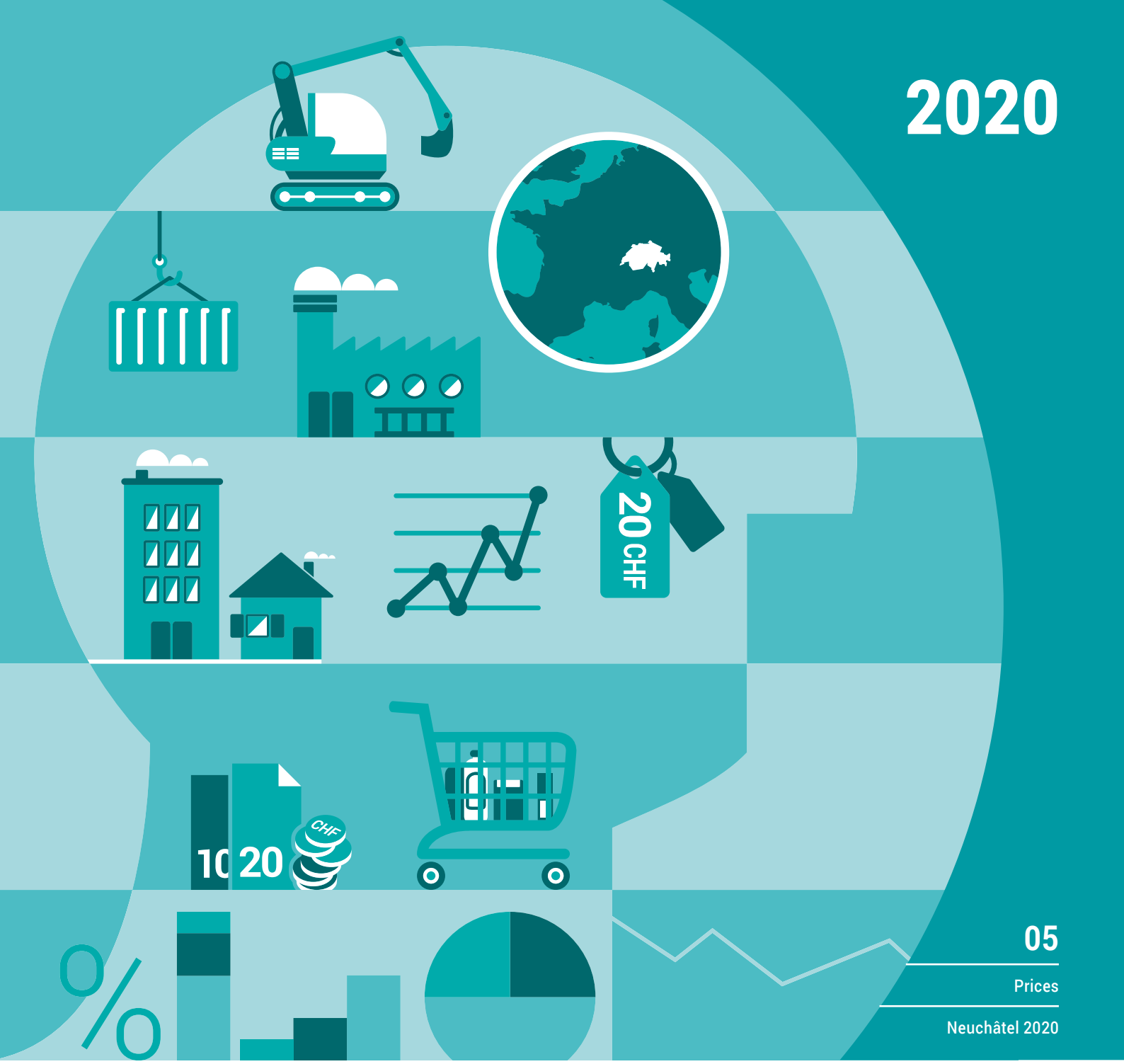

2020

05

Prices

Neuchâtel 2020

Swiss residential property price index (Q4 2019 = 100)

Methodological principles

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Le programme de comparaison d'EUROSTAT et de l'OCDE, Parités de pouvoir d'achat – PIB par habitant – niveau des prix, Neuchâtel 2015, 6 pages, FSO number: 915-1500

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Swiss residential property price index (Q4 2019 = 100)

