which plots the log number of distinct occupations against the log number of apprenticeship contracts (using base-10 logarithms on both axes). Clearly, and not surprisingly, the size of the local apprenticeship market, measured by the total number of apprenticeship contracts, is strongly associated with the total number of distinct apprenticeship occupations trained in a specific municipality.[21]

While there is variation in the number of distinct training occupations for a given number of apprenticeship contracts within a municipality, the main regularity evident from figure 5 is that the number of distinct training occupations closely aligns with the size of the local apprenticeship market. Of course, this may have implications for individuals' occupational choice because the structure of the available training occupations ultimately restricts adolescents' choices (i.e.

[21] A simple regression of the log number of occupations on the log number of contracts yields an R-squared of about 0.94. Thus the size of the local apprenticeship market, measured by the total number of apprenticeship contracts, closely predicts the variation in the number of distinct training occupations.

from the perspective of the individual apprentice, the choice set is determined by the apprenticeship positions offered by employers in the neighborhood they are searching); and a similar argument applies to employers searching for an apprentice. Note that the net effect for a given individual apprentice is not obvious, exactly because a larger set of different occupations goes hand-in-hand with more adolescents applying for these apprenticeship positions.

4.2 Summary measures of the size and the occupational structure of local apprenticeship markets

In the next step I use the additional information on occupations' cognitive requirements and broad task content along the things-versus-people orientation to describe the spatial variation of a region's occupational structure simultaneously across (almost) all occupations. To construct these measures, I also want to take into account that adolescents will consider not only training positions in the municipality they actually live in, but presumably also those in their broader neighborhood.

Apprentices' commuting patterns

In an ancillary step, however, I first take a look at the distribution of the effective travelling times apprentices undertake when traveling from their homes to their training firms and back – this allows me to objectively define what the relevant neighborhood for the typical apprentice in fact is. Note that I can recover this information only because the data on the apprenticeship contracts contain both the location of the apprentice's domicile (or that of his/her parents, respectively) as well as the employer's location. I can thus merge the travelling time by public transportation for each individual apprentice who is covered by the data, i.e. I match the travelling time for each pair of apprentice and employer from the data matrix on pairwise travelling times (as discussed in section 3.2 above).

Figure 6

The result is graphically illustrated in figure 6, which shows the frequency distribution of

all individual (one-way) travelling times by public transportation in minutes.[22] More precisely, panel (a) shows the individual travelling times from an apprentice's domicile to the location of his/her training company, while panel (b) plots the cumulative frequency distribution of the same variable. When the apprentice lives in the same municipality where his/her employer is located, note that the travelling time is strictly larger than zero because the underlying data record a positive travelling time for individuals commuting from one place to another within the same municipality. Both figures show the distribution of travelling times truncated at 120 minutes because longer travelling times are very rare (only about 1.5%). On average, apprentices need about half an hour (mean travelling time of about 33 minutes) to travel from their domiciles to their training firms, or vice versa. There is a pronounced skewness in the distribution of travelling times, with about 25% (50%, 75%) of the apprentices travelling 12 (27, 47) minutes or less per single commute. Remarkably, however, almost 25% of the apprentices do travel about 90 minutes or more per day (i.e. counting the time needed to travel back and forth).[23]

Constructing a weighting functions

I will use this information on the distribution of actual commuting times to construct a simple weighting function used to aggregate the number of available training positions located in the neighborhood of any given municipality in the canton of Bern. Specifically, I assign a weight of 1 to positions located in the very near vicinity and reachable within 15 or less minutes, and a weight of 0 for all positions with a travelling distance of more than 90 minutes. The remaining weights are constructed by linearly interpolating the weighting function in the range of travelling distances between 15 and 90 minutes (cf. appendix figure A.4 for a graphical representation).

Figure 7

By way of illustration, figure 7 maps the resulting weighting function for the municipality of

[22]Keep in mind, however, that I have excluded apprentices who signed an apprenticeship contract with an employer outside the canton of Bern.

[23]Given that the regular working hours equal 8.4 hours per weekday, this amounts to relatively long hours that apprentices spend either working or commuting to or from work. In fact, legal regulations with regard to work hours as well as night and shift work are more restrictive for apprentices than for regular workers.

Thun, a medium-sized city (by Swiss standards) with about 43,000 residents in the year 2014 and located relatively central in the canton, on Lake Thun (*"Thunersee"*), as well as for the bilingual municipality of *Biel/Bienne*, another city of similar size (about 54,000 residents in the year 2014) located in the northwestern part of the canton. The location of the two municipalities within the cantonal borders is shown in the two left-hand panels of figure 7. In turn, the two figures on the right plot the weights when taking the perspective from an adolescent residing in Thun or Biel/Bienne, respectively. Not only can individuals from the two municipalities reach different regions within the same time, it is also the case that individuals living in different municipalities tend to be able to reach a different number of municipalities within the same amount of travelling time.

Spatial variation in the size and the structure of the local apprenticeship market

In a next step, and using this weighting function, I compute the spatially weighted number of apprenticeship positions available for every municipality located in the canton of Bern, as well as the spatially weighted structure of the local apprenticeship market (by construction, this procedure also generates values for municipalities which do not actually host any apprenticeship positions in the year 2014). The result can again easily be illustrated graphically, by mapping the resulting weighted variables across the different municipalities.

Figure 8

The first two panels of figure 8 show the spatial variation in the size of the local apprenticeship markets, by mapping the (weighted) absolute number of apprenticeship contracts and the (weighted) absolute number of distinct apprenticeship occupations across the various municipalities. Not surprisingly, panel (a) of figure 8 shows that apprenticeships are heavily clustered around the city and broader agglomeration of Bern. Panel (b) shows that this goes hand-in-hand with a similar pattern in the number of distinct training occupations available in a given municipality, also consistent with figure 5 above. Thus, larger local apprenticeship markets are characterized by a more diverse set of training occupations.

The results for the occupational structure are much less obvious, at least in their graphical representation, yet still suggest that there is variation across local apprenticeship markets.

Panel (c) of figure 8 maps the spatial distribution of the average demand level of all apprenticeships located within a given municipality; note that the more lightly (darkly) shaded areas in this figure correspond to a higher (lower) overall demand level. Analogously, panel (d) maps the spatial variation in occupations' broad task content along the things-people dimension (remember that this variable is independent of the overall demand level of occupations). In this case, more darkly shaded areas denote areas where the occupational structure is more heavily tilted towards things-oriented occupations (e.g. crafts or technical occupations), while more lightly shaded areas correspond to regions where the occupational composition tends towards more towards people-occupations (e.g. occupations in the care sector). For both variables, it appears that there is variation along the urban-rural dimension as well as between the two language regions (section 4.4 below will give a more definitive answer).

4.3 Spatial variation in economic and social variables

In a further step, I show that there is spatial variation in various socio-demographic and economic variables, such as median per-capita income or the distance to the nearest baccalaureate school, as well. Note that the geographic features of a municipality may influence some, or perhaps most, of these variables, which makes these variables endogenous (however, as I have stressed in the introduction, the aim of my empirical analysis is descriptive and explorative – and thus I deliberately sidestep the discussion about cause and effect).

Figure 9

Figure 9 shows the spatial distribution of four selected variables. The figure in the top-left panel, panel (a), maps the distance from any given municipality to the national border. This feature could be relevant if, for example, employers closer to the national border have easier access to cross-border workers than employers located farther away, ceteris-paribus (as argued by Aepli and Kuhn, 2021). Panel (b), in turn, shows the distance of any given municipality to the municipality/city of Bern, with more darkly shaded areas representing more distant municipalities. Due to the existence of agglomeration economics, this variable could be relevant in various ways. Next, panel (c) plots the distance to the nearest baccalaureate school, which potentially affects both the number and the composition of adolescents choosing to complete an

apprenticeship training. Finally, panel (d) maps the distance to the German-French language border, which partially runs through the canton of Bern (as mentioned in section 2 above, there is a French language minority in the northeastern part of the canton).

Figure 10

Next, figure 10 shows the spatial variation in some selected economic and social variables. Panel (a) shows the spatial variation in the median per-capita income. Again, there is a very clear spatial pattern, with higher median incomes clustering in the more urban regions, and especially in the municipalities located around the city of Bern. Panel (b) shows that there is spatial variation in the distribution of taxable income as well. Interestingly, the pattern looks quite different from the pattern for median income in that inequality appears to be higher not only in the more affluent municipalities (i.e. those in the agglomeration around the city of Bern), but also in the regions with lower median income (in the southern as well as in the northeastern part of the canton).

The final two figures show the spatial variation in two empirical measures of local norms, approximated using municipality-level results from various national-level votes. Panel (c) plots the spatial variation in local gender norms, where darker areas reflect more progressive gender norms (see Kuhn and Wolter, 2022a, for details). Panel (d) shows the variation in the results of a vote which demanded more public involvement in the provision of apprenticeship positions, which has been used to measure local norms describing the role of the state in the provision of apprenticeship positions (Aepli *et al.*, 2021; Kuhn *et al.*, 2022). Interestingly, both variables show a similar spatial pattern, with variation not only between urban and rural areas, but also between the two language regions (i.e. between the German and the French language regions).

Overall, the descriptive evidence from figures 9 and 10 suggests that almost every variable which could be relevant in the context of occupational choice shows considerable spatial variation. This in turn suggests that the geographic features of a given municipality may predict variation in characteristics of local apprenticeship markets, such as their size or their occupational structure (again, in a descriptive rather than in a causal sense).

4.4 Geographic features predict the size and structure of local apprenticeship markets

In the next and final step of the empirical analysis, I thus try to directly relate several geographic as well as some economic and demographic features of a municipality with the main summary measures of the size and structure of a local apprenticeship market, using simple linear regression models of the following form:

$$o_j = \alpha + \beta g_j + \gamma x_j + \epsilon_j, \tag{1}$$

where the dependent variable o_j denoting a summary measure of either the size or the occupational structure of the local apprenticeship market of municipality j (i.e. the dependent variable is one of the four measures mapped in figure 8). Municipalities' geographic features, such as the median elevation or the roughness of the terrain (approximated by the observed range in the elevation within a given municipality), are denoted by vector g_j in equation (1), and socio-demographic and economic features are denoted by x_j. This second set of variables includes median income or local gender norms, for example. The number of observations is given by the number of distinct municipalities in the canton of Bern as of the year 2014 ($J = 362$).

