

Quantifying Land Use Regulation and its Determinants - Ease of Residential Development across Swiss Municipalities

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Abstract

We analyze land use regulation and the determinants thereof across the majority of Swiss municipalities. Based on a comprehensive survey, we construct several indices on the ease of local residential development, which capture various aspects of local regulation and land use coordination across jurisdictions. The indices provide harmonized information about what local regulation entails and the local regulatory environment across municipalities. Our analysis shows that, among others, historical building density, socio-demographic factors, local taxes, cultural aspects, and the quality of natural amenities are important determinants of local land-use regulation. We test the validity of the index with regard to information about the local refusal rates of development projects and show that the index captures a significant part of the variation in local housing supply elasticities. Based on a machine learning cross-validation model, we impute the values for non-responding municipalities.

Key words: Local regulation, zoning, housing markets

JEL classification: R1, R14, R31, R52

1. Introduction

Local land use regulations affect the amount, location, and architecture of residential development. The existing literature establishes a clear relationship between land use regulations and inelastic housing supply.¹ As documented by Glaeser and Gyourko (2018) the inelastic housing supply has profound economic implications. Inelastic housing supply leads to higher house prices (Hilber and Vermeulen, 2016; Cosman et al., 2018), spatial misallocation of labor (Hsieh and Moretti, 2019), and lower migration response of households (Diamond, 2017). However, land use regulations also foster economic, environmental, and social goals. They limit the negative externalities arising from congestion, pollution, and overbuilding. Therefore policymakers must find the right balance in land use regulations. To analyze the impact of land use regulations, it is inevitable first to understand the nature of local land use regulatory environments. Yet, systematic information about regulatory instruments and the degree of regulation across local jurisdictions is still scarce.² In this paper, we construct a residential regulatory constraints index for Switzerland and contribute to a growing literature on the importance of land use regulation. Our results show a substantial variation in the instruments used for land-use regulation, the agents involved in the process, and the outcome of the regulatory process. We find that municipalities with a historically high population density as well as touristic places are more regulated. Switzerland provides an interesting setting to study land use regulation since it displays a high degree of autonomy of local jurisdictions such that we obtain variation in the regulatory instruments used at a fine spatial scale. Moreover, urban sprawl and the increasing land use for residential and touristic purposes have increased concerns in recent decades (see Hilber and Schöni, 2020). Finally, local jurisdictions also have considerable fiscal autonomy (see Roller and Schmidheiny, 2016), allowing us to explore interactions between land use regulation and local taxation.

Most of the land use regulation literature focuses on the US. Pendall et al. (2006) use a survey to discern how the 50 largest metropolitan areas in the US regulate land use and promote housing affordability. They find that the instruments employed by these areas vary widely across space. Also using a survey, Gyourko et al. (2008) develop a comprehensive residential land use regulatory index for over 2,600 communities across

¹See Gyourko and Molloy (2015) for a literature review.

²While the Wharton Residential Land Use Regulation Index provides such information for the US, we are not aware of such an analysis for an European country.

the US.³ The authors expound that the coastal markets are more highly regulated. Gyourko et al. (2019) renew this index with a new survey. The new results show that the Great Recession did not lead to significant changes in regulation. Glaeser and Ward (2009) examine the causes and consequences of land-use regulations in Greater Boston. Their analysis establishes a positive link between historical density and regulations. Additionally, they corroborate that regulations like minimum lot size requirements are associated with reductions in new construction activity. Brueckner and Singh (2018) compute a land use regulatory stringency measure for five US cities. Specifically, they estimate the elasticity of the land price with respect to floor to area ratio (FAR). Their estimates indicate that New York and Washington, D.C. suffer the stringiest height regulations.

The literature for Europe is scarce and we are not aware of an index about regulatory constraints of land use in Europe. Buechler et al. (2019) evaluate the role of geographic and regulatory constraints on the Swiss housing supply elasticity. They distinguish between regulatory constraints on the intensive and extensive margin. However, due to a lack of data, they rely on proxies to quantify the intensive margin regulatory constraints. There is no comprehensive and harmonized information about the local regulatory environment for Switzerland. To fill this gap, we conducted a survey among all municipalities in Switzerland and construct an aggregate index that documents how regulation of residential buildings varies across the 26 cantons and more than 2000 municipalities in Switzerland. We name this measure the CRED⁴ Ease of Residential Development Index (CERDI).

In Switzerland, cantons regulate land use by defining their zoning plans. These zoning plans are subject to general guidelines dictated by the federal government.⁵ However, land use regulations are primarily under the municipalities' control. Municipalities have a wide array of instruments to control residential developments in several ways. Most evidently, they can set regulations that simply ban development. However, regulation can also obstruct developments by restricting the intensity and type of development, or by delaying a project. Moreover, regulations may be influenced by local residents. To cover the most important factors of this complex regulatory environment, we develop several sub-indices.

³The authors call this measure the Wharton Residential Land Use Regulation Index (WRLURI).

⁴Note that CRED stands for the Center for Regional Economic Development of the University of Bern.

⁵The concepts and plans set according to Article 13 of the Federal Act on Spatial Planning (RPG) represent the most important spatial planning instruments of the federal government.

To construct the sub-indices, we firstly rely on responses from a nationwide survey on land use regulation. We complement this with rich regulation data. The sub-indices are divided into three categories. The first one pertains to the process of local regulation. In this category, we document who is involved in the regulatory process and how much influence they have over it. The second category captures the rules of extensive margin, intensive margin, and financial regulatory constraints. The last category relates to the outcomes of the regulatory process and rules. By comprising these three categories the CERDI indicates, with a simple number, how restrictive the regulations of local housing markets are across Switzerland. Note that a lower number indicates a less restrictive environment.

The remainder of the paper is structured as follows. Section 2 introduces the methodology to construct the sub-indices and the CERDI. Section 3 explains the machine learning (ML) methods employed to predict the CERDI for non-responding municipalities. Section 4 presents the land use regulation, determinants, housing, and external validation data. Section 5 reports the variation in regulatory stringency across Swiss municipalities and analyses the determinants of land use regulation. Section 6 concludes.

2. Methodology

To outline the most crucial aspects and the heterogeneity of local land use regulations, we proceed as follows. First, we document the process, rules, and outcome of land use regulations with ten sub-indices. To construct these sub-indices, we use answers from a comprehensive survey conducted in 2019 (see Appendix A.2) and land use regulation data (see Section 4.1). Second, we merge these sub-indices into a single index. This final index, named CERDI, captures the degree of land use restrictiveness across municipalities.

2.1. Land use regulation process

The involvement of actors and stakeholders in the land use regulation process differs across municipalities and cantons. The following three sub-indices reflect this involvement.

Citizens involvement index (CII): The CII measures how citizens influence the regulatory process. As argued by Frieden (1979), what we today know as NIMBYism can be a significant deterrent of development. We use the answers to the following questions to construct this index. Question 1 item (m) asks how involved voting citizens are

in affecting residential spatial planning. Question 3 item (e) asks how important the cooperation/coordination with voting citizens is, for spatial planning regarding residential building in the municipality. Question 5 item (h) asks how the citizens opposition to urban sprawl restricts the construction of residential dwellings in the municipality? Question 11 asks how many objections to building permit applications did the municipality receive in the year 2019. The first component of the CII is based on the sum of the individual responses to Question 1 item (m), Question 3 item (e), and Question 5 item (h). The second component is the number of objections to building permit applications in 2019 (Question 11) divided by the number of building permit applications (provided by Question 10).

Municipality involvement index (MII): Switzerland's federalist structure leaves municipalities considerable freedoms in affecting the regulatory process. This index captures the municipalities' involvement in this process. The following questions provide the basis for the MII. Question 1 items (a), (b), (c), (d), and (e) ask how involved the municipality executive body, legislative body, municipal secretary, building commission, and municipal administrative unit are in affecting residential spatial planning. Question 3 items (a) and (b) ask how important the cooperation/coordination with municipalities in the same canton and in neighboring cantons is, for spatial planning regarding residential building in the municipality. Question 5 item (g) asks how the municipality executive body opposition to growth restricts the construction of residential dwellings in the municipality. The index is composed of the sum of the individual responses to Question 1 items (a), (b), (c), and (e), Question 3 items (a), (b), and Question 5 item (g).

Cantonal involvement index (CAII): The CAII looks at the cantonal involvement in the regulatory process. This index only varies at the cantonal level. We use the answers of the following questions to construct the index. Question 1 items (f) and (g) ask how involved the inter-municipal administrative unit and cantonal administrative unit are in affecting residential spatial planning.⁶ Question 5 items (f) and (i) asks how the noise regulations and monument protection authority restrict the construction of residential dwellings in the municipality. To construct the CAII, we first sum up the individual responses to Question 1 items (f), and (g) and Question 5 item (f) and (i). Second, we average these sums at the cantonal level because municipalities may view the cantonal

⁶Note that the inter-municipal administrative unit is technically not managed by the cantons. Nonetheless, we include it in the CAII because the cantons often coordinate these units.

involvement differently. For example, a municipality in the country side may underestimate the cantonal involvement because the restrictions are not binding.

Organizations involvement index (OII): The OII measures how other organizations, such as cooperatives or associations influence the regulatory process. We use the answers to the following questions to construct this index. Question 1 items (h), (i), (j), (k), and (l) asks how involved a external planning office, cooperatives, associations, land owners, and investors are in affecting residential spatial planning. Question 3 items (c), (d), and (f) asks how important the cooperation/coordination with associations, land owners, and others are, for spatial planning regarding residential building in the municipality. The OII is based on the sum of the individual responses to Question 1 items (d), (i), (j), (k), and (l), and Question 3 items (c), (d), and (f).

2.2. Rules of regulatory constraints

Land use regulations affect residential developments on the extensive, intensive, and financial margin. Extensive margin regulatory constraints are measures that prevent new construction on developed land. One example is the protected forests. Intensive margin regulatory constraints govern the intensity and type of residential development. They include regulations on, e.g., height restriction or open space requirements. Financial regulatory constraints include, e.g., affordable housing requirements or the requirement to pay for pertinent infrastructure. The following six sub-indices capture the rules of regulatory restrictions.

Project approval index (PAI): The PAI looks at the required organizations to approve a new construction project. The answers to Question 4 provide the basis for this index. The listed organizations range from the municipal executive body to voting citizens. The PAI is the simple sum of the organizations required to approve a new construction project that does not need a rezoning. Thus, higher value for the PAI indicates stricter regulations.

Density restrictions index (DRI): Density restriction comes in many forms. In Switzerland, the most prevalent density restrictions are height restrictions, limits to the number of floors, FAR restrictions, and limits to boundary distances. The DRI relies on a series of questions about how binding these density restrictions are. Question 5 items (b) and (c) asks the importance of density restrictions and minimal density

requirements for the regulation of residential dwellings in the municipality. Question 6 specifies and asks which of the prevalent density restrictions are the most relevant for the regulation of residential dwellings in the municipality. Question 7 items (a) i., and ii. ask if developers have to meet minimum lot size requirements, and/or FAR requirements to build single and multi-family dwellings. Question 7 items (b) i., and ii. ask if developers have to meet minimum lot size requirements, and/or FAR requirements to build large area developments.