Methodological principles

Editors Corinne Becker Vermeulen, FSO; Manuel Brand, FSO; Yves Carpy, FSO; David Fischbach, FSO

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1 Definition and scope of the Swiss residential property price index (IMPI)

1.1 The residential property price index (IMPI) as part of the national and international system of price statistics

The residential property price index is part of the Swiss statistical system, supplementing the other price indices already produced by the Federal Statistical Office (FSO): the consumer price index and the harmonised consumer price index, which measure changes in the prices of products consumed by private households; the producer and import price index, which provides information on the price development of goods and services produced/imported by companies and sold in Switzerland and abroad; the construction price index; which monitors the development of prices of services supplied to the construction sector; and the health insurance premium index, which measures the evolution of compulsory and supplementary health insurance premiums and estimates the impact on the disposable income of private households. Finally, purchasing power parity allows price levels in Switzerland to be compared with those of Europe, the OECD, and the rest of the world.

The real estate sector in Switzerland represents a significant part of the economy and accounts for more than 7% of Swiss GDP.[1] It comprises 2.3 million buildings, 1.8 million of which are residential, and 4.6 million dwellings.[2] Purchasing a property is the biggest investment a household will make. It is therefore essential to have information on the evolution of prices in the sector.

The FSO has initially focused on residential property given its importance in Swiss housing stock and because the methodology is well developed. In terms of investment and commercial property, the methodology is much less advanced and only a small number of countries have started producing such indicators.

1.1.1 History

Following the parliamentary motion 11.3021 «Statistische Erfassung der Immobilienpreise» (statistical recording of property prices) in March 2011 and postulate 12.3003 in the Council of States «Machbarkeitstudie für die statistische Erfassung der Immobilienpreise» (feasibility study for the statistical recording of property prices), a feasibility study ARGE EPFL, Econability and HEG on the introduction of an official residential property price index was commissioned by the FSO in 2012. The results of this study were positive and established that there is a real user need for an official index. It also identified potential data sources and developed a rough outline of possible methodological solutions. At the request of the Federal Council on 7 November 2012, a project was therefore set up in 2014 to develop an official Swiss residential property price index.

1.1.2 Legal basis

The legal bases of the residential property price index are the Federal Statistics Act of 9 October 1992 (FStatA, RS 431.01), and the Ordinance of 30 June 1993 on the Conduct of Federal Statistical Surveys (RS 431.012.1), which make it mandatory for the companies surveyed to participate in the price survey.

The Federal Statistical Office complies with the provisions of the Federal Data Protection Act (FADP, RS 235.1), as set out in the Act. All the data collected are treated confidentially and used for statistical purposes only.

[1] FSO national accounts, production account by industry, real estate activities, NOGA 68, 2017

[2] Federal Register of Buildings and Dwellings RegBL (FSO, october 2020)

Existing property price indices at cantonal, national and international level

A number of cantons (Zurich, Geneva, Basel-Stadt, Basel-Landschaft, Ticino, Aargau, Fribourg) publish figures on the cantonal property market: average prices, number of real estate transactions and volume of transactions.

At national level, there is a vast and varied range of private statistics available on the real estate sector: Wüest Partner, IAZI-CIFI and Fahrländer Partner Raumentwicklung calculate numerous indices for different property types at a relatively detailed regional level. The major banks also provide a lot of information on the real estate market. The Swiss Real Estate Datapool SRED provides anonymised data on the real estate transactions of UBS, Credit Suisse and ZKB, as well as analyses on the sector and its evolution over time.

At European level, 26 EU countries plus the United Kingdom, Iceland and Norway publish quarterly housing price indices in accordance with the Regulation (EU) 2016/792 of the European Parliament and of the Council of 11 May 2016. Sub-indices for new and existing constructions are available for 20 countries. A small number of countries publish monthly figures.

A Handbook on Residential Property Price Indices, drawn up by six international organisations, lists conceptual and practical issues and provides recommendations.[3] The International Monetary Fund, which provides very active support to countries all over the world in establishing property price indices, has published a practical guide on the production of residential property price indices.

OECD and the Bank for International Settlements (BIS) compile the results available at global level on its website.