Because my main interest is in exploring the overall relevance of geographic features on the size and structure of local apprenticeship markets, the estimated coefficients associated with g_j, i.e. the parameter vector β, is for once of only subordinate interest. I therefore mainly focus on corresponding F-statistics as well as on the R-squared associated with the estimated regressions, as these will describe how closely the geographic features overlap with the summary measures of the local apprenticeship market.

Table 3

The results are presented in in a very compact form in table 3. For each of the four different dependent variables, I estimate two different regressions. The first specification is a regression which only includes municipalities' geographic features as predictors; the second specification also includes the additional economic and demographic control variables. In the main part of the table, I show the robust F-statistic associated with testing the null hypothesis that the

geographic features of a municipality have, taken together, no explanatory power in predicting variation in the corresponding dependent variable (i.e. the first test statistic relates to the null hypothesis that $H_0 : \beta = 0$). Analogously, a second robust F-statistic tests the null hypothesis that the additional economic and demographic controls have no predictive power, conditional on the geographic variables (i.e. $H_0 : \gamma = 0$). As mentioned above, the regressions which include both the geographic and the socio-economic features as predictors presumably underestimate the overall relevance of municipalities geographic features because part of their effect will be picked up by variation in the socio-economic controls (see also appendix table A.2, which makes this explicit for a few selected variables).

Turning to the estimation and test results, the first column of table 3 shows that, consistent with the patterns from figures 8 and 9, the geographic variables are overall highly predictive of the size of the local apprenticeship market (the resulting robust F-statistic is about 135 and statistically highly significant, and the R-squared associated with the regression equals 0.78). This clearly shows that a municipality's geographic features genuinely drive the variation in the local number of apprenticeship contracts. Including additional economic and demographic controls further increases the fit of the model, though not by a huge amount, with a R-squared of 0.803 (but keep in mind that the controls are presumably also highly correlated with each other, thus the relatively small increase may simply be due to that feature of the underlying data; see also appendix table A.2). In fact, this is consistent with the large drop in the F-statistic associated with the geographic predictors. Nonetheless, both F-statistics are statistically significant for this specification, suggesting that both the geographic and the socio-economic features of a municipality predict variation in the characteristics of the local apprenticeship market. The results are qualitatively and quantitatively similar for the number of distinct occupations trained in a given local apprenticeship market, as evident from columns (3) and (4) of table 3.

The remaining four columns of table 3 focus on the occupational structure, i.e. the weighted level of cognitive requirements and the things-orientation of local apprenticeship markets. First, regarding the overall demand level, columns (5) and (6) suggest that the observable variation in the demand level of the training occupations is also related to municipalities' geographic features. However, the predictive power of the geographic variables is substantially lower than for the preceding two outcomes. This is reflected both in lower F-statistics as well as in a

smaller R-squared. Finally, the last two columns of table 3 show the results for occupations' task content along the things-people orientation. Similar to the overall demand level, municipalities' geographic features predict variation in the things-orientation, but both F-statistics and R-squared are substantially smaller than for the two measures of the size of the local apprenticeship market (but at the same time larger than for the level of cognitive requirements).

4.5 Implications

None of the results and patterns presented above is really surprising – yet one may argue they may have subtle implications for various research topics in the context of adolescents' occupational choice. First and foremost, of course, spatial variation in occupational structure across different local apprenticeship markets will necessarily have a direct impact on individual occupational choices.

Beyond that, however, I would argue that there are less obvious implications as well. For example, regional variation in the structure of apprenticeship positions may impact an individual's choice between vocational and general education at the upper-secondary level because the set of apprenticeship positions to choose from differs across municipalities. In this context, note that baccalaureate schools are mostly located in those municipalities that also host the largest and most diverse apprenticeship markets, which may implicate complex effects on individual educational decision making.

Closely related, the spatial variation in the structure of the local apprenticeship markets may also have an impact on the observed variation in occupational gender segregation, given that female and male adolescents tend to prefer different apprenticeship occupations (Kuhn and Wolter, 2022b). This, in turn, may have a downstream effect on regional variation in gender differences in wages (Fuchs *et al.*, 2021).

Moreover, the fact that there are persistent differences in the structure of local apprenticeship markets may partially explain why we observe an intergenerational correlation in occupations (e.g. Aina and Nicoletti, 2018) and employers (Corak and Piraino, 2011). As another example, there may also be regional differences in the process matching adolescents with training positions, depending on the size of the local apprenticeship market. More specifically, one can imagine that the matching between training occupations and adolescents becomes better

the larger the local apprenticeship market is (on this specific issue, see Dauth *et al.*, 2018; Papageorgiou, 2020). And, last but not least, these patterns are also relevant for studies that focus on variables which inherently vary along the spatial dimension, but where the research interest is on the more substantive level. For example, results from national-level votes about various topics have been used to measure societal gender norms. In turn, these voting results have then been associated with gendered occupational choice among adolescents (Kuhn and Wolter, 2022a; Palffy *et al.*, 2021). Note that the variation in gender norms comes from observing different municipalities. This, however, means that we must take care to control of spatial differences in the occupational structure, because these have a direct impact on the outcome variables of interest.[24] Another example in this context is the widely replicated finding that the local unemployment rate prevailing at the time of an individual's first entry into the labor market has an important impact both on individuals' short- and medium-run labor market outcomes (e.g. von Wachter, 2020); again, the variation in the main regressor comes from spatial variation across regions.

Finally, the results from both table 3 and appendix table A.2 suggest a potential, if only partial, fix to this issue, at least in the Swiss context. Given that variables which describe the topographical features of a municipality are highly predictive of both variables directly describing local apprenticeship markets as well as other economic or demographic variables that are associated with these characteristics, researchers may consider including a few key topographic variables as additional control variables in their empirical analyses and check whether their results are robust to the inclusion of these variables.

5 Conclusions

Using a unique combination of different data sources, I explore the spatial differences in the size and the occupational structure of local apprenticeship markets in the canton of Bern. Even though the data cover only a small area in absolute terms, by any standard, I find that

[24] Appendix figure A.5 illustrates this argument graphically. It plots the (spatially weighted) things-orientation of the apprenticeship occupations versus progressive gender norms at the municipality level. Note that higher values on the y-axis denote a stronger orientation towards things, while higher values on the x-axis denote more progressive gender norms. Thus the more rural (urban) municipalities are located in the top-left (bottom-right) corner of the scatterplot.

there is significant spatial variation in almost every variable of potential interest, such as the total number of apprenticeship positions available in a given municipality or the task structure of a given local apprenticeship market. Moreover, the observable regional variation in both the size and the structure across local apprenticeship markets is closely associated with the fundamental topography of the canton of Bern, measured using different geographic features of the municipalities, such as the median elevation or the roughness of the terrain.

In the empirical analysis, I first show that there is considerable variation in the travelling times across different pairs of municipalities due to variation in the roughness of the terrain across municipalities, as well as due to regional differences in, for example, population density (which, of course, are also partially driven by geography). I then use this information on actual travelling times of apprentices to construct spatially weighted averages of several empirical measures of both the size and structure of local apprenticeship markets. I find that there is considerable variation in all these measures across local apprenticeship markets, and even though the canton of Bern is very small in absolute terms by any measure. I also show that a large part of this variation can, directly or indirectly (i.e. through economic and/or social characteristics), be traced back to variation in the underlying geographic features of the various regions. Yet another interesting finding is that variables that describe different aspects of either apprenticeship market or other educational options are correlated across space with each other, suggesting that adolescents are indeed faced with different choice sets.

One immediate consequence of these spatial patterns is that individuals growing up in some regions have a larger and more diverse set of educational and occupational options than individuals from other regions that are only a few kilometers away in linear distance, thereby acting as a kind of a natural restriction on adolescents' choice set. This illustrates that geography still has significant leverage on important decisions of individuals in the educational and occupational context.

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Table 1: Apprenticeship contracts in the canton of Bern, the 30 most popular occupations

Rank	Occupation j	f_j	F_j
1.	Commercial employee (*"Kaufmann"*)	16.95	16.95
2.	Health care assistant (*"Fachmann Gesundheit"*)	7.37	24.32
3.	Retail assistant (*"Detailhandelsfachmann"*)	5.79	30.11
4.	Information technician (*"Informatiker"*)	3.48	33.60
5.	Certified social care worker (*"Fachmann Betreuung"*)	3.11	36.70
6.	Mechanical engineer (*"Polymechaniker"*)	2.75	39.45
7.	Chef (*"Koch"*)	2.66	42.11
8.	Licensed electrician (*"Elektroinstallateur"*)	2.57	44.68
9.	Drafter in the field of spatial and constructional planning (*"Zeichner"*)	2.56	47.24
10.	Farmer (*"Landwirt"*)	2.45	49.69
11.	Gardener (*"Gärtner"*)	2.39	52.08
12.	Carpenter (*"Schreiner"*)	2.36	54.44
13.	Logistician (*"Logistiker"*)	2.05	56.50
14.	Carpenter (*"Zimmermann"*)	1.91	58.41
15.	Automotive technician (*"Automobil-Fachmann"*)	1.37	59.78
16.	Hairdresser (*"Coiffeur"*)	1.33	61.11
17.	Medical assistant (*"Medizinischer Praxisassistent"*)	1.25	62.36
18.	Retail assistant (*"Detailhandelsassistent"*)	1.23	63.59
19.	Automotive mechatronics technician (*"Automobil-Mechatroniker"*)	1.21	64.81
20.	Bricklayer (*"Maurer"*)	1.21	66.01
21.	Dental assistant (*"Dentalassistent"*)	1.17	67.18
22.	Painter (*"Maler"*)	1.13	68.31
23.	Metal worker (*"Metallbauer"*)	1.10	69.41
24.	Pharma assistant (*"Pharma-Assistent"*)	1.05	70.46
25.	Sanitary plumber (*"Sanitärinstallateur"*)	1.01	71.47
26.	Electronics engineer (*"Elektroniker"*)	0.94	72.41
27.	Baker-Patissier-Confectioner (*"Bäcker-Konditor-Confiseur"*)	0.94	73.35
28.	Specialist in restaurant service (*"Restaurationsfachmann"*)	0.92	74.27
29.	Mediamatics technician (*"Mediamatiker"*)	0.89	75.16
30.	Automation engineer (*"Automatiker"*)	0.88	76.04

Notes: The table lists the 30 most popular apprenticeship occupations in the canton of Bern as of August 2014. The table shows the official English description, along with the original German description (for simplicity, I show the masculine form only). f_j denotes the percentage proportion of contracts in a given occupation, and F_j gives the cumulated proportion of contracts until and including occupation j (in descending order). Note that there is both a three- and a two-year apprenticeships as a retail assistant (i.e. rank number 3 and 18, respectively) among the 30 most popular occupations. See also appendix figure A.2 for a graphical representation of the distribution of the population of contracts across all occupations.