Extensive margin regulation index (EMRI): An important form of regulation is the protection of certain areas from development. The regulations on the extensive margin include crop rotation areas, forests, high amenity value areas, and UNESCO cultural and natural heritage sites (see Section 4 for a detailed description). The first component of the EMRI is the share of land that is protected by the regulations on the extensive margin (provided by Buechler et al., 2018). The second component is the response to Question 5 item (a). This question asks the importance of land supply in restricting the construction of residential dwellings in the municipality.

Open space and affordable housing index (OSAHI): The OSAHI is the sum of two dummy variables. The first variable takes the value of one if a developer has to include affordable housing to build large area developments (Question 7 item (b) iii.). The second variable takes the value of one if a developer has to supply mandatory open space requirements to build large area developments (Question 7 item (b) iv.).

Cost index (CI): Another important facet of local land use regulations is the costs concerning development. Developers have to pay for the building permit and allocable share of the expenses of infrastructure improvement. The CI comprises two components. The first component uses the answers to question 9, which asks how high the building permit costs are in the municipality. The second component relies on the answers to a set of questions about the fees concerning development. Question 5 items (d), (e), (k) ask the importance of new infrastructure costs, fees and duties, and capital gain tax for the regulation of residential dwellings in the municipality. Question 7 items (a) iii. ask if developers have to pay allocable share of costs of infrastructure improvements to build single and multi-family dwellings. Question 7 items (b) v. ask if developers have to pay allocable share of costs of infrastructure improvements to build large area developments.

2.3. Outcomes of regulation process and rules

The third category focuses on the outcome of the regulation process and rules. It quantifies, e.g., how easy it is and how long it takes to get a building permit. This category comprises the following index.

Outcome index (OI): The OI builds on the answers to the following questions. Question 5 item (j) asks the importance of the duration of the review process for building permits for the regulation of residential dwellings in the municipality. Question 16 asks how long does a building permit procedure for single-family and multi-family dwellings currently take.

2.4. CRED Ease of Residential Development Index (CERDI)

To aggregate the ten sub-indices, we use the following two methods. In the first, we take the simple mean of the ten sub-indices and denote the Mean Index Y_i . In the second, we use factor analysis. Specifically, we use the first principal-component factor from each sub-index to construct the aggregate index. We denote the Factor Analysis Index F_i . Factor analysis ensures that the variation of the ten sub-indices does not reflect the variation in unobserved variables.⁷ Both methods capture the local regulatory environment for each municipality in a single dimension.

To normalize the aggregate indices we employ three different approaches. First, following Gyourko et al. (2008), the CERDI is standardized using the subsequent equation:

$$Z_i = \frac{Y_i - Y_{i\text{mean}}}{Y_{i\text{sd}}}, \quad (1)$$

where Y is the aggregate Mean Index in municipality i and Z_i denotes the standardized index. Note that Z_i has a sample mean of zero and a standard deviation of one.

Second, we perform a min-max normalisation following Marchante and Ortega (2006) and Ferrara and Nisticò (2013):

$$M_i = \frac{Y_i - Y_{i\text{min}}}{Y_{i\text{max}} - Y_{i\text{min}}}, \quad (2)$$

where M_i denotes the min-max index and takes a maximum value of one and a minimum value of zero.

⁷The factor loadings for the sub-indices are: CII=0.69; MII=0.67; CAII=0.26; OII=0.79; PAI=0.61; EMRI=0.01; DRI=0.06; OSAHI=0.29; CI=0.10; OI=0.11.

Third, we compute a min-max normalization based on the type of municipality. Using the Swiss Federal Statistical Office (FSO) spatial regions (“Raumregionen”) definition, we differentiate between urban, periphery, and rural municipalities.

$$T_i = \frac{Y_i - Y_{ipmin}}{Y_{ipmax} - Y_{ipmin}} \quad (3)$$

The type of municipality is indicated by p and T_i denotes the spatial region min-max index. Like the previous normalization, this index takes a maximum value of one and a minimum value of zero. This index ensures the comparability between different types of municipalities. Note that for all indices a higher (lower) value implies more (less) regulation. Due to its simplicity, we consider the Mean Index Y_i our benchmark index.

3. Empirical framework

While the majority of municipalities responded to our survey, we still have many non-responding municipalities for which cannot directly compute the CERDI. In order to address the missing values we use the answers of our survey (see Appendix A.2) in combination with detailed data about municipal characteristics such as information about the local housing markets (rents, vacancy rates etc.), sociodemographics, political majorities etc. and a machine learning method. This allows us to predict the CERDI for the municipalities that did not respond to our survey. The main challenge of predicting the CERDI is selecting the predictors, i.e., the determinants of land use regulation \mathbf{D}' . Including too many predictors leads to overfitting. In other words, the model provides a good in-sample prediction (high R^2), but a bad out-of-sample prediction. In contrast, including too few predictors leads to omitted variable bias (Ahrens et al., 2020). This challenge is augmented by the high-dimensional data and the collinearity of the predictors. Thus, running an OLS model, including all the predictors, is incongruous for this out-of-sample prediction. To solve this challenge, we rely on machine learning methods. Specifically we use the regularization methods lasso and square-root lasso.⁸ Like OLS, the regularization methods minimize the residual sum of squares (RSS), but they *penalize* some predictors towards zero. This reduces the variance, limiting the model complexity, but at the cost of introducing some bias.

⁸Although there are numerous other regularization methods (see Ahrens et al., 2020 for an overview), we focus on lasso and square-root because, in our case, they yield the best-performing predictions.

The lasso estimator, developed by Frank and Friedman (1993) and Tibshirani (1996), is given by the following equation:

$$\hat{\beta}_{lasso}(\lambda) = \arg \min \frac{1}{n} \sum_{i=1}^n (y_i - \mathbf{x}'\boldsymbol{\beta})^2 + \frac{\lambda}{n} \sum_{j=1}^p \psi_j |\beta_j|, \quad (4)$$

where the first term denotes the RSS. The second term denotes the penalty, where λ is the overall penalty parameter and ψ_j are predictor-specific penalty loadings. Note that if $\lambda = 0$ the model is exactly like an OLS model. In contrast, if $\lambda \rightarrow \infty$ the model is empty (all predictors are set to zero). Thus, lasso minimizes the RSS subject to a constraint on the absolute size of coefficient estimates (l_1 -penalty) for given values of λ .

The square-root lasso, introduced by Belloni et al. (2011, 2014), is a modification of the standard lasso. As can be seen in the following equation, it minimizes the square root of RSS instead of the RSS:

$$\hat{\beta}_{\sqrt{lasso}}(\lambda) = \arg \min \sqrt{\frac{1}{n} \sum_{i=1}^n (y_i - \mathbf{x}'\boldsymbol{\beta})^2} + \frac{\lambda}{n} \sum_{j=1}^p \psi_j |\beta_j|, \quad (5)$$

The advantages over the standard lasso are that it is theoretically grounded, and the data-driven optimal λ is independent of the unknown error variance under homoskedasticity (Ahrens et al., 2020). However, it is computationally expensive. We predict the CERDI for the non-responding municipalities by training our models using the CERDI of the participating municipalities.

We use cross-validation for our benchmark model. I.e., we iteratively split the data in training and validation sample and select the λ that minimizes the estimate of the out-of-sample prediction error. In our case, the cross-validation runs through ten iterations. To run our predictions, we use the Stata command *cvlasso* developed by Ahrens et al. (2018, 2020).

The main advantage of regularized regressions is that they perform better in predictions with high dimensional data. They also lead to a sparser model that is more straightforward and easy to interpret. By standardizing the dependent variable and predictors prior to estimation and returning coefficients in standard deviation units, we can rank the determinants by their relative importance for predicting land use regulation. However, regularized regressions' estimates cannot be interpreted causally, and statistical inference on the coefficients is complex. These regressions do not necessarily choose

the true predictors, but variables that are correlated to them. Regularized regressions may select the true model with a large sample size, but this is only true under strong assumptions.⁹ Nevertheless, the selected determinants serve as useful indicators of what drives land use regulation, and they enable a simple comparison between municipalities.

4. Data

4.1. Land use regulation data

Regulatory constraints limit housing development. In this section, we describe the available data on the extensive margin regulatory constraints which complements our survey information. Table 1 summarizes the data sources, definitions, and importance of these data sets.

Table 1: **Data on extensive regulatory constraints**

Data	Description	Area share of Switzerland	Source
Crop rotation areas	Areas best suited for agriculture	12.3%	Cantonal offices for spatial development
Forests	Protected forest	27.7%	Arealstatistik Schweiz
Federal inventory of landscapes and natural monuments	Most valuable landscapes for Switzerland	18.9%	Federal Office for the Environment (FOEN)
Regional and national parks	Parks of national importance	12.7%	Federal Office for the Environment (FOEN)
UNESCO cultural sites	Buildings of particular architectural merit, entire towns, and sites created by the emergence of industrialisation	2.8%	Federal Office for the Environment (FOEN)
UNESCO natural sites	Natural sites with outstanding universal value	2.8%	Federal Office for the Environment (FOEN)

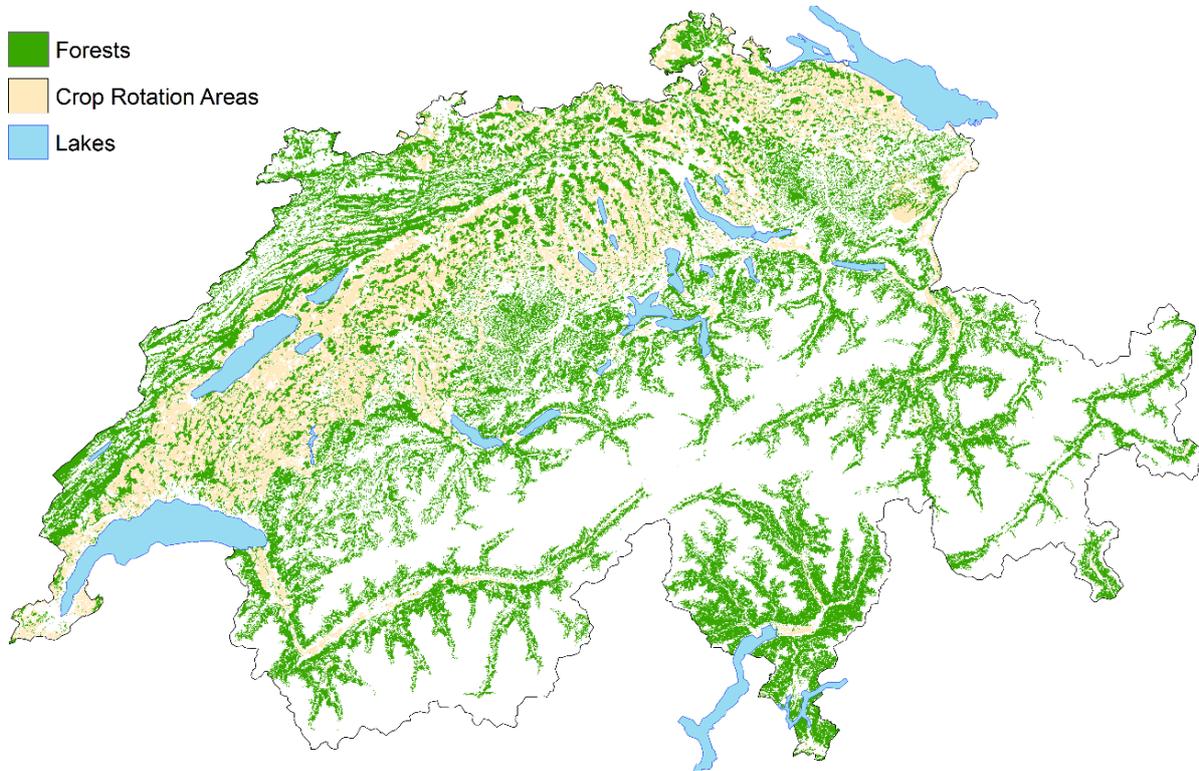
Notes: Regulations on the extensive margin are not mutually exclusive. Overall, these protected areas cover approximately 60 percent of the Swiss territory.