1.2 Applications and user groups

(Residential) property price indices have multiple uses:

1. **Economic indicator:** There is a strong correlation between property prices and the economy. The major banking crises since the mid-1970s have been triggered by the bursting of a property bubble. Do property prices drive the economy, or are they driven by it? In any event, they play a very important role in the economic cycle. Increasing real estate prices are often associated with economic growth, while their decline corresponds to phases of stagnation or recession.
2. **Monitoring financial market stability:** Variation of real estate prices may influence the financial sector and household financial stability. A fall in prices leads to an increase in homeowner debt to equity ratios and creditor risk. Mortgage losses oblige banks to review their mortgage strategy. Overvaluation of property assets presents hidden dangers for the entire economy and property price indices are fundamental in detecting and identifying property bubbles.
3. **Monetary policy and inflation driving:** Several central banks including the Swiss National Bank aim to limit inflation. As owner-occupied housing is a substantial part of consumption, it is important to consider this for inflation driving. The importance of property price indices for this purpose is likely to increase in the future.
4. **Decision-making basis:** For most households, buying a property is their most important investment and thus this decision should be well-founded. While price trends have a considerable impact on the decision to buy or sell a property and when, price indices are one of the most important pieces of information influencing this decision. Furthermore, property price indices are also used by lawmakers and the private sector.
5. **International comparison:** The evolution of the Swiss real estate sector compared with its European neighbours.
6. **Use in other official statistics:** In the Swiss Consumer Price Index, the price trend of owner-occupied housing is currently represented by the rental price index (rental equivalence method). A residential property price index could replace this practice (acquisition concept principle). Both the Federal Statistical Office (which is responsible for the production of national accounts) and the State Secretariat for Economic Affairs are interested in an official price index for the calculation and plausibility checking of the value of housing stock within the scope of the publication of the gross domestic product.
7. **Analyses and forecasts:** For economic forecasting and research institutes.

[3] Eurostat, Handbook on Residential Property Price Indices, Luxembourg: Publications Office of the European Union, 2013

1.3 The IMPI profile

The Swiss residential property price index is an economic indicator produced quarterly by the FSO. It measures price changes in the transactions of single-family households and condominiums bought and sold for residential purposes. The data used to calculate it come from mortgage-lending institutions. To cancel out the qualitative differences between properties, given that every transaction is unique, a hedonic model has been developed and is used. The results are published around six weeks after the end of the quarter under review at national level and according to five municipality types.

2 Necessary data and sources

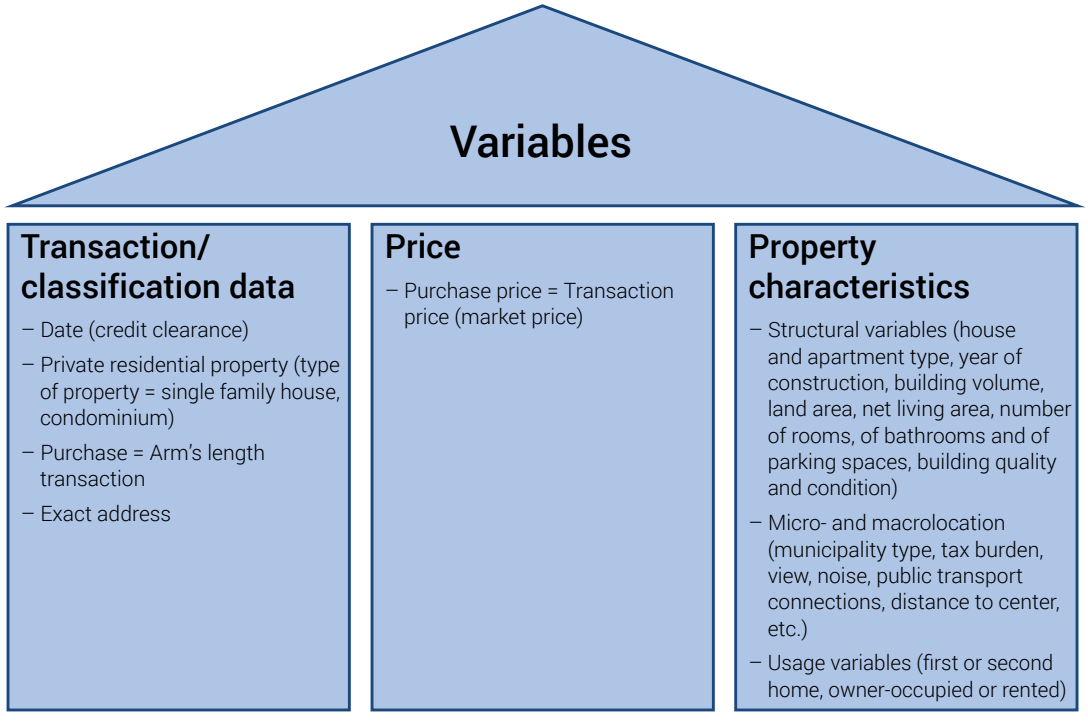
For the production of the residential property price index (IMPI), the FSO is only interested in a specific part of Switzerland's property stock, namely changes in the prices of private residential properties (single-family houses and condominiums). The survey only takes into account residential properties sold at market prices in the respective time period.