Table 2: Descriptives for key variables

Variable	Mean	SD
(a) Municipalities' main topographical features		
Median elevation, in meters	762.67	357.26
Range in elevation, in meters	539.83	646.49
Area, in hectares	1,613.40	2,709.88
(b) Summary measures of the local apprenticeship market		
Number of apprenticeship contracts	505.26	262.45
Number of distinct apprenticeship occupations	25.69	12.20
Cognitive requirements	0.21	0.08
Things orientation	0.68	0.13

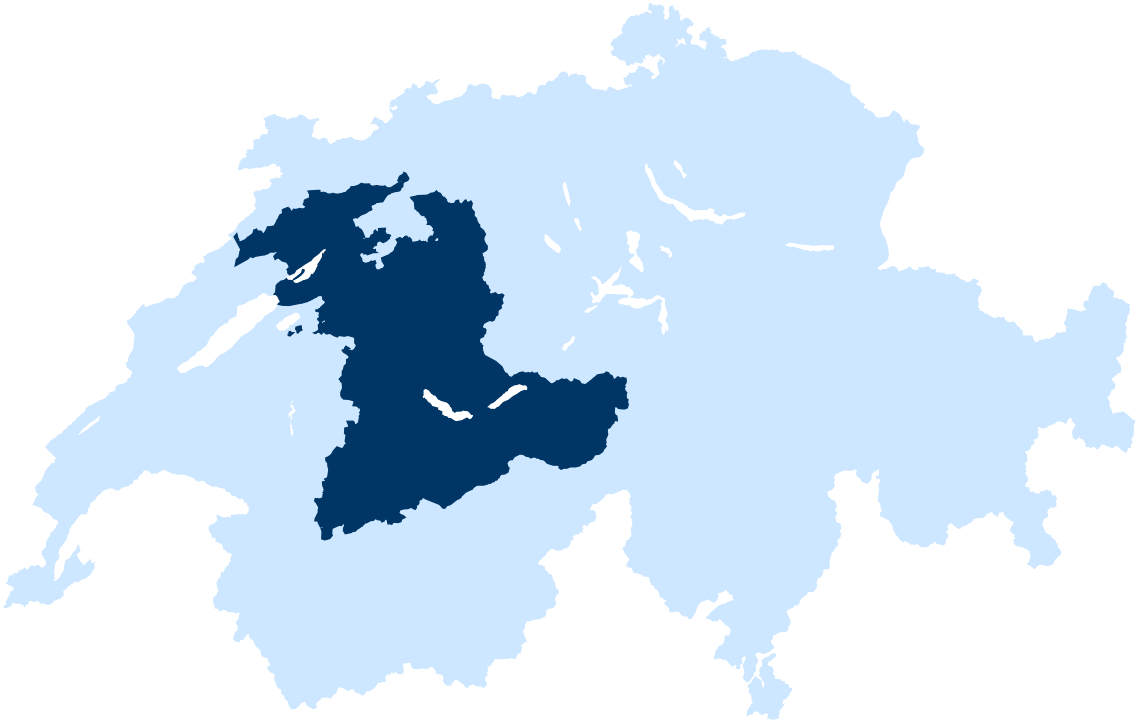
Notes: The table shows descriptives for the key variables, i.e. the geographic features of a municipality in panel (a) and the summary measures of the occupational structure of a municipality in panel (b). Descriptives for additional variables are shown in appendix table A.1. Note that the variables in panel (b) are constructed as spatially weighted averages, which implies that the descriptives do no coincide with the descriptives for the underlying individual-level data. There are 362 distinct municipalities covered by the data.

Table 3: The association between geographic features and summary measures of the local occupational structure

	Size measures				Task measures			
	#Positions		#Occupations		Cognitive requirements		Things orientation	
(a) Geographic variables								
F-statistic	134.875***	63.114***	98.966***	42.151***	11.620***	6.059***	35.180***	26.220***
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
(b) Demographic and socio-economic variables								
F-statistic		4.162***		11.005***		1.656*		5.010***
(p-value)		(0.000)		(0.000)		(0.054)		(0.000)
Number of observations	362	362	362	362	362	362	362	362
p-value (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-Squared	0.780	0.803	0.797	0.836	0.221	0.284	0.364	0.384

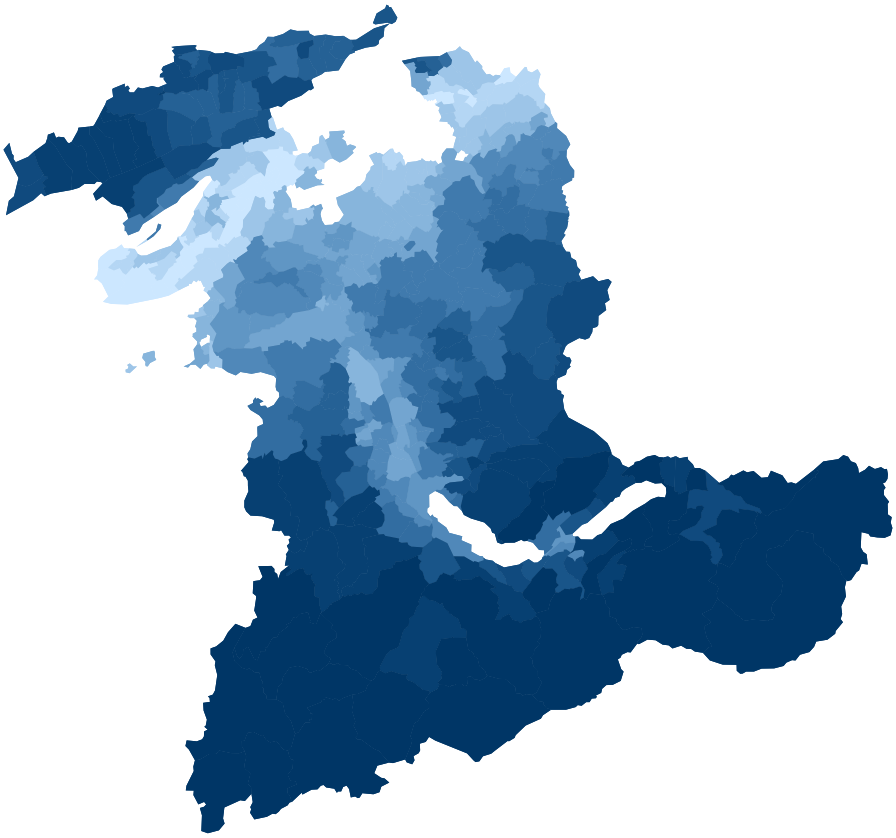
Notes: The table shows robust test statistics associated with testing the null hypothesis that the regression coefficients associated with the geographic predictors (socio-economic predictors) are all simultaneously equal to zero. ***, **, and * denote statistical significance on the 1%, 5%, and 10% level, respectively. Heteroscedasticity-robust p-values are given in parentheses.

Figure 1: The location of the canton of Bern within Switzerland



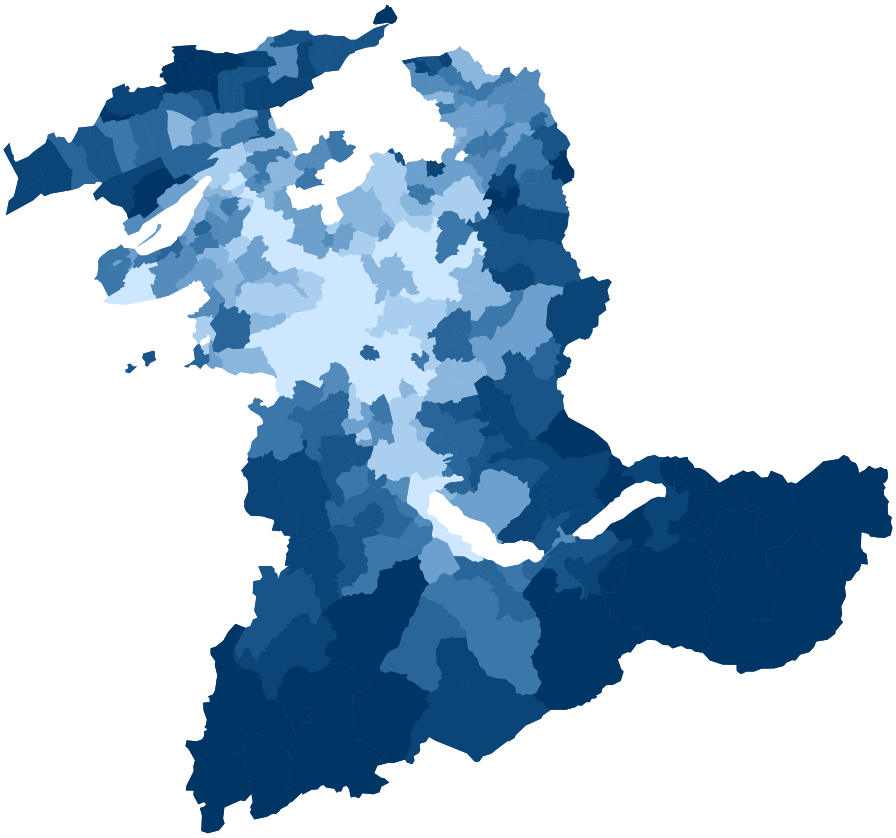
Notes: The figure highlights the location (and the relative size) of the canton of Bern (shaded in darker blue) within the borders of Switzerland. Areas in white within the country borders represent lakes.