Regulations on the extensive margin include crop rotation areas, forests, high amenity value areas, and UNESCO cultural and natural heritage sites, as illustrated in Table 1.

⁹See Hastie et al. (2015) for a detailed explanation on the mechanics of regularized regressions.

Figures 1 and 2 show the spatial extent of these restrictions. Note that in general, regulations on the extensive margin are not mutually exclusive. For example, the UNESCO classification of an area of particular natural value might partly overlap with the boundary of a regional park.

Figure 1: Forests and crop rotation areas

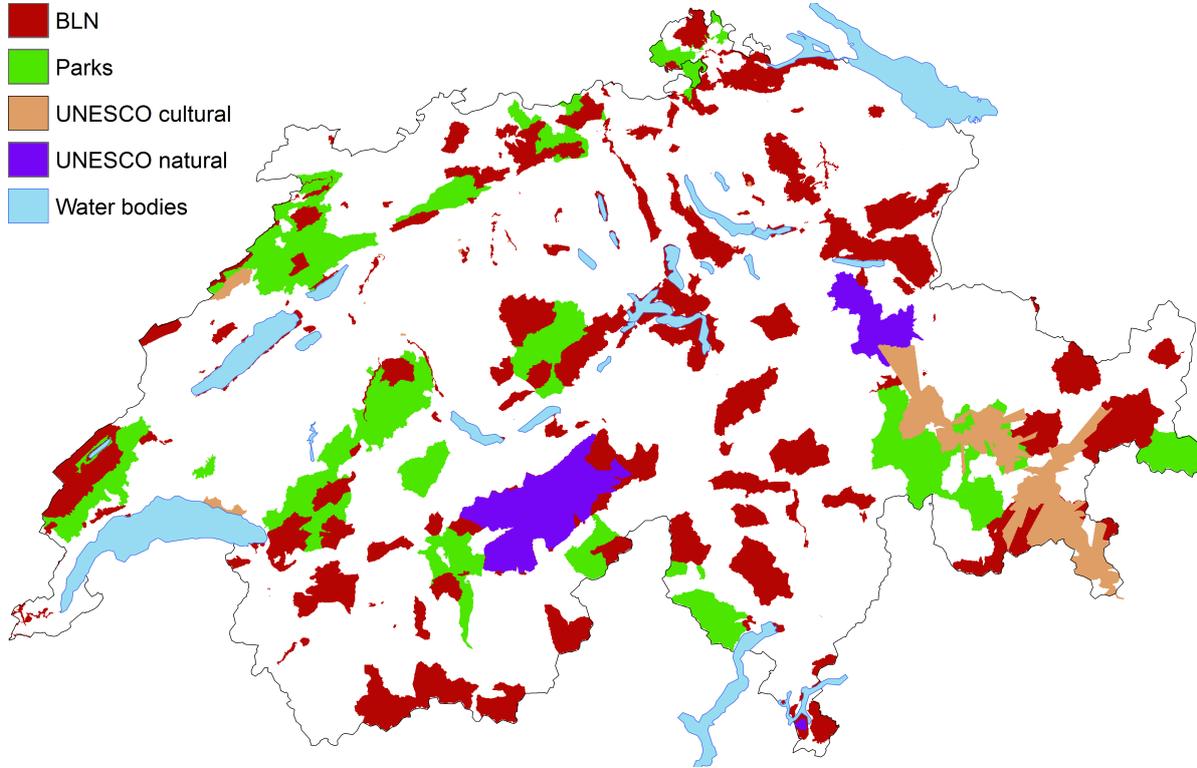


Notes: Forests and crop rotation areas may overlap due to imprecision of the FFF data. In total only 1.2% of the forest area overlaps with the FFF.

Crop Rotation Areas (FFF, Fruchtfolgeflächen) are plots of land best suited for agriculture use. These areas comprise approximately 4,400 km² of cultivable land. Their purpose – as stipulated by the Swiss Federal Law on Spatial Planning (Bundesgesetz über die Raumplanung) from 1979 – is to secure nutrition in Switzerland in the long run in case of emergency. In 1992, the Swiss Federal Council fixed the minimal amount of FFF for each canton according to stringent soil quality criteria relating to the physical and biological properties, such as soil texture, arable suitability, pollutant load, and the shape of the land parcel. For example, alpine cantons having high shares of unproductive surfaces typically have smaller FFFs. Cantons were then responsible for defining the precise location of FFFs within their boundaries. Since FFFs are allocated for agricultural use, they must not be developed. Cantons can make exceptions in this regard provided that the municipality in which the FFF is located manages to replace it with

an equivalent plot of land fulfilling soil quality criteria. Given the stringency of such rules, developers rarely employ this burdensome process.

Figure 2: UNESCO, BLN, and Parks



Notes: With the exception of lakes, colored areas correspond to extensive margin regulations. They may overlap

In response to industrialization in Europe and Switzerland, in 1876, Switzerland passed a law prohibiting further deforestation, de facto freezing forest areas to the level observed at that time. The law has remained mainly unchanged to the present day.¹⁰ As a result of these laws, the forest area in the highly populated regions has remained practically unchanged since 1876.

The Federal Inventory of Landscapes and Natural History (BLN, Bundesinventar der Landschaften und Naturdenkmäler) classifies the most typical and most valuable landscapes in Switzerland. The aim of the inventory – which was progressively introduced from 1977 to 1998 – is to protect Switzerland’s scenic diversity and to ensure that the

¹⁰The law was revised in 1991 as part of the Federal Act on Forestry (Bundesgesetz über den Wald). The revision introduced minor exceptions allowing development. For example, buildings with public utility – such as rangers’ cabins – can be built within forest areas. However, the construction of such buildings is very infrequent because i) the federal government very rarely grants building permits and ii) cleared forest areas must be replaced with new equally sized plots of land.

distinctive features of these landscapes are preserved.

Parks of national importance are characterized by beautiful landscapes, rich biodiversity, and high-quality cultural assets. The communities and cantons preserve these values and ensure their sustainment for the economic and social development of their regions.

One of the objectives of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) is to protect the cultural and natural heritage of outstanding universal value. Currently, UNESCO recognizes 981 cultural or natural heritage sites worldwide, 11 of which are located in Switzerland. These areas mostly consist of buildings of particular architectural interest, historic towns, and areas with valuable natural amenities. Overall, areas protected by FFF, forest, UNESCO, regional and national parks or BLN regulations cover approximately 60 percent of the Swiss territory (see Figures 1 and 2).

4.2. Determinants, housing, and external validation data

Table 2 provides descriptive statistics for the variables used in our empirical analysis. To check the determinants of land use regulation, we gathered data on the municipalities' density, amenities, and socio-demographic factors from the Swiss Federal Statistical Office (FSO). The Federal Register of Buildings and Habitations published by the FSO provides a census of the residential housing stock of the country. To compute the quality-adjusted house prices and capitalization rates in 2015, we use geo-referenced data on advertised residential properties provided by Meta-Sys. The data contains more than 200,000 postings of rental properties and more than 70,000 million postings of selling residences for the whole of Switzerland for 2015.

For external validity, we use the *Documedia* data to compute building refusal rates at the municipality level. We define the building refusal rate as the number of refused buildings and renovation permits divided by their total number. It reflects the effective restrictiveness of local governments regarding residential development. The change in duration from the application to the approval of a development stem from question 15 (a) from our survey (see Appendix A.2). The price and rent housing supply elasticities stem from Buechler et al. (2019).

Table 2: Descriptive statistics

	mean	min	max	sd
Density	434.77	0.86	12810.99	788.18
Density 1919	29.70	0.12	1441.33	60.04
Av. no. of floors	0.69	0.01	4.10	0.44
Dist. lakes	15.99	0.01	103.08	14.38
SE plot	0.27	0.00	0.98	0.18
Ruggedness	0.15	0.00	0.93	0.17
Culture	0.01	0.00	0.30	0.02
Income	36.24	10.75	329.28	13.70
Agriculture	0.24	0.00	2.72	0.28
Industry	0.42	0.00	26.37	0.98
Tax rate s. 80	0.14	0.05	0.19	0.02
Right	0.53	0.00	0.90	0.12
Center	0.24	0.00	0.87	0.13
Left	0.22	0.00	0.58	0.10
House price	8.61	7.22	9.54	0.33
Cap rates	0.04	0.02	0.11	0.01
Own rate	0.51	0.00	0.93	0.11
Vac. rate	0.02	0.00	0.15	0.02
Refusal rate	0.13	0.00	1.00	0.14
Approval duration	3.05	0.00	5.00	1.10
Price elasticity	0.51	0.25	0.52	0.01
Rent elasticity	3.18	0.65	3.25	0.15

Notes: *Density* denotes residents per square kilometer of area in 2019. *Density 1919* denotes flats per square kilometer of area in 1919. *Av. no. of floors* denotes the average number of floors in the municipality’s residential buildings in 2015. The ground floor counts as 0. *Dist. lakes* denotes the distance to the nearest lake in km. *SE plot* denotes the share of 100×100 meters plots facing south-east. *Ruggedness* denotes the elevation standard deviation. *sd*=standard deviation. *Culture* denotes the share employed in the creative and cultural sector in 2018. *Income* denotes the average income in 1000 CHF per person in 2019. *Agriculture* and *Industry* denote the share employed in the agricultural and industrial sector in 2018, respectively. *Tax rate s. 80* denotes the tax rate for single with a taxable income of 80,000 in 2019. *Right*, *Center*, and *Left* denote the share who voted for right, center, and left-wing parties in the 2015 Swiss national elections, respectively. *House price* denotes house prices that are quality-adjusted for the living surface, the number of rooms, age, age squared, and building type. *Cap rates* denotes quality-adjusted capitalization rates in 2015. *Own rate* denotes the homeownership rate in 2015. *Vac. rate* denotes the vacancy rate in 2019. *Refusal rate* denotes the refusal rates for new building permits in 2015. *Approval duration* is a categorical variable that stems from question 15 (a) from our survey (see Appendix A.2) denoting the change in duration from the application to the approval of a development. *Price elasticity* and *Rent elasticity* denote the price and rent housing supply elasticities for Swiss municipalities, respectively.

5. Results

5.1. Final indices

Table 3 summarizes our final indices, and Figure 3 depicts the CERDI Mean Index (for all municipalities that responded to our survey) and the predicted Mean Index. Note that we predict the Mean Index for non-responding municipalities using our ML

models described in Sections 3 and 5.7.