The fact that properties are extremely heterogeneous makes comparing real estate prices difficult. No two properties are identical. The comparison of prices is only meaningful if we consider the different property characteristics. In addition to comparing the prices paid for residential property in the survey period and the previous period, the characteristics of the properties sold in the current and previous period must also be compared (section 3.2).

In order to track price changes over time, the FSO requires a whole set of information: primarily data on which properties were sold at which time. It is also necessary to ensure that we are looking at the right property type. The purchase price must also be a market price. Finally, the FSO requires certain information on the characteristics of the single-family houses and condominiums sold (figure G 1)[4]

The data for the IMPI

Necessary information for the definition of the sample and for quality adjustment **G 1**



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[4] Precise information on the characteristics of the transaction, address, use, structure and location variables (format, categories) can be found on the website: https://github.com/bfs-preis/impi/wiki.

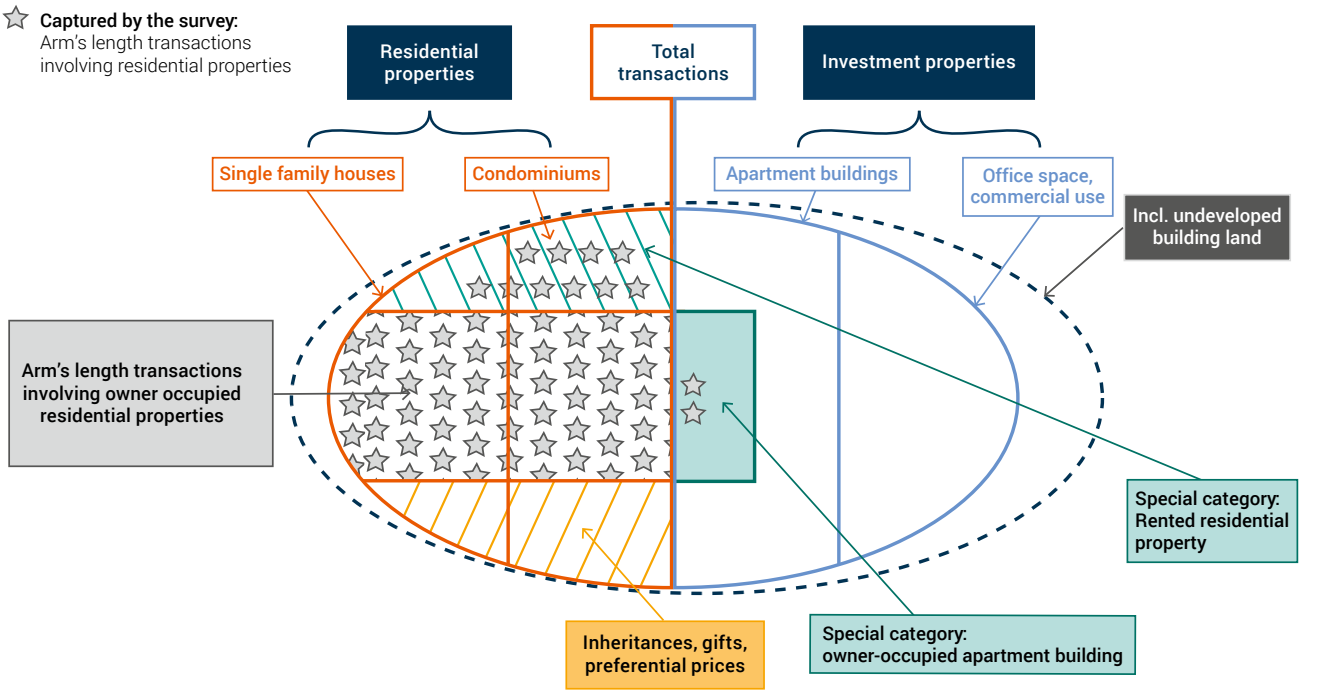
2.1 Property type

The IMPI measures price changes in single-family houses and condominiums. Single-family houses include all houses with one apartment and single-family houses with a granny flat. Condominiums generally refer to individually-owned apartments in an apartment block. Separate hobby rooms acquired as part of the dwelling and parking spaces in an underground garage belonging to a multi-family house are counted respectively as extra rooms and parking spaces (figure G 2).[5]