Figure 2: The topography of the canton of Bern



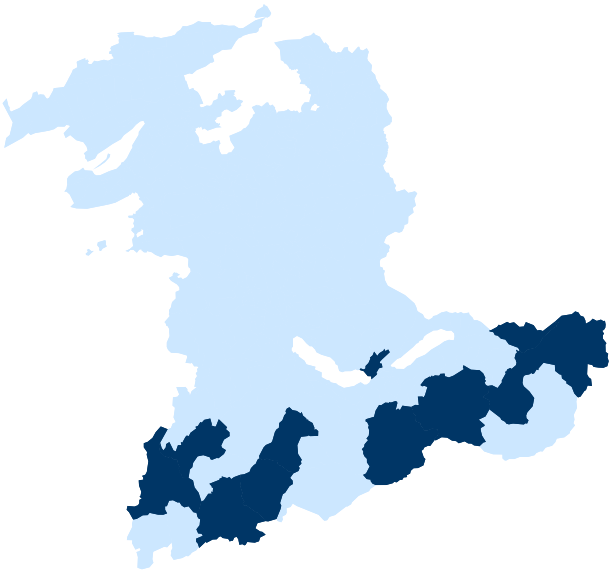
Notes: The figure shows the median elevation, in meters above sea level, for each municipality of the canton of Bern. Darker (lighter) shaded areas are municipalities with a higher (lower) median elevation. The larger areas in white within the cantonal borders are lakes. For example, in the southeastern part of the canton, one can spot the lake of Thun (*Thunersee*) and the lake of Brienz (*Brienzersee*).

Figure 3: Mean travelling times by public transport in the canton of Bern



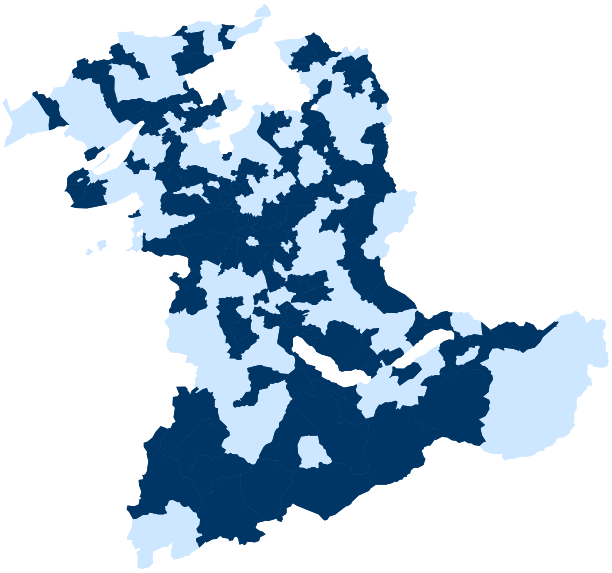
Notes: The figure shows the mean travelling time, by public transport, from a specific municipality to any other municipality in the canton of Bern. Darker (lighter) shaded areas denote longer (shorter) travelling times.

Figure 4: The spatial distibution of occupations across municipalities

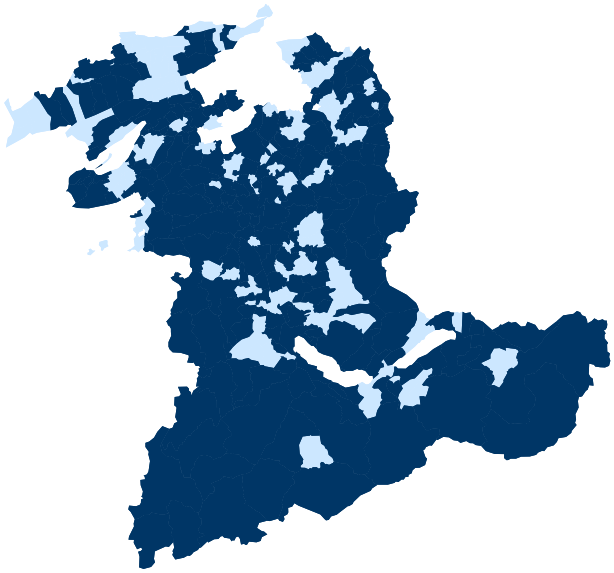


(a) Funicular technician

(b) Watchmaker



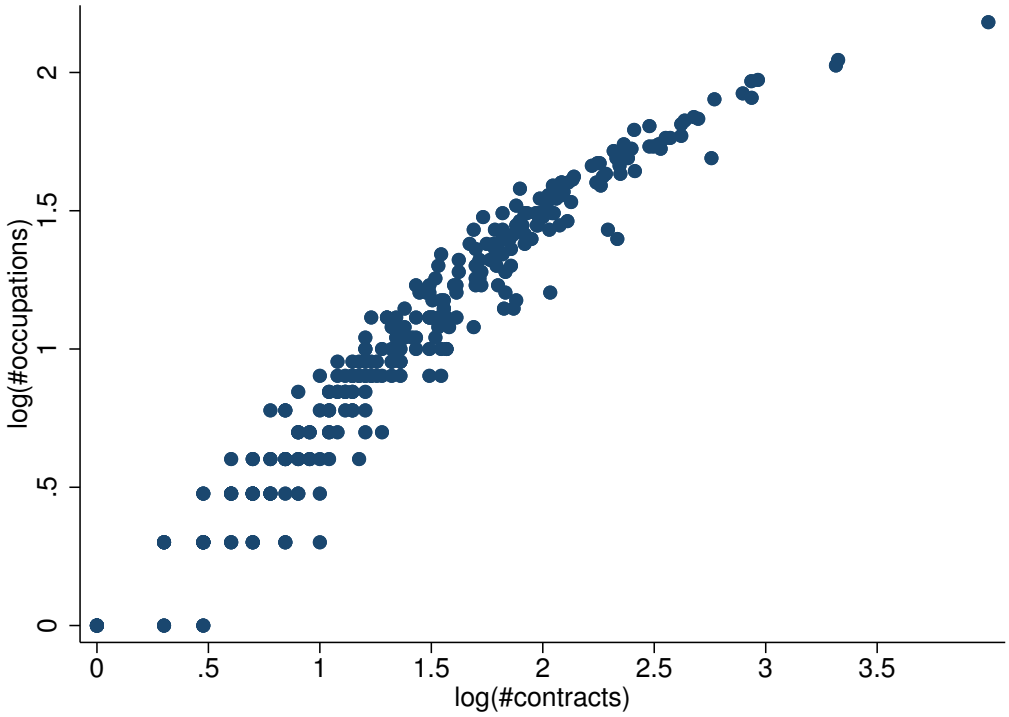
(c) Healthcare assistant



(d) Commercial employee

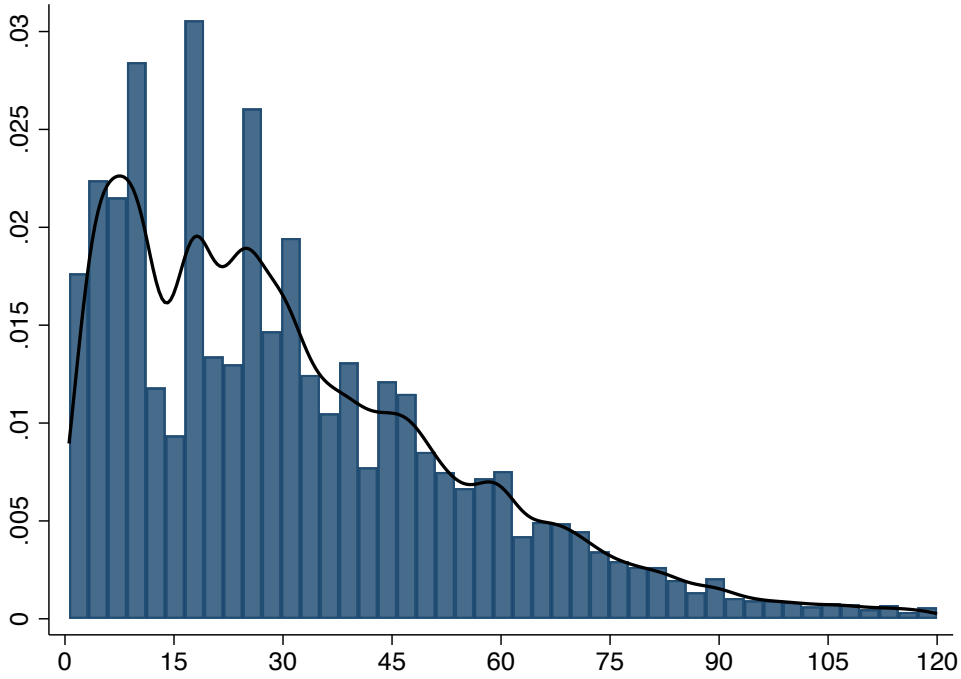
Notes: The figure maps the location of employers offering apprenticeships in four different apprenticeship occupations: funicular technician (*"Seilbahn-Mechatroniker"*), watchmaker (*"Uhrmacher"*), healthcare assistant (*"Fachmann Gesundheit"*), and commercial employee (*"Kaufmann"*).

Figure 5: The number of apprenticeship contracts and the number of distinct occupations

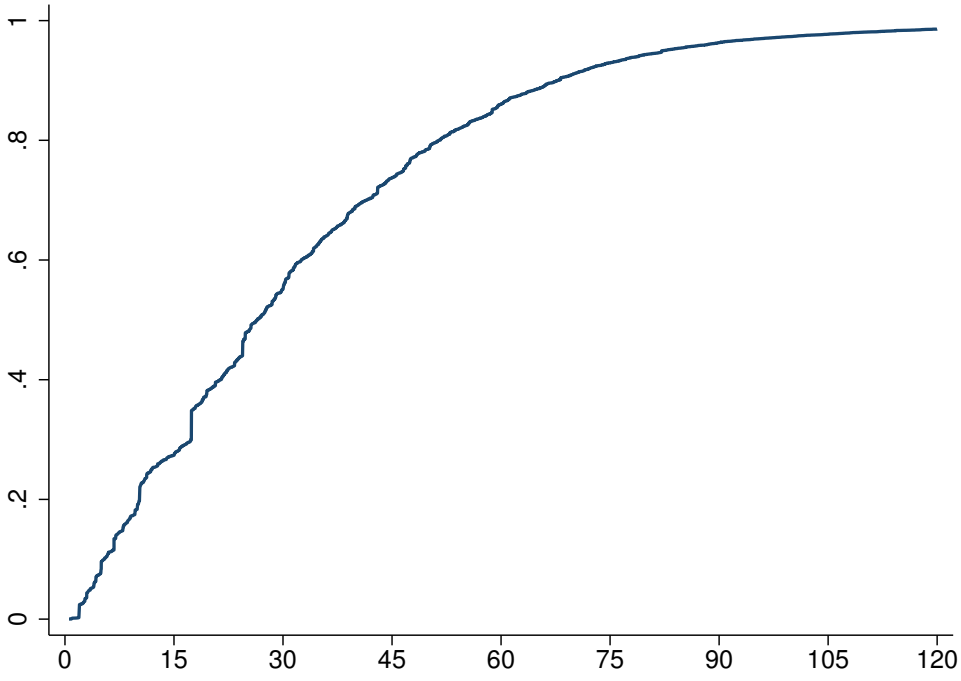


Notes: The figure plots the number of distinct occupations trained in a municipality (on the y-axis) against the number of individual apprenticeship contracts (on the x-axis) in a given municipality. Both variables are rescaled using the base-10 logarithm.