Table 3: **Descriptive statistics final indices**

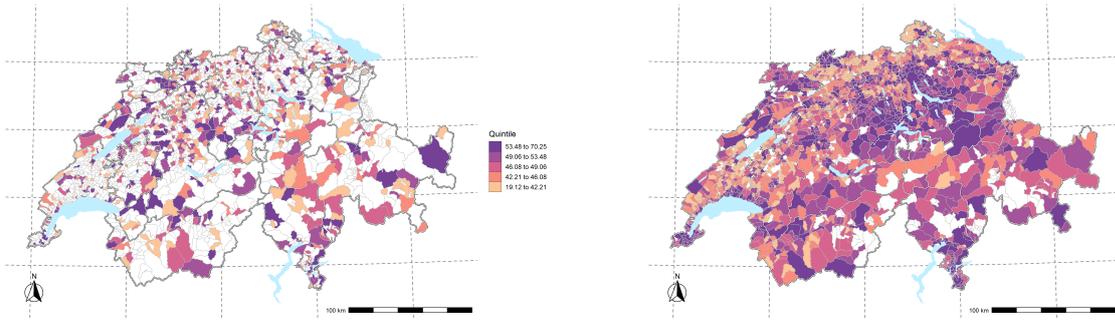
	mean	min	max	sd
Y_i	47.90	19.12	70.25	6.75
F_i	0.00	-2.82	3.39	1.00
Z_i	0.00	-4.26	3.31	1.00
M_i	0.56	0.00	1.00	0.13
T_i	0.49	0.00	1.00	0.17

Notes: Y_i = Mean Index, F_i = Factor Analysis Index, Z_i = Standardized Index, M_i = Min-max Index, T_i = Min-max by municipality types (urban, periphery, and rural) Index. sd=standard deviation. The indices are based on 715 municipalities.

Figure 3: Ease of residential development across Swiss Municipalities

Panel A: Mean Index Y_i

Panel B: Predicted Mean Index Y_i



Notes: Panel A shows the Mean Index Y_i for the 715 municipalities that responded to our survey (see Appendix A.2). Panel B shows the predicted Mean Index Y_i . To predict this index, we use a ML model (see Sections 3 and 5.7).

5.2. Indices correlation

To determine if a restrictive municipality is restrictive in all dimensions, we compute the indices' correlation. Table 4 shows the results. Predictably, the aggregate Mean Index Y_i has a strong and significant correlation with all the sub-indices. The four sub-indices capturing the land use regulation process (CII, MII, CAII, and OII) have a strong and positive correlation, whereby the weakest correlation is always with the CAII. The reason is that the CAII only varies at the cantonal level. Municipalities with a strong citizen's involvement in the regulatory process also feature strong municipality and organizations' involvement and, to a lesser extent, cantonal involvement.

Moreover, the strong correlation of CII, MII, and OII, with the remaining sub-indices, except EMRI, show that municipalities with a more regulated land use process also have stricter regulatory rules that lead to longer durations of the review process for building permits. Interestingly, the degree of citizen involvement (CII) is not strongly correlated with density restrictions (DRI) and extensive margin regulations (EMRI). More citizen involvement clearly correlates with a higher cost index (CI) and a longer process according to higher values of OI. The same holds true for the involvement of other stakeholders as captured in OII. The sub-indices capturing the rules of regulatory constraints (PAI, DRI, EMRI, OSAHI) also have a strong and positive correlation, except for EMRI. Since EMRI measures the protection of areas from development, like forests, and the Federal government determines this type of regulation, it does not seem to influence the municipalities' land use regulation process and rules much. Finally, the sub-index OI, which captures the regulation process and rules outcomes, has a strong and positive correlation with most other sub-indices. The exceptions are the EMRI and the OSAHI. The reason is that open space and affordable housing requirements captured by the OSAHI only matters for big urban municipalities.

Table 4: **Correlation indices**

	f _i	CII	MII	CAII	OII	PAI	DRI	EMRI	OSAH	CI	OI
Y _i	1.00										
CII	0.57***	1.00									
MII	0.55***	0.42***	1.00								
CAII	0.09**	0.10***	0.16***	1.00							
OII	0.55***	0.41***	0.33***	0.08**	1.00						
PAI	0.58***	0.22***	0.32***	0.14***	0.45***	1.00					
DRI	0.46***	0.05	0.18***	-0.17***	0.02	0.16***	1.00				
EMRI	0.23***	0.04	-0.09**	-0.05	-0.02	0.03	0.02	1.00			
OSAH	0.36***	0.13***	0.08**	-0.16***	0.21***	0.08**	0.14***	-0.08**	1.00		
CI	0.47***	0.18***	0.11***	-0.00	0.16***	0.18***	0.20***	-0.06*	0.17***	1.00	
OI	0.43***	0.16***	0.15***	0.10***	0.10***	0.22***	0.20***	-0.11***	-0.01	0.27***	1.00

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The indices are based on 715 municipalities. Land use regulation process: Citizens involvement index (CII), Municipality involvement index (MII); Cantonal involvement index (CAII); Organizations involvement index (OII). Rules of regulatory constraints: Project approval index (PAI); Density restrictions index (DRI); Extensive margin regulation index (EMRI); Open space and affordable housing index (OSAH); Cost index (CI). Outcomes of regulation process and rules: Outcome index (OI)

5.3. Variance decomposition

To discern how much of the aggregate indices' variance is contributed by each sub-index, we perform a Shorrocks-Shapley decomposition.¹¹ We compute this decomposition by regressing the aggregate final indices (Mean Index, Standardized Index, Min-max

¹¹See Shorrocks (1982) and Shorrocks (2013) for further details.

Index, and Min-max by municipality types Index) on all their respective possible combinations of sub-indices and obtain the corresponding R^2 for each combination. For each sub-index, we then calculate the R^2 's average improvement when adding that sub-index as a covariate to the regression. We interpret this average improvement as the sub-indexes relative importance to explain the variation in the aggregate indices. Table 5 shows the results. Note that the relative importances add to one.

Table 5: **Shorrocks-Shapley decomposition**

	(1)	(2)	(3)	(4)
	Y_i	Z_i	M_i	T_i
Index	Relative importance			
CII	0.1291	0.1374	0.1295	0.1414
PAI	0.1328	0.1414	0.1332	0.1255
MII	0.1188	0.1265	0.1192	0.1286
DRI	0.1145	0.1219	0.1149	0.0807
OII	0.1127	0.1200	0.1130	0.0671
CI	0.0899	0.0957	0.0901	0.0820
OI	0.0876	0.0933	0.0879	0.1252
EMRI	0.0781	0.0832	0.0783	0.0907
OSAH	0.0693	0.0738	0.0695	0.0514
CAII	0.0063	0.0067	0.0063	0.0181

Notes: Y_i = Mean Index, Z_i = Standardized Index, M_i = Min-max Index, T_i = Min-max by municipality types (urban, periphery, and rural) Index. The indices are based on 715 municipalities. Land use regulation process: Citizens involvement index (CII), Municipality involvement index (MII); Cantonal involvement index (CAII); Organizations involvement index (OII). Rules of regulatory constraints: Project approval index (PAI); Density restrictions index (DRI); Extensive margin regulation index (EMRI); Open space and affordable housing index (OSAH); Cost index (CI). Outcomes of regulation process and rules: Outcome index (OI)

Our results reveal that for the aggregate indices in columns (1) to (3) (Mean Index, Standardized Index, and Min-max Index), the sub-index PAI is the most important. It explains 13-14% of the overall variation. Most sub-indices related to the land use regulation process (CII, MII, and OII) are relatively important. This underscores the weight that citizen, municipal, and organizations' involvement have on regulation. One exception is the CAII which only differs at the cantonal level. This sub-index has the lowest importance for all aggregate indices. For the Min-max by municipality types Index (column(4)), the most important sub-index is the CII, followed by the PAI and OI. When considering the types of municipality, outcomes of regulation process and rules become more important in explaining the overall variation in regulation. It is noteworthy that the relative importance is well distributed among the sub-indices. No sub-index has a relative importance above 15% and lower than 5%, except for CAII. This shows

that the aggregate indices do a remarkable job capturing the different aspects of land use restrictiveness across municipalities.

5.4. Determinants of land use regulation

Table 6: **Determinants of land use regulation**

	(1) OLS	(2) OLS	(3) OLS	(4) IV	(5) OLS	(6) OLS	(7) OLS
Log Mean Index Y_i							
Density	0.021*** (0.005)	0.020*** (0.006)		0.022*** (0.007)	0.019*** (0.006)	0.020*** (0.006)	0.021*** (0.006)
Density 1919			0.022*** (0.008)				
Dist. lakes					-0.003 (0.005)		
SE plot						0.067** (0.032)	
Income							-0.019 (0.026)
Ruggedness	0.082* (0.044)	0.130** (0.059)	0.113* (0.059)	0.141** (0.064)	0.126** (0.059)	0.123** (0.059)	0.128** (0.058)
French	0.028* (0.017)	0.029 (0.029)	0.025 (0.029)	0.031 (0.029)	0.029 (0.028)	0.026 (0.028)	0.029 (0.029)
Italian	0.055*** (0.021)	0.144** (0.062)	0.137** (0.061)	0.145** (0.061)	0.143** (0.062)	0.144** (0.062)	0.142** (0.062)
Rhaeto-Romanic	0.014 (0.049)	0.042 (0.058)	0.031 (0.057)	0.042 (0.057)	0.040 (0.059)	0.041 (0.059)	0.038 (0.059)
Right	-0.082 (0.078)	-0.128 (0.095)	-0.156 (0.098)	-0.113 (0.102)	-0.129 (0.095)	-0.125 (0.095)	-0.128 (0.096)
Center	-0.003 (0.076)	-0.045 (0.105)	-0.056 (0.110)	-0.029 (0.107)	-0.043 (0.106)	-0.051 (0.106)	-0.044 (0.106)
Canton FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	705	705	705	705	705	705	705
R-squared	0.05	0.10	0.10	0.10	0.10	0.11	0.10

Notes: Robust standard errors in parentheses $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. The units of observations are Swiss municipalities. The Mean Index Y_i is based on 715 municipalities. *Density* denotes log residents per square kilometer of area in 2019. *Density 1919* denotes log flats per square kilometer of area in 1919. *Dist. lakes* denotes the log distance to the nearest lake in km. *SE plot* denotes the share of 100×100 meters plots facing south-east. *Income* denotes the average log income per person in 2019. *Ruggedness* denotes the elevation standard deviation. *French*, *Italian*, and *Rhaeto-Romanic* are dummy variables indicating the predominant spoken language in the municipality. *Right* and *Center* denote the share who voted for right-wing and center parties in the 2015 Swiss national elections, respectively. In column (4) *Density* is instrumented with *Density 1919*. The corresponding Kleibergen-Paap F statistic is 366.

The literature has discussed several mechanisms that contribute to stricter land-use regulation such as NIMBYism or density or the local composition of the jurisdictions population. In the following we analyze the determinants of land use regulation and test the hypotheses put forward in the literature. In particular, we regress variables encompassing the municipality type, sociodemographics, the economy, and geography on our Mean Index Y_i . Table 6 shows the results.