Delimitation of our population

Segments of the real estate market

G 2



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[5] It is rare for a two-family or three-family house to be included in the sample. This can occur if the owner uses one of the apartments themself. Strictly speaking, these are multi-family houses. They cannot be ruled out in these exceptional cases, however, as they are financed by the reporting mortgage-lending institutions according to the same criteria as owner-occupied property. Unlike with investment properties, in such cases the mortgage-lending institutions do not record the number of apartments in their databases, but instead treat the properties as if they comprise one single apartment. According to the data suppliers, the number of such cases is very small. With its statistical processing of extreme values, the FSO can exclude any distortion of the data.

2.2 Transaction date

The purchase of a property can take several months: from the listing of the property to searching for an institute to finance the transaction, estimating the market value and negotiating the price, to entry of the new owner in the land register (figure G 3). The FSO defines the date on which the risks and benefits of a property are transferred to the new owner as the transaction date. This transfer of ownership coincides with entry in the land register. The date of the purchase agreement and the transaction date do not need to be identical.

The data suppliers for the IMPI are mortgage-lending institutions. The closest date in banks' management systems to the transfer of ownership in the land register is the date of credit clearance. On this date the mortgage bond, which backs the loan from the bank, is also recorded in the land register. By searching in its database for new loans by payment date, the mortgage-lending institution ensures that the purchase or sale actually took place in the period in question.[6] It not only made a mortgage offer, along with competitor institutions, but it provided the financing, usually as the sole institution. In this way, duplicated values are excluded from the supplied data.

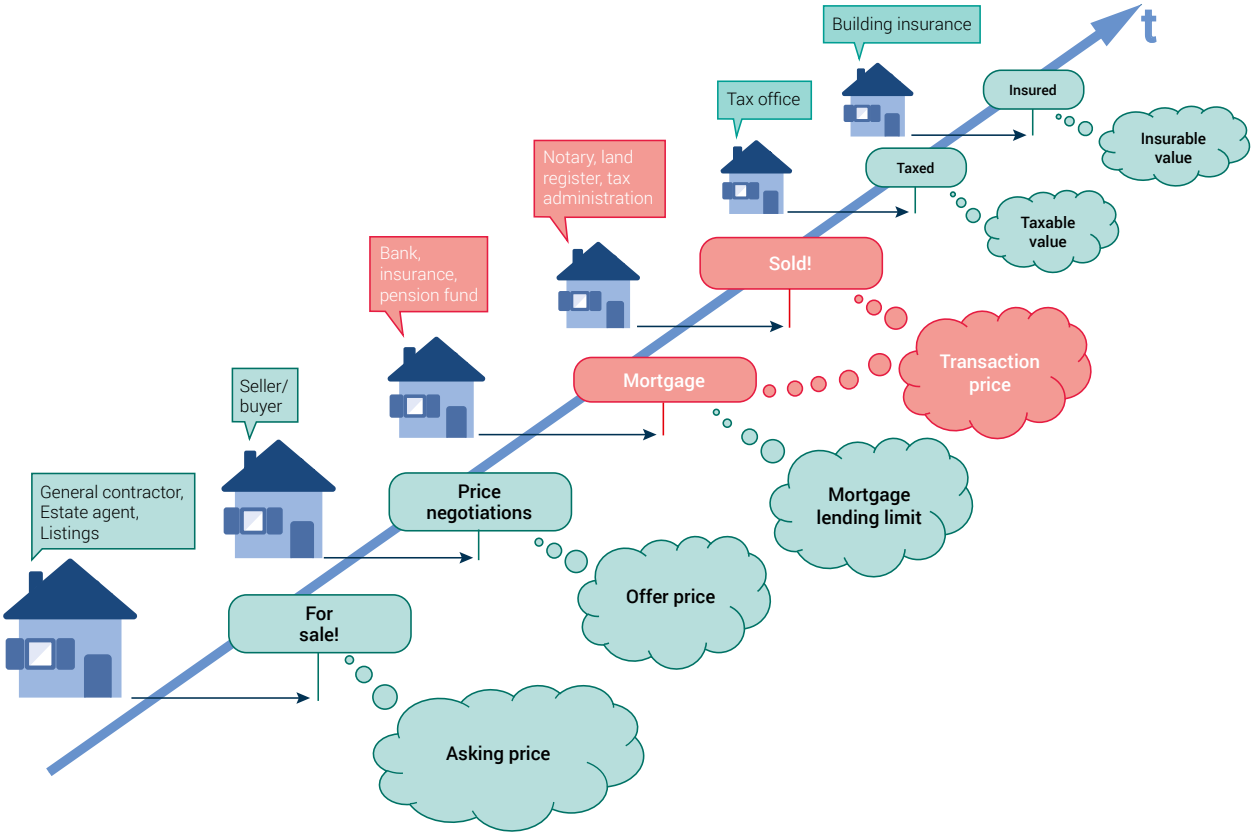
[6] This is the same distinction that the reporting mortgage-lending institution also makes for the Swiss National Bank's survey on new mortgages (HYPO-B). Only data on new mortgages for the purchase of residential property are supplied to the FSO. Transactions involving remortgaging are excluded.