Figure 6: The distribution of apprentices' travelling times, by public transportation



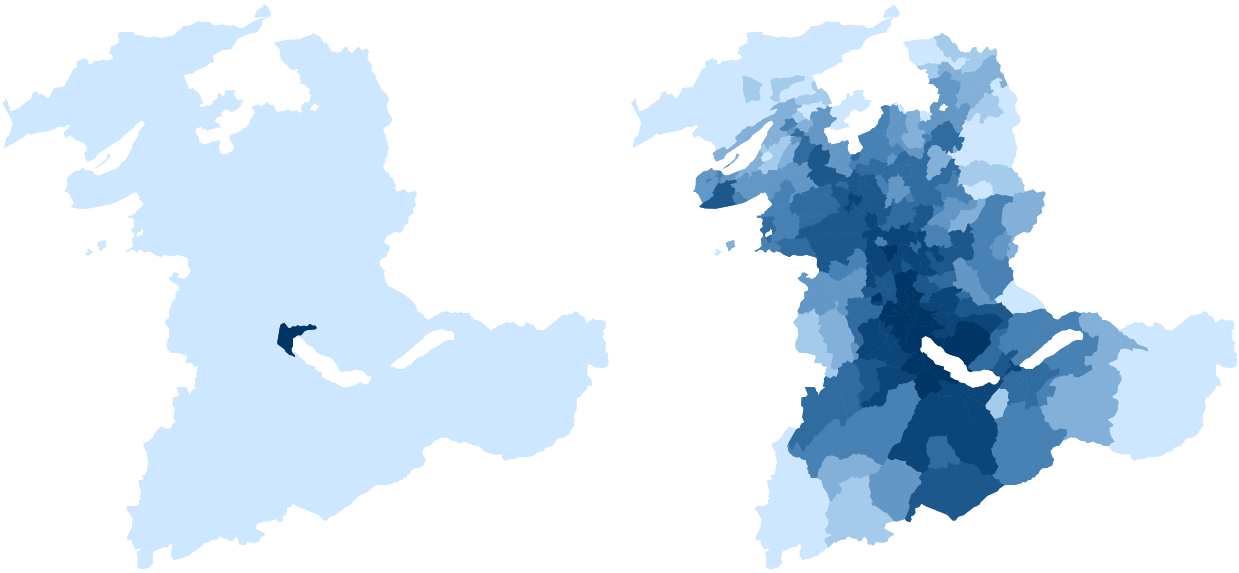
(a) Frequency distribution of apprentices' one-way commuting times



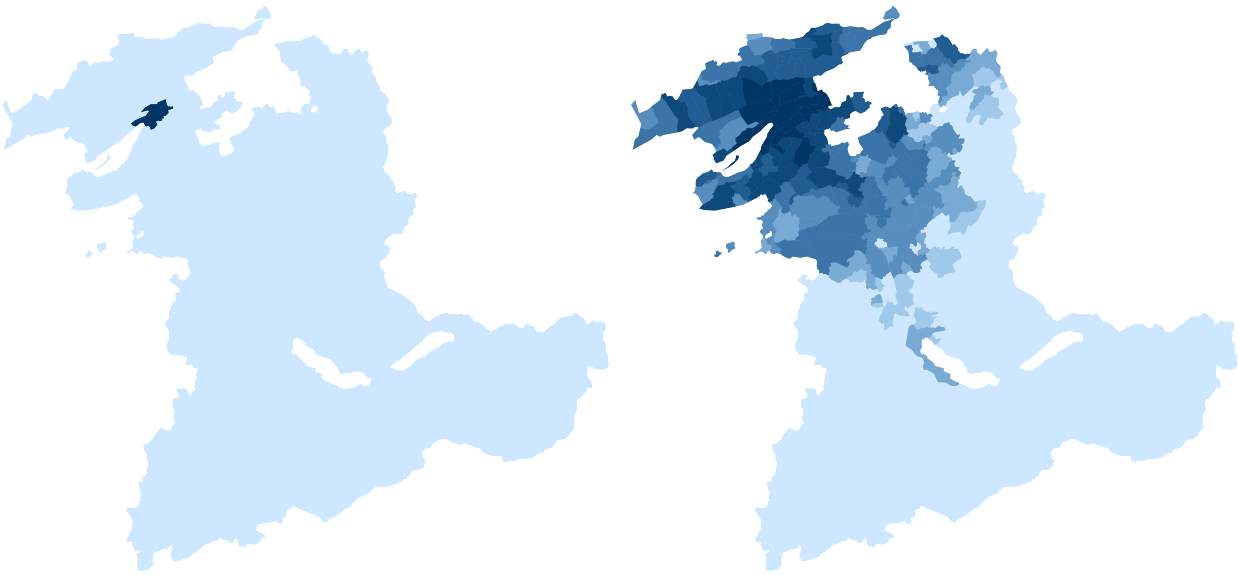
(b) Cumulative frequency distribution of commuting times

Notes: The figure at the top shows the frequency distribution (plus the estimated density function) of actual commuting times, in minutes, by public transport between apprentices' community of residence and the community hosting their training firm. The figure at the bottom shows the cumulative frequency of the same variable. Both figures are restricted to commutes of less than or equal to 120 minutes (about the 99th percentile of the full distribution of commuting times).

Figure 7: Spatial aggregation of neighboring municipalities



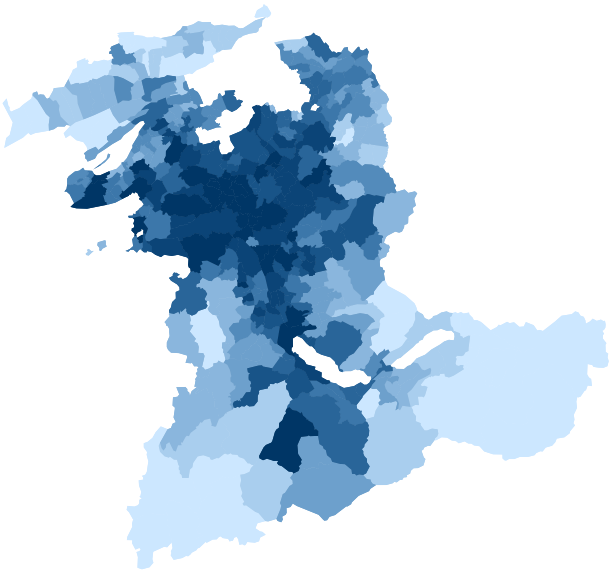
(a) Municipalities reachable from the municipality of Thun



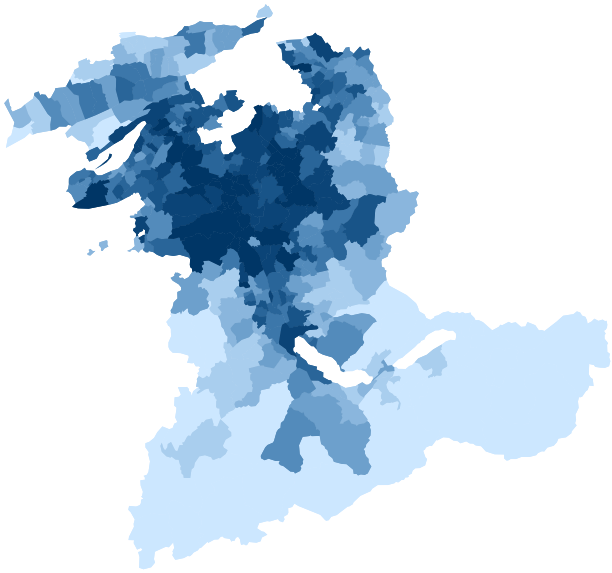
(b) Municipalities reachable from the municipality of Biel/Bienne

Notes: The two figures on the left show the location of the municipality of Thun and Biel/Bienne, respectively. The two figures on the right plot the weights derived from the distribution of actual commuting times (cf. appendix figure A.4).

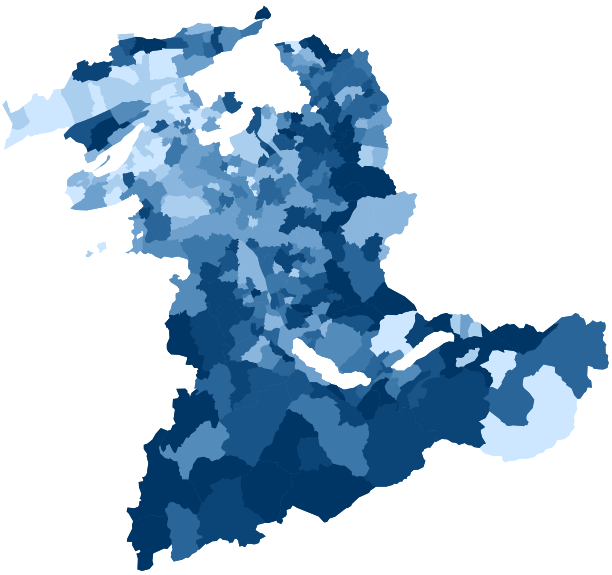
Figure 8: Spatial variation in the size and structure of local apprenticeship markets