In line with the literature, denser places display higher land use regulation. However, the magnitude of the effect is rather small. As is shown in columns (1) and (2), a 10% increase in density is associated with approximately 0.2% stricter regulation. Interestingly, land use restrictiveness is already explained by the historical density, measured as flats per square kilometer of area in 1919 (see column (3)). Running a two-stage least squares (2SLS) regression instrumenting density with historical density confirms this result (see column (4)). Favorable amenities, like closeness to lakes or south-east facing plots, lead to stricter land use regulation. In contrast to the literature, the resident’s average income does not affect land use regulation in Switzerland. Our results also show that more rugged municipalities and municipalities that predominantly speak Italian and French are more regulated. Moreover, a center-right political inclination is associated with lower land use regulation, although the coefficients are not significant. Overall, there seems to be a large share of variation in land use regulation that remains unexplained by the conventional determinants put forward in the literature.

5.5. Correlation with housing market equilibrium variables

To check land use regulation’s impact on the housing market we regress our Mean Index Y_i on housing market equilibrium variables. Of course, these variables are endogenous. Therefore the results shown in Table 7 can only be interpreted as correlations. Land use regulation is highly positively correlated with house prices. Albeit, the causality is probably reversed, i.e., stricter land use regulation leads to higher house prices. Since land use regulation is negatively correlated with capitalization rates, stricter land use regulations correlates positively with higher increase in house prices than rents. Contrary to findings in the previous literature, the ownership rate has a negative impact on land use regulation. This may be a Swiss phenomenon where homeownership is much lower than in other countries. As expected, the correlation with vacancy rates is negative.

5.6. External validation

We regress our Mean Index Y_i on the refusal rates of new building permits, changes in the building permit approval duration, and housing price and rent supply elasticities for external validity. Table 8 shows the results. Reassuringly, our indices show a positive and significant correlation with the refusal rates and approval duration. As shown in column (1), a 10% increase in regulation translates into a 0.8 percentage point increase in the refusal rate. We also check our Mean Index’s effect on the Swiss housing supply elasticities provided by Buechler et al. (2019). Our indices correlate negatively with both

Table 7: Correlation with housing market equilibrium variables

	(1)	(2)	(3)	(4)
	Log Mean Index Y_i			
House price	0.602*** (0.205)			
Cap rates		-1.749* (1.055)		
Own rate			-0.175*** (0.063)	
Vac. rate				-1.072*** (0.337)
Density	0.012** (0.006)	0.016*** (0.006)	0.013** (0.006)	0.021*** (0.006)
Ruggedness	0.121** (0.059)	0.132** (0.063)	0.101* (0.058)	0.123** (0.059)
French	0.027 (0.030)	0.017 (0.031)	0.029 (0.029)	0.037 (0.028)
Italian	0.169** (0.066)	0.112 (0.076)	0.150** (0.061)	0.136** (0.062)
Rhaeto-Romanic	0.046 (0.056)	0.027 (0.061)	0.040 (0.058)	0.041 (0.057)
Right	-0.171* (0.096)	-0.143 (0.103)	-0.121 (0.095)	-0.119 (0.094)
Center	-0.035 (0.103)	-0.020 (0.114)	-0.028 (0.106)	-0.039 (0.105)
Canton FE	Yes	Yes	Yes	Yes
Obs.	695	663	705	705
R-squared	0.12	0.10	0.11	0.12

Notes: Robust standard errors in parentheses $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. The units of observations are Swiss municipalities. The Mean Index Y_i is based on 715 municipalities. *House price* denotes log house prices that are quality-adjusted for the living surface, the number of rooms, age, age squared, and building type for 2015. *Cap rates* denotes quality-adjusted capitalization rates in 2015. *Own rate* denotes the homeownership rate in 2015. *Vac. rate* denotes the vacancy rate in 2019. *Density* denotes log residents per square kilometer of area in 2019. *Ruggedness* denotes the elevation standard deviation. *French*, *Italian*, and *Rhaeto-Romanic* are dummy variables indicating the predominant spoken language in the municipality. *Right* and *Center* denote the share who voted for right-wing and center parties in the 2015 Swiss national elections, respectively.

price and rental housing supply elasticities. Note that the effect seems to be larger on the rental (column (4)) compared to price (column (3)) housing supply elasticities. In line with previous literature, we underscore the negative impact of land use regulation on housing supply. These results show that our indices do a fine job capturing the ease of development at the municipality level.

5.7. Machine learning results

To predict our final aggregate indices for non-responding municipalities, we apply a ML cross-validation model (see Section 3 for more details). We feed the model with the above variables about determinants and housing market characteristics as well as

Table 8: **External validation**

	(1)	(2)	(3)	(4)
	Refusal rate	Approval duration	Price elasticity	Rent elasticity
Log Y_i	0.080** (0.036)	0.934*** (0.302)	-0.026*** (0.008)	-0.073*** (0.023)
Obs.	689	715	706	706
R-squared	0.01	0.01	0.03	0.03

Notes: Robust standard errors in parentheses $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. The units of observations are Swiss municipalities. Refusal rate for new building permits are computed with *Documedia* 2015 data. Change in duration from the application to the approval of a development stems from question 15 (a) from our survey (see Appendix A.2). Price and rent housing supply elasticities are from Buechler et al. (2019). The Mean Index Y_i is based on 715 municipalities.

some additional variables which may help to explain the variation.¹² encompassing the municipality type, sociodemographics, the housing market, the economy, and geography and let it choose the best land use regulation predictors. Since we standardize the dependent variable and predictors prior to estimation, Table 9 shows the land use regulation predictors in standard deviation units. This allows us to rank them by their relative importance. For most final indices, vacancy rates are the most important predictor, followed by share employed in industry, and capitalization rates. The variable capturing the average numbers of floors, a proxy for density, is also among the top predictors. Interestingly, the ML model shows that higher tax rates are associated with higher land use regulation. The model also underpins the importance of amenities and socio-demographic factors as drivers of land-use regulation.

6. Conclusion

The local regulatory environment is of crucial importance for land use and housing supply. Sharply rising real estate prices call for increasing supply and revision of regulation in many areas. Simultaneously, concerns about the way we use our land space and its impacts on environmental conditions often demand stricter regulation. In many

¹²These variables are: Density; density 1919; average number of floors in the municipality's residential buildings; municipality type dummy (urban, periphery, and rural); language dummy (German, French, Italian, and Rhaeto-Romanic); share who voted for right, center, and left wing parties; share employed in the creative and cultural sector; share of foreigners, hedonic house prices, rents, and capitalization rates; ownership rate; vacancy rate; average household size living in the municipality; share employed in the agricultural, industrial, and service sector; tax rate for single/married with a taxable income of 80,000/150,000 CHF; average income; distance to lake in km; share of 100×100 meters plots facing south-east; mean municipality elevation, municipality elevation standard deviation; canton fixed effects.

Table 9: CV-lasso results

	(1)	(2)	(3)	(4)	(5)
	Y_i	F_i	Z_i	M_i	T_i
Urban	0.0404	0.0825	0.0404	0.0404	
Av. no. of floors	0.0510	0.1148	0.0510	0.0510	
SE plot	0.0260		0.0260	0.0260	0.0334
Culture	0.0309	0.0338	0.0309	0.0309	
Agriculture		0.0619			
Industry	0.0758	0.0209	0.0758	0.0758	0.0420
Tax rate s. 80	0.0325		0.0325	0.0325	0.0438
Italian	0.0346	0.0506	0.0346	0.0346	0.0468
Rhaeto-Romanic		-0.0095			
Right	-0.0112	-0.0401	-0.0112	-0.0112	
Center		0.0390			
Left					0.0223
House price		0.0204			
Cap rates	-0.0679	-0.0104	-0.0679	-0.0679	-0.0629
Own rate	-0.0526	-0.0018	-0.0526	-0.0526	
Vac. rate	-0.0812	-0.0282	-0.0812	-0.0812	-0.0906
Lambda	26.86	25.69	26.86	26.86	29.98
Observations	661	645	661	661	661

Notes: $*p < 0.10$, $**p < 0.05$, $***p < 0.01$. The units of observations are Swiss municipalities. Y_i = Mean Index, F_i = Factor Analysis Index, Z_i = Standardized Index, M_i = Min-max Index, T_i = Min-max by municipality types (urban, periphery, and rural) Index. The indices are based on 715 municipalities. *Urban* is a dummy variable indicating if a municipality is urban. *Av. no. of floors* denotes the average number of floors in the municipality’s residential buildings in 2015. The ground floor counts as 0. *SE plot* denotes the share of 100×100 meters plots facing south-east. *Culture* denotes the share employed in the creative and cultural sector in 2018. *Agriculture* and *Industry* denote the share employed in the agricultural and industrial sector in 2018, respectively. *Tax rate s. 80* denotes the tax rate for single with a taxable income of 80000 in 2019. *Italian* and *Rhaeto-Romanic* are dummy variables indicating the predominant spoken language in the municipality. *Right*, *Center*, and *Left* denote the share who voted for right, center, and left-wing parties in the 2015 Swiss national elections, respectively. *House price* denotes log house prices that are quality-adjusted for the living surface, the number of rooms, age, age squared, and building type in 2015. *Cap rates* denotes quality-adjusted capitalization rates in 2015. *Own rate* denotes the homeownership rate in 2015. *Vac. rate* denotes the vacancy rate in 2019. Following Canton fixed effects enter positively (+) or negatively (-) in our ML model: BE (+), LU (+), SZ (+), OW (+), NW (+), ZG (-), SO (-), BS (+), BL (+), SH (-), AI (-), SG (+), GR (-), TG (+), VD (-), VS (-), NE (+), GE (+), JU (+).

countries, local authorities have a high degree of autonomy about land use regulations, and the instruments used vary significantly across regions. This makes a systematic measure of regulatory constraints fundamental. We conducted a survey to construct such a measure along several dimensions capturing the ‘ease of local residential development’. Our results show a large degree of variation in land use regulation and provide first insights into regulatory stringency determinants. We find the historical develop-

ment, natural amenities, cultural dimensions, and political aspects impact local land use regulation's stringency.

References

- Ahrens, A., Hansen, C. B., and Schaffer, M. E. (2018). Pdslasso: Stata module for post-selection and post-regularization OLS or IV estimation and inference. *Statistical Software Components, Boston College Department of Economics*.
- Ahrens, A., Hansen, C. B., and Schaffer, M. E. (2020). lassopack: Model selection and prediction with regularized regression in Stata. *Stata Journal*, 20:176–235.
- Belloni, A., Chernozhukov, V., and Wang, L. (2011). Square-root lasso: Pivotal recovery of sparse signals via conic programming. *Biometrika*, 98:791–806.
- Belloni, A., Chernozhukov, V., and Wang, L. (2014). Pivotal estimation via square-root lasso in nonparametric regression. *Annals of Statistics*, 42:757–788.
- Brueckner, J. K. and Singh, R. (2018). Stringency of land-use regulation: Building heights in us cities. *CESifo Working Paper Series No. 6978*.
- Buechler, S., von Ehrlich, M., and Schöni, O. (2018). On the responsiveness of housing development to rent and price changes: Evidence from Switzerland. *Study for the Swiss State Secretariat for Economic Affairs (SECO)*.
- Buechler, S., von Ehrlich, M., and Schöni, O. (2019). The amplifying effect of capitalization rates on housing supply. *mimeo*.
- Cosman, J., Davidoff, T., and Williams, J. (2018). Housing appreciation and marginal land supply in monocentric cities with topography. *mimeo*.
- Diamond, R. (2017). Housing supply elasticity and rent extraction by state and local governments. *American Economic Journal: Economic Policy*, 9(1):74–111.
- Ferrara, A. R. and Nisticò, R. (2013). Well-being indicators and convergence across italian regions. *Applied Research in Quality of Life*, 8:15—44.
- Frank, L. E. and Friedman, J. H. (1993). A statistical view of some chemometrics regression tools. *Technometrics*, 35(2):109–135.
- Frieden, B. J. (1979). A new regulation comes to suburbia. *Public Int.*, 55:15–27.