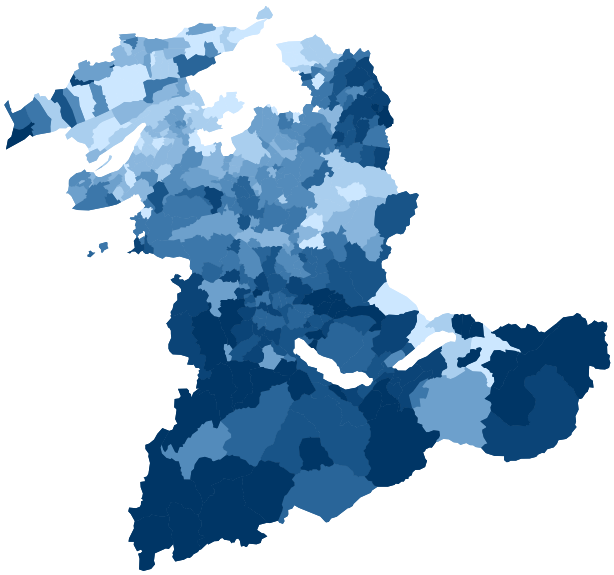
(a) Number of apprenticeship positions



(b) Number of distinct training occupations



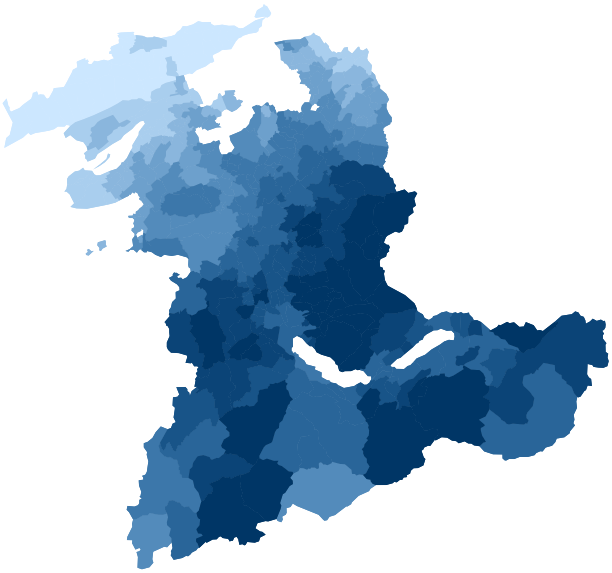
(c) Cognitive requirements



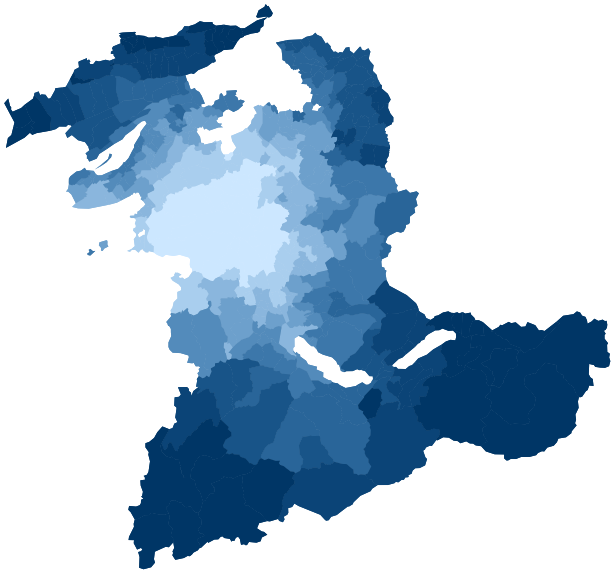
(d) Things orientation

Notes: The figure shows the spatial distribution of the two measures of the size of the local apprenticeship market, i.e. the number of contracts and the number of distinct training occupations, as well as two summary measures of the occupational structure in the local apprenticeship market, i.e. the overall level of cognitive requirements and the broad task level along the things-people orientation. See main text for details.

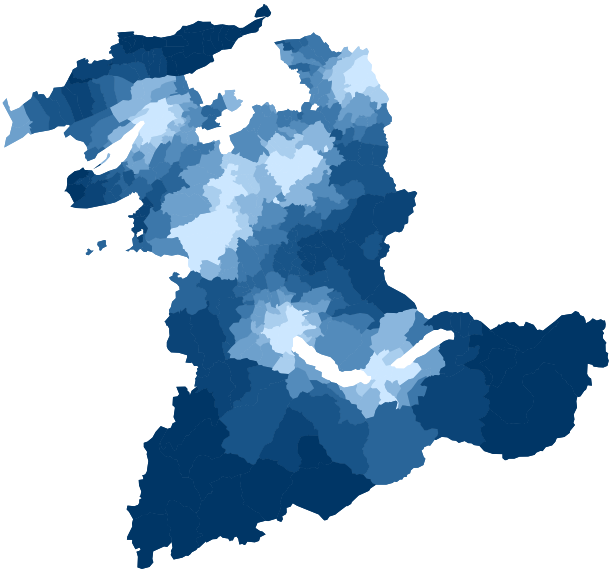
Figure 9: Spatial variation in selected geographic variables



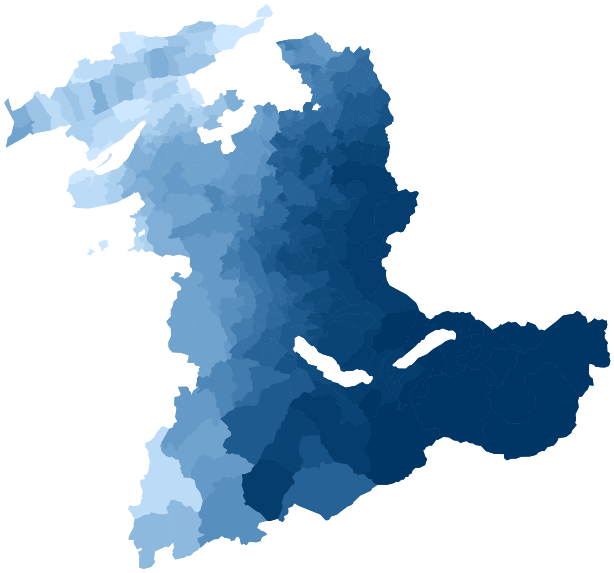
(a) Distance to the country border



(b) Distance to the municipality of Bern



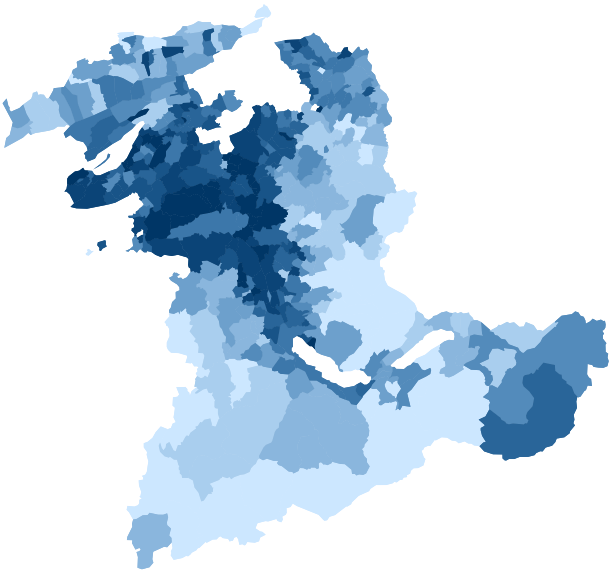
(c) Distance to the nearest baccalaureate school



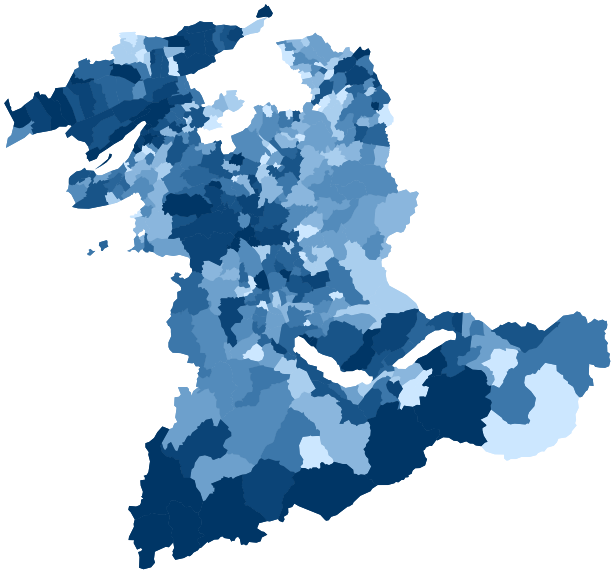
(d) Distance to the language border

Notes: The figure maps four different geographic variables of interest: the distance to the country border (i.e. the distance to the nearest border crossing (which can be crossed by car), the distance to the city/municipality of Bern, the distance to the nearest baccalaureate school, and the distance to the language border (between German and French speaking regions).

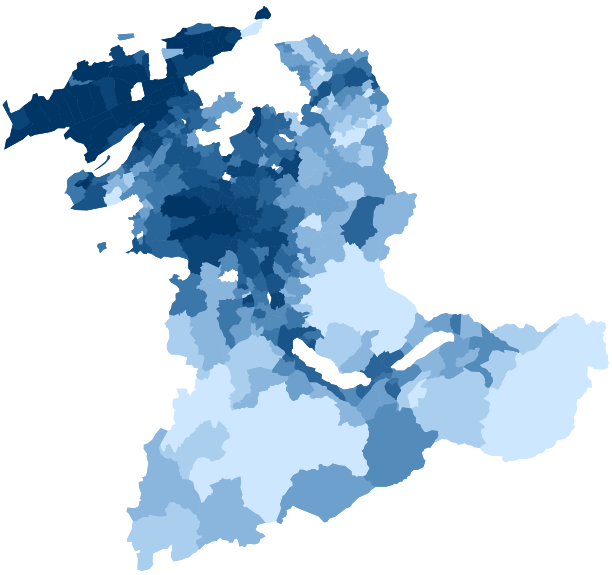
Figure 10: Spatial variation in economic variables and social norms



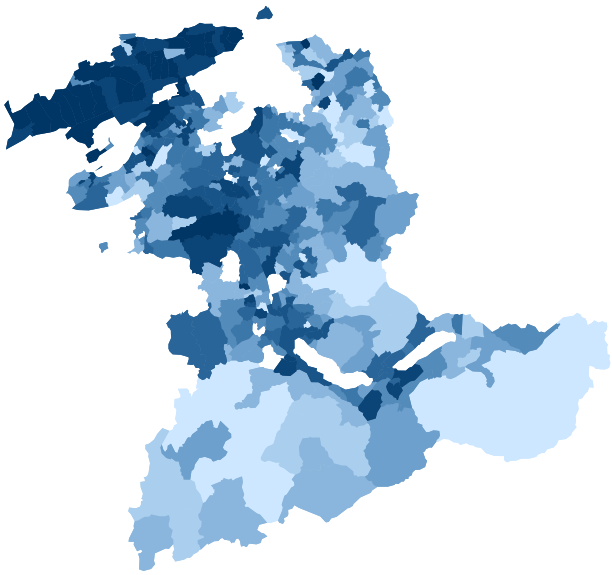
(a) Median per-capita income



(b) Gini coefficient in per-capita income



(c) Progressive gender norms



(d) Norms towards a stronger role of the state

Notes: The figure maps the median income and the gini coefficient in income, as well as progressive gender norms and local norms towards a stronger role of the state in the context of apprenticeship training.