- Glaeser, E. L. and Gyourko, J. (2018). The economic implications of housing supply. *Journal of Economic Perspectives*, 32(1):3–30.
- Glaeser, E. L. and Ward, B. (2009). The causes and consequences of land use regulation: Evidence from greater boston. *Journal of Urban Economics*, 65:265–278.
- Gyourko, J., Hartley, J., and Krimmel, J. (2019). The local residential land use regulatory environment across u.s. housing markets: Evidence from a new wharton index. *NBER Working Paper No. 26573*.
- Gyourko, J. and Molloy, R. (2015). Regulation and housing supply. In Duranton, G., Henderson, J. V., and Strange, W. C., editors, *Handbook of Regional and Urban Economics*, volume 5, chapter 19, pages 1289–1337. Elsevier Science and Technology.
- Gyourko, J., Saiz, A., and Summers, A. (2008). A new measure of the local regulatory environment for housing markets: The wharton residential land use regulatory index. *Urban Studies*, 45(3):693–729.
- Hastie, T. J., Tibshirani, R. J., and Wainwright, M. (2015). *Statistical Learning with Sparsity: The Lasso and Generalizations*. CRC Press.
- Hilber, C. A. and Schöni, O. (2020). On the economic impacts of constraining second home investments. *Journal of Urban Economics*, 118(C).
- Hilber, C. A. and Vermeulen, W. (2016). The impact of supply constraints on house prices in england. *Economic Journal*, 126(591):358–405.
- Hsieh, C.-T. and Moretti, E. (2019). Housing constraints and spatial misallocation. *American Economic Journal: Macroeconomics*, 11(2):1–39.
- Marchante, A. J. and Ortega, B. (2006). Quality of life and economic convergence across spanish regions, 1980–2001. *Regional Studies*, 40(5):471–483.
- Pendall, R., Puentes, R., and Martin, J. (2006). From traditional to reformed: A review of the land use regulations in the nation’s 50 largest metropolitan areas. *The Brookings Institution*.
- Roller, M. and Schmidheiny, K. (2016). Effective tax rates and effective progressivity in a fiscally decentralized country. *CESifo Working Paper Series 5834*.
- Shorrocks, A. F. (1982). Inequality decomposition by factor components. *Econometrica*, 50(1):193–211.

Shorrocks, A. F. (2013). Decomposition procedures for distributional analysis: a unified framework based on the shapley value. *Journal of Economic Inequality*, 11(1):99–126.

Tibshirani, R. (1996). Regression shrinkage and selection via the lasso. *Journal of the Royal Statistical Society. Series B (Methodological)*, 58(1):267–288.

Appendix A. Survey

Appendix A.1. Survey methodology

Appendix A.2. Survey (English)

1. In your municipality, how involved are the following organizations/stakeholders in affecting residential spatial planning? Please rate the importance of each on a scale from 1 to 5. (1 = not involved at all; 5 = very involved)
 - (a) Municipality executive body
 - (b) Municipality legislative body (community assembly or parliament)
 - (c) Municipal secretary
 - (d) Building commission
 - (e) Municipal administrative unit (e.g. local planning office)
 - (f) Inter-municipal administrative unit (e.g. inter-municipal planning office, regional administrative unit)
 - (g) Cantonal administrative unit (e.g. cantonal planning office)
 - (h) External planning office
 - (i) Cooperatives
 - (j) Associations
 - (k) Land owners
 - (l) Investors (e.g. pension funds)
 - (m) Voting citizens
2. Approximately how many people are involved in residential spatial planning processes in your municipality?
3. How important is cooperation/coordination with the following organizations/stakeholders for spatial planning regarding residential building in your municipality? Please rate the importance of each on a scale from 1 to 5. (1 = not important at all; 5 = very important)
 - (a) Municipalities in the same canton
 - (b) Municipalities in neighboring cantons
 - (c) Associations

- (d) Land owners
 - (e) Voting citizens
 - (f) Others (Please specify which ones. E.g. neighborhood organizations, political parties, etc.)
4. In your municipality, to what extent are the following organizations typically involved in approving a new construction project (which does not need rezoning)? Please rate the involvement of each on a scale from 1 to 5. (1 = not involved at all; 5 = very involved)
- (a) Municipality executive body
 - (b) Municipality legislative body (community assembly or parliament)
 - (c) Municipal administrative unit (e.g. local planning office)
 - (d) Inter-municipal administrative unit (e.g. inter-municipal planning office, regional administrative unit)
 - (e) Cantonal administrative unit (e.g. cantonal planning office)
 - (f) Environmental examining board
 - (g) Monument protection authority
 - (h) Water protection authority
 - (i) Cooperatives
 - (j) Associations
 - (k) Land owners
 - (l) Investors (e.g. pension funds)
 - (m) Voting citizens
5. How restrictive are the following factors for building residential dwellings in your municipality? Please rate the restrictiveness of each on a scale from 1 to 5. (1 = not restrictive at all; 5 = very restrictive)
- (a) Supply of land
 - (b) Density restrictions (e.g. height restrictions, number of floors, floor area ratio, and boundary limit distances)
 - (c) Minimal density requirements

- (d) New infrastructure costs (e.g. infrastructure access costs)
 - (e) Fees/duties
 - (f) Noise regulations
 - (g) Municipality executive body opposition to growth (e.g. due to crowded schools)
 - (h) Citizen opposition to urban sprawl
 - (i) Monument protection
 - (j) Duration of the review process for building permits
 - (k) Capital gain tax
6. Which of the following density restrictions are relevant in your municipality?
- (a) Height restrictions and boundary limit distances
 - (b) Floor area ratio
 - (c) Green space requirements
7. In your municipality, do developers typically have to meet the following requirements to be able to build? (Yes or no)
- (a) For single and multi-family dwellings:
 - i. Meet minimum lot size (e.g. 1000 square meters) requirements
 - ii. Floor to area ratios requirements
 - iii. Pay allocable share of costs of infrastructure improvement
 - (b) For large area developments (when negotiations with the developers take place):
 - 0. Not applicable to our municipality
 - i. Meet minimum lot size (e.g. 1000 square meters) requirements
 - ii. Floor to area ratios requirements
 - iii. Include affordable housing (however defined)
 - iv. Supply mandatory open space
 - v. Pay allocable share of costs of infrastructure improvement
8. In your municipality, how does the supply of zoned land compare to the demand for the following land uses? (Far more than required; More than required; Roughly enough; Less than required; Far less than required)

- (a) Single-family
 - (b) Multi-family
 - (c) Commercial
 - (d) Industrial
9. Approximately how high are the building permit costs (for applicants), including cantonal fees and excluding connection costs, in your municipality for the following properties:
- (a) 1 apartment building with 15 apartments: Construction price CHF 5'000'000.-
5'460m³, 1'175m² living space
 - (b) 1 apartment building with 5 apartments: Construction price CHF 2'000'000.-
2'160m³, 460m² living space
 - (c) 1 single-family house: Construction price CHF 700'000.-, 750m³, 150m² living space
10. Approximately how many residential building permit applications did your municipality receive in the year 2019?
11. Approximately against how many residential building permit applications did your municipality receive objections in the year 2019?
12. In the last 10 years, how much have the building permit fees changed in your municipality? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, ≥50%)
13. In the last 10 years, how much have the costs of a single-family house changed in your municipality? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, ≥50%)
14. In the last 10 years, how much have the costs of an apartment changed in your municipality? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, ≥50%)
15. In the last 10 year, how has the duration from the application to the approval of a development changed in your municipality (if the documents were entered correctly and completely)? (Considerably shorter; A little shorter; No change; A little longer; Considerably longer)
- (a) Single-family dwelling
 - (b) Multi-family dwelling

16. In your municipality, how long does a building permit procedure for the following currently take (if the documents have been entered correctly and completely)? (In days)
 - (a) Single-family dwelling
 - (b) Multi-family dwelling
17. Does your municipality accept digital building permit applications? (Yes or no)
18. How important are the special plans for land use for spatial planning in your municipality? Please rate the importance of each on a scale from 1 to 5. (1 = not important at all; 5 = very important)
19. Do the following sociodemographic factors influence residential spatial planning in your municipality?
 - (a) Age
 - (b) Size of household (e.g. family with children)
 - (c) Income/Assets
 - (d) Other
 - (e) Not applicable
20. Which of the following spatial planning strategies best applies to your municipality?
 - (a) Passive: Tendency to have little intervention and control.
 - (b) Proactive: based on growth.
 - (c) Reactive: intervention and cooperation if necessary.

Appendix A.3. Survey (German)

1. Wie stark sind die folgenden Organisationen in Ihrer Gemeinde an der Wohnraumplanung beteiligt? Bitte bewerten Sie die Wichtigkeit auf einer Skala von 1 bis 5. (1 = überhaupt nicht beteiligt; 5 = sehr beteiligt)
 - (a) Exekutivorgan der Gemeinde
 - (b) Legislativorgan der Gemeinde (Gemeindeversammlung oder -parlament)
 - (c) GemeindeschreiberIn

- (d) Baukommission
 - (e) Kommunale Verwaltungseinheit (z.B. Bauamt)
 - (f) Interkommunale Verwaltungseinheit (z.B. interkommunales Bauamt, regionale Verwaltungseinheit, Regierungsstatthalteramt)
 - (g) Kantonale Verwaltungseinheit (z.B. kantonales Amt für Raumplanung)
 - (h) Externes Planungsbüro
 - (i) Genossenschaften
 - (j) Verbände
 - (k) Grundeigentümer
 - (l) Investoren (z.B. Pensionskassen)
 - (m) Die StimmbürgerInnen
2. Wie viele Personen ungefähr sind in Ihrer Gemeinde an der Wohnraumplanung beteiligt?
3. Wie wichtig ist die Kooperation/Koordination mit den folgenden Organisationen für die Wohnraumplanung in Ihrer Gemeinde? Bitte bewerten Sie die Wichtigkeit auf einer Skala von 1 bis 5. (1 = überhaupt nicht wichtig; 5 = sehr wichtig)
- (a) Gemeinden im selben Kanton
 - (b) Gemeinden in einem Nachbarkanton
 - (c) Verbände
 - (d) Grundeigentümer
 - (e) Die StimmbürgerInnen
 - (f) Andere (Bitte geben Sie an, welche. Z.B. Quartierorganisationen, Parteien usw.)
4. Wie stark sind die folgenden Organisationen typischerweise beteiligt, um ein neues Bauprojekt (für das keine Umzonung erforderlich ist) in Ihrer Gemeinde zu genehmigen? Bitte bewerten Sie die Beteiligung auf einer Skala von 1 bis 5. (1 = überhaupt nicht beteiligt; 5 = sehr beteiligt)
- (a) Exekutivorgan der Gemeinde
 - (b) Legislativorgan der Gemeinde (Gemeindeversammlung oder -parlament)