A Additional tables and figures

Table A.1: Sample descriptives, additional variables

Variable	Mean	SD	Source
(a) Additional geographic variables			
X–coordinate (longitude), in meters	3,751.93	22,393.78	FSO
Y–coordinate (latitude), in meters	6,266.57	18,924.97	FSO
Distance to the country border, in minutes	93.32	29.05	
Distance to the city of Bern, in minutes	68.01	26.51	
(b) Demographic and socio-economic variables			
Mean per-capita income	56,061.92	25,004.97	FTA
Median per-capita income	47,418.92	6,101.31	FTA
Gini index of per-capita income	0.42	0.05	FTA
Number of taxable persons	1,767.29	5495.93	FTA
Language region:			FSO
German	0.89	0.32	
French	0.11	0.32	
Type of municipality:			FSO
Center	0.02	0.15	
Suburban municipality	0.09	0.28	
High-income municipality	0.01	0.10	
Periurban municipality	0.10	0.30	
Tourist municipality	0.05	0.21	
Industrial and tertiary municipality	0.14	0.35	
Rural commuter municipality	0.23	0.42	
Mixed agricultural municipality	0.20	0.40	
Agrarian municipality	0.16	0.37	
Number of permanent inhabitants	2,788.45	8,262.89	FSO
Proportion female	0.50	0.02	FSO
Proportion non-citizen	0.09	0.06	FSO
(c) Voting results			
Gender norms	37.49	9.25	FSO
Norms towards the role of the state	28.06	8.67	FSO

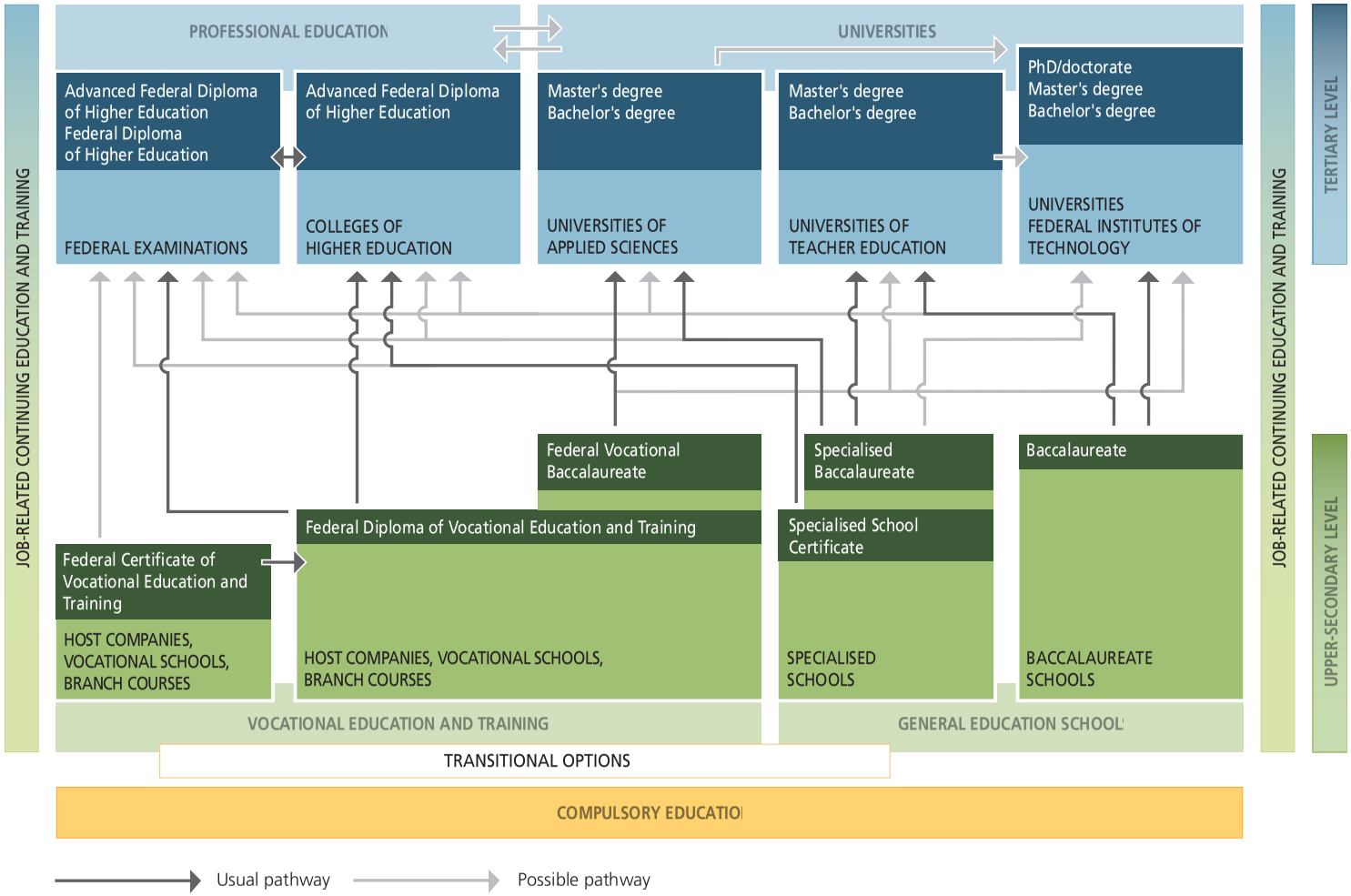
Notes: The table shows the mean and standard deviation of the additional geographic controls as well as the demographic and economic control variables used in table 3. The four variables on per-capita income and the number of taxable persons are taken from the Federal Tax Administration, all other variables are taken from various sources made available by the Federal Statistical Office (FSO), or derived from these variables. Note that the two variables from panel (c) are only used as additional outcomes in appendix table A.2. The Swiss coordinates are centered at the city of Bern (see https://www.swisstopo.admin.ch/de/wissen-fakten/geodaesie-vermessung/koordinaten/schweizer-koordinaten.html for additional details).

Table A.2: The association between geographic features and selected control variables

	Income		Labor force shares		Voting results	
	Median	Gini	Female	Foreign	Gender	VET
F-statistic	29.222***	6.211***	3.450***	17.194***	39.379***	18.583***
(p-value)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Number of observations	362	362	362	362	346	346
p-value (F-statistic)	0.000	0.000	0.001	0.000	0.000	0.000
R-Squared	0.467	0.087	0.099	0.337	0.494	0.249

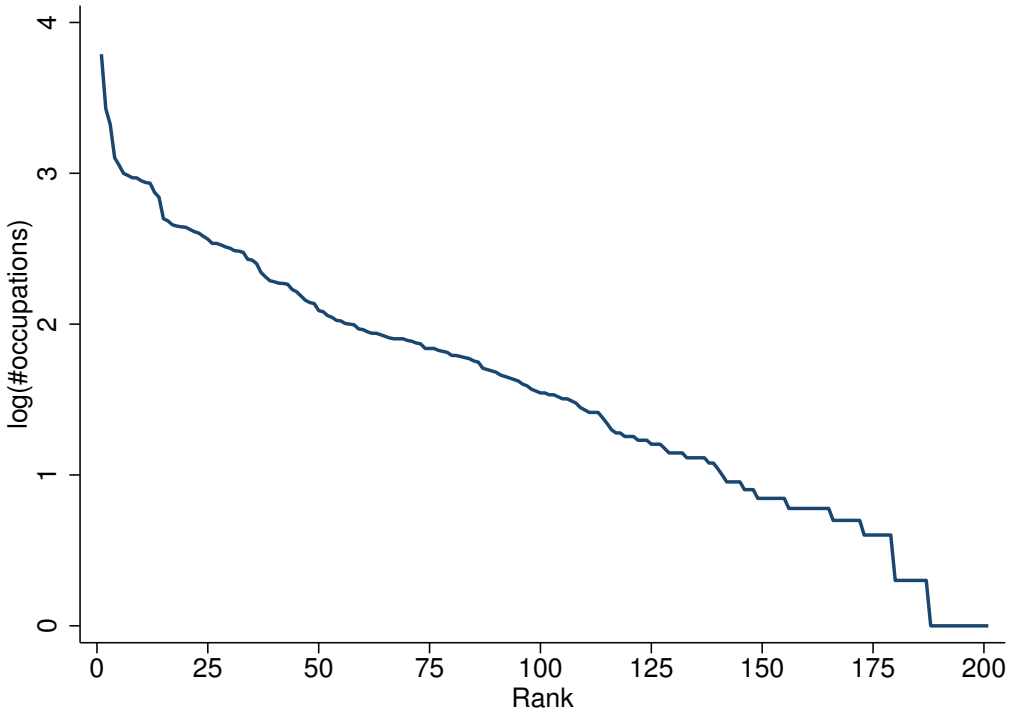
Notes: The table shows robust F-statistics associated with testing the null hypothesis that the coefficients of the geographic predictors are all simultaneously equal to zero (associated p-value shown in parentheses).

Figure A.1: The Swiss educational system

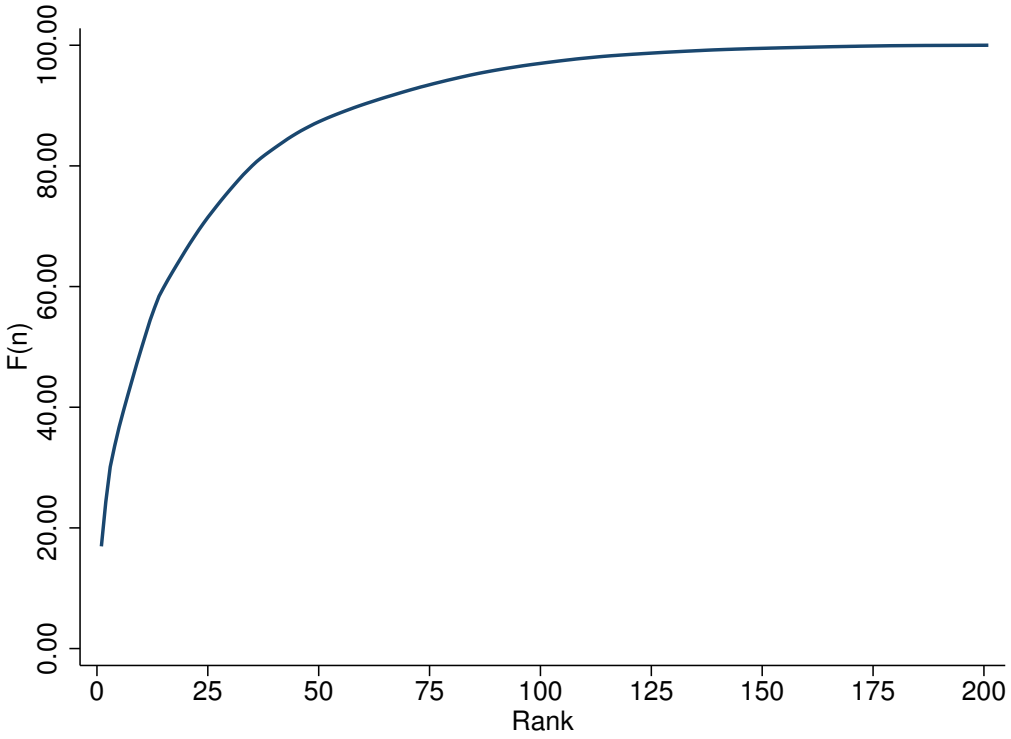


Source: Swiss State Secretariat for Education, Research and Innovation (SERI).