- (c) Kommunale Verwaltungseinheit (z.B. Bauamt)
 - (d) Interkommunale Verwaltungseinheit (z.B. interkommunales Bauamt, regionale Verwaltungseinheit, Regierungsstatthalteramt)
 - (e) Kantonale Verwaltungseinheit (z.B. kantonales Amt für Raumplanung)
 - (f) Umweltprüfungsausschuss
 - (g) Denkmalschutz
 - (h) Gewässerschutz
 - (i) Genossenschaften
 - (j) Verbände
 - (k) Grundeigentümer
 - (l) Investoren (z.B. Pensionskassen)
 - (m) Die StimmbürgerInnen
5. Wie einschränkend sind die folgenden Faktoren für den Wohnungsbau in Ihrer Gemeinde? Bitte bewerten Sie die Einschränkung auf einer Skala von 1 bis 5 (1 = gar nicht einschränkend; 5 = sehr einschränkend).
- (a) Landangebot
 - (b) Dichteeinschränkungen (z.B. Bauhöhe, Anzahl Stockwerke, Nutzungsziffer, und Grenzabstände)
 - (c) Mindestdichteanforderungen
 - (d) Kosten für neue Infrastruktur (z.B. Erschliessungskosten)
 - (e) Gebühren/Abgaben
 - (f) Lärmvorschriften
 - (g) Widerstand des Gemeinderats gegen Wachstum (z.B. wegen überfüllter Schulen)
 - (h) Bürgeropposition gegen Zersiedlung
 - (i) Denkmalschutz
 - (j) Dauer des Überprüfungsverfahrens für Baugenehmigungen
 - (k) Mehrwertabgabe
6. Welche der folgenden Dichteeinschränkungen für den Wohnungsbau sind in Ihrer Gemeinde relevant? (Wählen Sie alle relevanten Einschränkungen aus.)

- (a) Bauhöhe und Grenzabstände
 - (b) Nutzungsziffer
 - (c) Grünflächenanteil
7. Müssen BauherrenInnen typischerweise diese Anforderungen erfüllen, um in Ihrer Gemeinde bauen zu können? (Ja oder nein)
- (a) Für Ein- und Mehrfamilienhäuser:
 - i. Anforderung von Mindestgrundstückgrössen (z.B. 1'000m²)
 - ii. Anforderung von Nutzungsziffern
 - iii. Anrechenbaren Anteil an die Kosten der Infrastrukturverbesserung zahlen
 - (b) Für grosse Arealentwicklungen (wenn Verhandlungen mit den BauherrInnen stattfinden):
 - 0. Für unsere Gemeinde nicht zutreffend
 - i. Anforderung von Mindestgrundstückgrössen (z.B. 1'000m²)
 - ii. Anforderung von Nutzungsziffern
 - iii. Gemeinnützigen und preisgünstigen Wohnungsbau einbeziehen (wie auch immer definiert)
 - iv. Obligatorische Freiflächen zur Verfügung stellen
 - v. Anrechenbaren Anteil an die Kosten der Infrastrukturverbesserung zahlen
8. Welches Angebot an Baufläche für die folgenden Landnutzungen besteht im Vergleich zur Nachfrage in Ihrer Gemeinde? (Weit mehr als erforderlich; mehr als erforderlich; ungefähr genug; weniger als erforderlich; weit weniger als erforderlich)
- (a) Einfamilienhäuser
 - (b) Mehrfamilienhäuser
 - (c) Gewerbeimmobilien
 - (d) Industrieimmobilien
9. Wie hoch sind ungefähr die Baubewilligungskosten (für die Gesuchsteller), inklusive kantonale Gebühren und exklusive Anschlusskosten, in Ihrer Gemeinde für die folgenden Immobilien:

- (a) 1 Mehrfamilienhaus mit 15 Wohnungen: Bausumme CHF 5'000'000.- 5'460m³, 1'175m² Wohnfläche
 - (b) 1 Mehrfamilienhaus mit 5 Wohnungen: Bausumme CHF 2'000'000.- 2'160m³, 460m² Wohnfläche
 - (c) 1 Einfamilienhaus: Bausumme CHF 700'000, 750m³, 150m² Wohnfläche
10. Wie viele Wohnbaugesuche ungefähr sind im Jahr 2019 in Ihrer Gemeinde eingegangen?
 11. Gegen wie viele Wohnbaugesuche ungefähr sind Einsprachen im Jahr 2019 in Ihrer Gemeinde eingegangen?
 12. Wie stark sind in Ihrer Gemeinde die Baugenehmigungskosten, in den letzten 10 Jahren, verändert? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, >50%)
 13. Wie stark sind in Ihrer Gemeinde die Kosten für Einfamilienhäuser, in den letzten 10 Jahren, verändert? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, >50%)
 14. Wie stark sind in Ihrer Gemeinde die Kosten für Stockwerkeigentum, in den letzten 10 Jahren, verändert? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, >50%)
 15. Wie hat sich in Ihrer Gemeinde die Dauer von der Eingabe bis zur Genehmigung eines Wohnprojektes, in den letzten 10 Jahren, verändert? (Erheblich kürzer; etwas kürzer; keine Änderung; etwas länger; erheblich länger)
 - (a) Einfamilienhaus
 - (b) Mehrfamilienhaus
 16. Wie lange dauert derzeit ein Baubewilligungsverfahren in Ihrer Gemeinde (wenn die Dokumente korrekt und vollständig eingegeben wurden)? (In Tagen)
 - (a) Einfamilienhaus
 - (b) Mehrfamilienhaus
 17. Kann man in Ihrer Gemeinde die Baugesuche digital einreichen? (Ja oder nein)
 18. Wie wichtig sind die Sondernutzungspläne für die Raumplanung in Ihrer Gemeinde? Bitte bewerten Sie die Wichtigkeit auf einer Skala von 1 bis 5. (1 = überhaupt nicht wichtig; 5 = sehr wichtig)

19. Beeinflussen die folgenden soziodemografischen Faktoren die Wohnraumplanung in Ihrer Gemeinde?
- (a) Alter
 - (b) Haushaltsgrösse (z.B. Familie mit Kindern)
 - (c) Einkommen/Vermögen
 - (d) Andere
 - (e) Nicht zutreffend
20. Welche der folgenden Raumplanungsstrategien trifft am ehesten auf Ihre Gemeinde zu?
- (a) Passiv: Tendenziell wenig Interventionen und Steuerung.
 - (b) Proaktiv: Basierend auf Wachstum.
 - (c) Reaktiv: Intervention und Kooperation wenn erforderlich.

Appendix A.4. Survey (French)

1. Dans quelle mesure les organisations suivantes participent-elles à l'aménagement du territoire résidentiel dans votre commune? Veuillez évaluer l'importance de chacune sur une échelle de 1 à 5. (1 = pas du tout impliqué ; 5 = très impliqué)
- (a) Organe exécutif de la commune
 - (b) Organe législatif de la commune (assemblée ou parlement communal)
 - (c) Secrétaire communal
 - (d) Commission de la construction
 - (e) Unité administrative communale (par exemple, l'autorité de construction)
 - (f) Unité administrative intercommunale (par exemple, autorité intercommunale de construction, unité administrative régionale d'urbanisme, préfecture)
 - (g) Unité administrative cantonale (par exemple, bureau cantonal de l'aménagement du territoire)
 - (h) Bureau de planification externe
 - (i) Coopératives
 - (j) Associations
 - (k) Propriétaires terriens

- (l) Investisseurs (par exemple, les caisses de pension)
 - (m) Les électeurs
2. Combien de personnes environ sont impliquées dans l'aménagement du territoire résidentiel dans votre commune?
 3. Quelle est l'importance de la coopération/coordination avec les organisations suivantes pour l'aménagement du territoire en matière de construction résidentielle dans votre commune? Veuillez évaluer l'importance de chacune sur une échelle de 1 à 5. (1 = pas important du tout ; 5 = très important)
 - (a) Communes du même canton
 - (b) Communes des cantons voisins
 - (c) Associations
 - (d) Propriétaires terriens
 - (e) Les électeurs
 - (f) Autres (veuillez préciser lesquels. Par exemple, les organisations de quartier, les partis politiques, etc.)
 4. Dans quelle mesure les organisations suivantes sont-elles généralement impliquées dans l'approbation d'un projet de nouvelle construction (qui n'a pas besoin d'être rezonée) dans votre commune? Veuillez évaluer la participation sur une échelle de 1 à 5. (1 = pas du tout impliqué ; 5 = très impliqué)
 - (a) Organe exécutif de la commune
 - (b) Organe législatif de la commune (assemblée ou parlement communal)
 - (c) Unité administrative communale (par exemple, l'autorité de construction)
 - (d) Unité administrative intercommunale (par exemple, autorité intercommunale de construction, unité administrative régionale d'urbanisme, préfecture)
 - (e) Unité administrative cantonale (par exemple, bureau cantonal de l'aménagement du territoire)
 - (f) Comité de vérification environnementale
 - (g) Protection des monuments historiques
 - (h) Autorité de protection de l'eau

- (i) Coopératives
 - (j) Associations
 - (k) Propriétaires terriens
 - (l) Investisseurs (par exemple, les caisses de pension)
 - (m) Les électeurs
5. Dans quelle mesure les facteurs suivants sont-ils restrictifs pour la construction de logements résidentiels dans votre municipalité? Veuillez évaluer la restriction sur une échelle de 1 à 5. (1 = pas du tout restrictif ; 5 = très restrictif).
- (a) Offre de terrains
 - (b) Restrictions de densité (par exemple, restrictions de hauteur, nombre d'étages, indice d'utilisation, distances limites)
 - (c) Exigences en matière de densité minimum
 - (d) Coûts des nouvelles infrastructures (par exemple, les coûts d'accès aux infrastructures)
 - (e) Frais/taxes
 - (f) Réglementation relative aux nuisances sonores
 - (g) Résistance du conseil communal à la croissance (par exemple en raison de la surpopulation des écoles)
 - (h) L'opposition des citoyens à l'expansion urbaine
 - (i) Protection des monuments historiques
 - (j) Durée de la procédure de contrôle des permis de construire
 - (k) Taxe sur la plus-value
6. Laquelle des restrictions suivantes en matière de densité de logements dans votre commune est applicable? (Choisissez toutes les restrictions qui sont applicables.)
- (a) Restrictions de hauteur et distances limites
 - (b) Indice d'utilisation du sol
 - (c) Exigences en matière d'espaces verts
7. Pour construire dans votre commune, les constructeurs doivent-ils généralement satisfaire aux exigences suivantes? (Oui ou non)