Figure A.2: The distribution of apprenticeship contracts across occupations



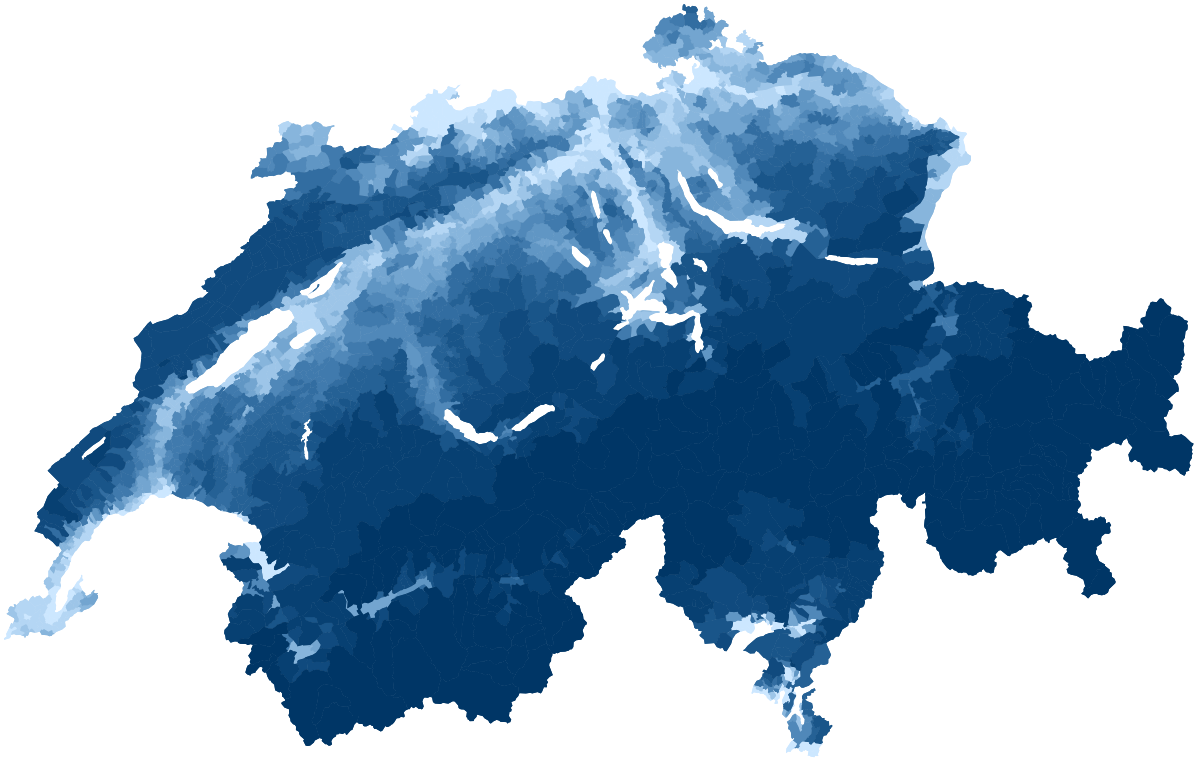
(a) The number of apprenticeship contracts by occupation



(b) Cumulative frequency of apprenticeship contracts across occupations

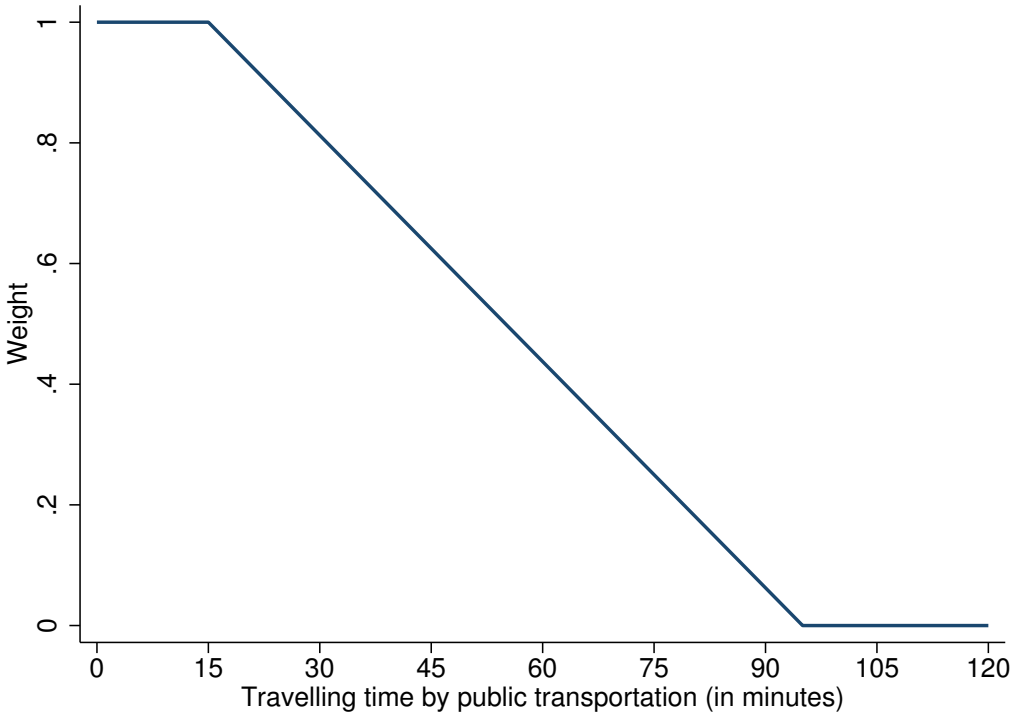
Notes: The figure at the top shows the log number of apprenticeship contracts (base-10 logarithm) against the rank of the occupation (ordered descendingly by the number of apprenticeship contracts). The figure at the bottom plots the cumulative frequency of contracts against the rank of the occupation.

Figure A.3: The topography of Switzerland



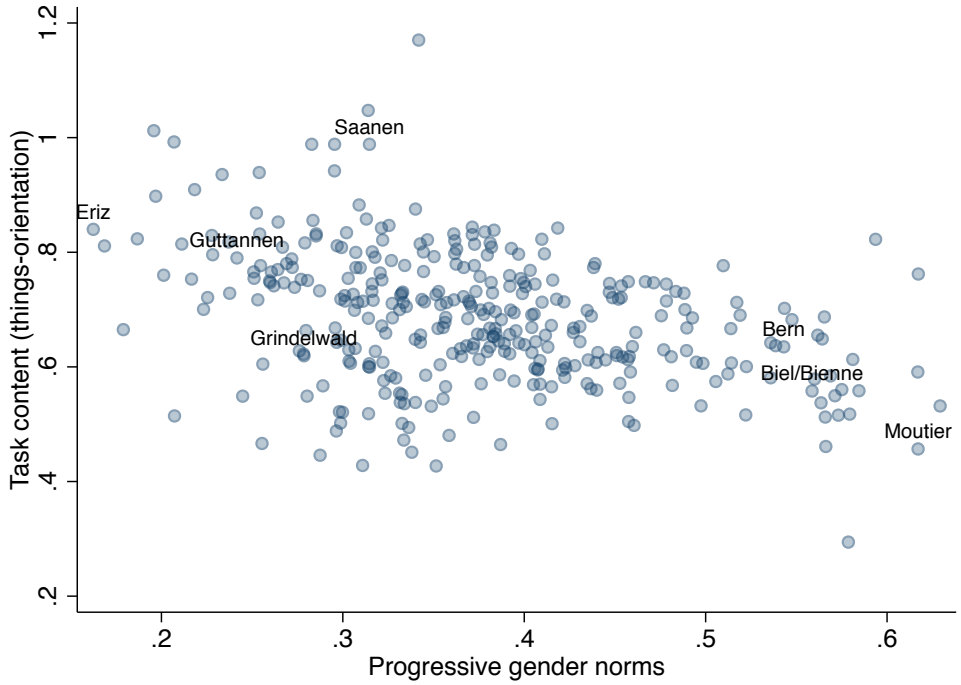
Notes: The figure shows the median elevation, in meters above sea level, by municipality. Darker (lighter) shaded areas are municipalities with a higher (lower) median elevation. The larger areas in white within the country borders are lakes. See also figure 2, which zooms in into the canton of Bern. The lowest elevation is at the shore of the *Lago di Maggiore* at Locarno in the canton of *Ticino*, at about 195 meters, the highest elevation is the peak of the *Dufourspitze* in the canton of *Wallis*, at 4'634 meters.

Figure A.4: Weighting function



Notes: The figure shows the weighting function used to construct the summary measures of both the size and structure of local apprentceship markets. The weighting function is derived from and a stylized version of the empirical distribution of apprentices' commuting times (see figure 6 as well as section 4.2 in the main text).

Figure A.5: Spatial association between task composition and gender norms



Notes: The figure plots the (spatially weighted) task composition of a local apprenticeship market (on the y-axis, with higher values denoting a stronger orientation towards things of occupations) against the prevailing local gender norm (on the x-axis). Gender norms are measured using the results from several national-level votes on policies related to gender issues such as paid maternity leave, and higher values correspond to more progressive gender norms (see Kuhn and Wolter, 2022a, for details). In drawing the figure I exclude the municipality of *Schangnau*, which is a clear outlier with regard to the things orientation (but also a small municipality).