- (a) Pour les maisons individuelles et plurifamiliales:
 - i. Exigences de dimensions minimales des parcelles (par exemple 1'000m²)
 - ii. Exigences en matière d'indices d'utilisation
 - iii. Payment de la part imputable des coûts d'amélioration des infrastructures
 - (b) Pour les développements de grandes surfaces (lorsque des négociations avec les constructeurs ont lieu):
 - 0. Ne s'applique pas à notre commune.
 - i. Exigences de dimensions minimales des parcelles (par exemple 1'000m²)
 - ii. Exigences en matière d'indices d'utilisation
 - iii. Inclusion de logements d'utilité publique ou de logements à loyer ou à prix modérés (quelle qu'en soit la définition)
 - iv. Mise à disposition des espaces ouverts obligatoires
 - v. Payment de la part imputable des coûts d'amélioration des infrastructures
8. Quelle est l'offre de terrains à bâtir pour les utilisations suivantes en comparaison avec la demande dans votre commune? (Beaucoup plus que nécessaire; plus que nécessaire; à peu près suffisante; moins que nécessaire; beaucoup moins que nécessaire)
- (a) Maisons individuelles
 - (b) Maisons plurifamiliales
 - (c) Immeubles commerciaux
 - (d) Immeubles industriels
9. Quels sont les coûts approximatifs des permis de construire (pour le requérants), y compris les taxes cantonales et hors frais de raccordement, dans votre commune pour les immeubles suivants:
- (a) 1 maison plurifamiliale avec 15 appartements: Coûts de construction CHF 5'000'000.-, 5'460 m³, 1'175 m² de surface habitable
 - (b) 1 maison plurifamiliale avec 5 appartements: Coûts de construction CHF 2'000'000.-, 2'160m³, 460m² de surface habitable

- (c) 1 maison individuelle: Coûts de construction CHF 700'000.-, 750m³, 150m² de surface habitable
10. Combien de demandes de permis de construire environ votre commune a-t-elle reçues en 2019?
 11. Combien de demandes de permis de construire ont été contestées dans votre commune en 2019?
 12. Au cours des dix dernières années, de combien les frais de permis de construire ont-ils changé dans votre commune? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, ≥50%)
 13. Au cours des dix dernières années, de combien les coûts d'une maison individuelle ont-ils changé dans votre commune? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, ≥50%)
 14. Au cours des dix dernières années, de combien les coûts d'un appartement en propriété ont-ils changé dans votre commune? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, ≥50%)
 15. Au cours des dix dernières années, comment le délai entre la demande et l'approbation d'un projet de logement a-t-il évolué dans votre commune? (Beaucoup plus court; un peu plus court; pas de changement; un peu plus long; beaucoup plus long)
 - (a) Maison individuelle
 - (b) Maison plurifamiliale
 16. Combien de temps prend actuellement une procédure de permis de construire dans votre commune (si les documents sont saisis correctement et complètement)? (En jours)
 - (a) Maison individuelle
 - (b) Maison plurifamiliale
 17. Votre commune accepte-t-elle les demandes de permis de construire sous forme digitale? (Oui ou non)
 18. Quelle est l'importance des plans d'affectation spéciaux pour l'aménagement du territoire dans votre commune? Veuillez évaluer leur importance sur une échelle de 1 à 5. (1 = pas du tout important; 5 = très important).

19. Les facteurs sociodémographiques suivants influencent-ils l'aménagement du territoire en matière de construction résidentielle dans votre commune?
- (a) Âge
 - (b) Taille du ménage (par exemple, famille avec enfants)
 - (c) Revenus/actifs
 - (d) Autres
 - (e) N'est pas applicable
20. Laquelle des stratégies d'aménagement du territoire suivantes correspond le plus à votre commune?
- (a) Passif: Tendance de peu d'intervention et de contrôle.
 - (b) Proactif: basé sur la croissance.
 - (c) Réactif: intervention et coopération lorsque cela est nécessaire.

Appendix A.5. Survey (Italian)

1. Nel vostro comune, in che modo le seguenti organizzazioni sono coinvolte nella pianificazione del territorio residenziale? Si prega di valutare l'importanza di ciascuna su una scala da 1 a 5. (1 = per niente coinvolti; 5 = molto coinvolti)
- (a) Organo esecutivo del Comune
 - (b) Organo legislativo del Comune (assemblea comunale o parlamento)
 - (c) Segretario comunale
 - (d) Commissione edilizia
 - (e) Unità amministrativa comunale (ad es. autorità edilizia)
 - (f) Unità amministrativa intercomunale (ad es. autorità edilizia intercomunale, unità amministrativa regionale, prefettura)
 - (g) Unità amministrativa cantonale (ad es. ufficio cantonale per la pianificazione del territorio)
 - (h) Ufficio pianificazione esterna
 - (i) Cooperative
 - (j) Associazioni
 - (k) Proprietari di terreni

- (l) Investitori (ad es. fondi pensione)
 - (m) Gli elettori
2. Quante persone sono approssimativamente coinvolte nei processi di pianificazione territoriale residenziale nel vostro comune?
3. Quanto è importante la cooperazione/il coordinamento con le seguenti organizzazioni per la pianificazione territoriale in materia di edilizia residenziale nel vostro comune? Si prega di valutare l'importanza di ciascuno su una scala da 1 a 5. (1 = per niente importante; 5 = molto importante)
- (a) Comuni dello stesso cantone
 - (b) Comuni dei cantoni limitrofi
 - (c) Associazioni
 - (d) Proprietari di terreni
 - (e) Gli elettori
 - (f) Altri (si prega di specificare quali. Ad es. organizzazioni di quartiere, partiti politici, ecc.)
4. Nel vostro comune, in che misura le seguenti organizzazioni sono tipicamente coinvolte nell'approvazione di un nuovo progetto di costruzione (che non necessita di rezonizzazione)? Si prega di valutare la partecipazione di ciascuna di esse su una scala da 1 a 5. (1 = per niente coinvolta; 5 = molto coinvolta)
- (a) Organo esecutivo del Comune
 - (b) Organo legislativo del Comune (assemblea comunale o parlamento)
 - (c) Unità amministrativa locale (ad es. autorità edilizia)
 - (d) Unità amministrativa intercomunale (ad es. autorità edilizia intercomunale, unità amministrativa regionale, prefettura)
 - (e) Unità amministrativa cantonale (ad es. ufficio cantonale per la pianificazione del territorio)
 - (f) Commissione di controllo ambientale
 - (g) Protezione dei monumenti storici
 - (h) Protezione dell'acqua

- (i) Cooperative
 - (j) Associazioni
 - (k) Proprietari di terreni
 - (l) Investitori (ad es. fondi pensione)
 - (m) Gli elettori
5. Quanto sono restrittivi i seguenti fattori per la costruzione di abitazioni residenziali nel vostro comune? Si prega di valutare la restrittività di ciascuno su una scala da 1 a 5. (1 = per niente restrittivo; 5 = molto restrittivo)
- (a) Offerta del terreno
 - (b) Restrizioni di densità (ad es. restrizioni di altezza, numero di piani, indici di utilizzazione e distanze limite)
 - (c) Requisiti di densità minima
 - (d) Costi per nuove infrastrutture (ad es. costi di accesso all'infrastruttura)
 - (e) Tasse/imposte
 - (f) Regolamentazione del rumore
 - (g) Resistenza del consiglio comunale alla crescita (ad es. a causa del sovraffollamento delle scuole)
 - (h) L'opposizione dei cittadini all'espansione urbana
 - (i) Protezione dei monumenti storici
 - (j) Durata della procedura di revisione delle licenze edilizie
 - (k) Tassa sul plusvalore
6. Quale delle seguenti restrizioni di densità abitativa si applicano al vostro comune? (Selezionare tutte le restrizioni applicabili.)
- (a) Restrizioni di altezza e distanze limite
 - (b) Indici di utilizzazione
 - (c) Quota di spazio verde
7. Nel vostro comune, i costruttori devono in genere soddisfare i seguenti requisiti per poter costruire? (Sì o no)

- (a) Per case unifamiliari e plurifamiliari:
 - i. Requisito di dimensioni minime del terreno (ad es. 1'000m²)
 - ii. Requisiti per gli indici di utilizzazione
 - iii. Quota ammissibile dei costi per il miglioramento delle infrastrutture
 - (b) Per lo sviluppo di grandi aree (quando si svolgono le trattative con i costruttori):
 - 0. Non applicabile al nostro comune.
 - i. Requisito di dimensioni minime del terreno (ad es. 1'000m²)
 - ii. Requisiti per gli indici di utilizzazione
 - iii. Inclusione dell'edilizia popolare e a basso costo (comunque definite)
 - iv. Fornitura obbligatoria di spazi aperti
 - v. Quota ammissibile dei costi per il miglioramento delle infrastrutture
8. Nel vostro comune, come si confronta l'offerta di terreni edificabili con la domanda per i seguenti usi del suolo? (Molto più del necessario; Più del necessario; Abbastanza approssimativamente; Meno del necessario; Molto meno del necessario)
- (a) Case unifamiliari
 - (b) Case plurifamiliari
 - (c) Immobili commerciali
 - (d) Immobili industriali
9. All'incirca a quanto ammontano i costi della licenza edilizia (per i richiedenti), comprese le tasse cantonali ed esclusi i costi di allacciamento, nel vostro comune per le seguenti proprietà:
- (a) 1 casa plurifamiliare con 15 appartamenti: Prezzo di costruzione CHF 5'000'000.-
5'460m³, 1'175m² superficie abitabile
 - (b) 1 casa plurifamiliare con 5 appartamenti: Prezzo di costruzione CHF 2'000'000.-
2'160m³, 460m² superficie abitabile
 - (c) 1 casa unifamiliare: Prezzo di costruzione CHF 700'000.-, 750m³, 150m² superficie abitabile
10. All'incirca quante domande di permesso di costruzione residenziale ha ricevuto il vostro comune nel 2019?

11. All'incirca contro quante domande di permesso di costruzione residenziale il vostro comune ha ricevuto obiezioni nel 2019?
12. Negli ultimi 10 anni, quanto sono cambiati all'incirca i costi dei permessi di costruzione nel vostro comune? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, ≥50%)
13. Negli ultimi 10 anni, quanto sono cambiati all'incirca i costi di una casa unifamiliare nel vostro comune? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, ≥50%)
14. Negli ultimi 10 anni, quanto sono cambiati all'incirca i costi di un appartamento nel vostro comune? (<0%, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, ≥50%)
15. Negli ultimi 10 anni, come è cambiata nel vostro comune la durata dalla richiesta all'approvazione di un progetto di edilizia abitativa? (Significativamente più breve; leggermente più breve; nessun cambiamento; leggermente più lungo; considerevolmente più lungo)
 - (a) Casa unifamiliare
 - (b) Casa plurifamiliare
16. Nel vostro comune, quanto tempo dura attualmente una procedura di autorizzazione edilizia per i seguenti progetti (se i documenti sono inseriti correttamente e completamente)? (In giorni)
 - (a) Casa unifamiliare
 - (b) Casa plurifamiliare
17. È possibile presentare domande di costruzione in formato digitale nel vostro comune? (Sì o no)
18. Quanto sono importanti i piani particolareggiati per l'uso del suolo per la pianificazione territoriale nel vostro comune? Valutate l'importanza di ciascuno su una scala da 1 a 5. (1 = per niente importante; 5 = molto importante)
19. I seguenti fattori sociodemografici influenzano la pianificazione territoriale in materia di edilizia residenziale nella vostra comune?
 - (a) Età
 - (b) Dimensioni della famiglia (ad es. Famiglia con bambini)

(c) Entrate/attività

(d) Altri

(e) Non applicabile

20. Quale delle seguenti strategie di pianificazione territoriale si applica meglio al vostro comune?

(a) Passivo: Tendenza de poco intervento e controllo.

(b) Proattivo: basato sulla crescita..

(c) Reattivo: intervento e cooperazione quando necessario.

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