2.3 Price

The FSO records the purchase price, as entered in the purchase agreement. To measure price changes in residential property, the FSO only records purchase prices on the open market. Market prices are the result of what are known as 'arm's length transactions'. This refers to a transaction where the purchase price is negotiated between a buyer and seller, who are both acting in their own self-interest. Sales at preferential prices or between friends or family members (e.g. pre-inheritance and partial donations) are excluded from the residential property price index.[7]

Our focus: The development of transaction prices

The different prices in the course of a real estate transaction **G3**



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[7] In the course of a real estate transaction, the same property has different prices and estimated values: the seller and estate agent set the asking price. The mortgage-lending institution, from which the potential buyer has requested a mortgage offer, estimates the market value and sets a lending limit for the property. During the negotiations between the buyer and seller, the price can also change several times. The final purchase price is the one recorded in the notarised purchase agreement. For regulatory reasons, the mortgage bank must document the final purchase price. Additional valuations are carried out by the cantonal building insurer and the tax administration. They generally vary significantly from the current market price (figure G3).

2.4 Use

The FSO also includes in its survey information on whether single-family houses and condominiums are «owner-occupied» or «rented». However, not all data suppliers can provide the FSO with information on «owner-occupied/rented». The number of transactions is insufficient to calculate price changes in the two property segments separately.[8] The data on whether a property is used as a first or second home by the owner is available across the whole sample. The type of use of a residential property is relevant in all municipalities in which the second home percentage threshold of 20% is reached or exceeded. It is expected that such locations will have a two-tier property market.

2.5 Property characteristics and location

Only in very rare cases is the same property sold in consecutive quarters. Price changes therefore have to be derived from the sale of different single-family houses and condominiums. When comparing two transactions, we need to be able to distinguish whether a change in property price from one period to the next is due to a change in the quality of the sold properties, or if a price change has actually taken place. There is a price change if more or less was paid for the same property characteristics on the open market. In order to ensure that like is compared with like, the FSO also records the objective characteristics of the houses and apartments. This is information on the property type and size, building quality and age, condition and location. Even if their architecture is identical, two properties can at least be distinguished by their location. No two views are the same. Public transport connections, travel time to the nearest town centre, noise pollution and tax burden are also characteristics that are linked to a property's location and for which buyers are willing to pay. By quantifying their location characteristics, the FSO ensures maximum comparability of residential properties.

2.6 Data sources

The FSO is legally obliged to minimise the burden on data suppliers. It obtains the data required for the IMPI from various sources and makes the greatest possible use of administrative data. The IMPI data suppliers are Switzerland's largest mortgage-lending institutions, the Federal Register of Buildings and Dwellings, and a range of federal offices with publicly-accessible geographical information.

2.6.1 Mortgage-lending institutions

The FSO collects the data for the IMPI from Switzerland's 26 largest mortgage-lending institutions (lending banks). Through the 26 banks, the FSO covers around 90% of the market, measured in terms of total mortgage volume[9] They are represented in all regions of Switzerland and can provide a large amount of high-quality data that are necessary for production of the property price index, as they report on which properties changed hands in a given time period. They are also able to draw a distinction between the market segments whose economic momentum the IMPI is designed to illustrate. For business purposes, they distinguish between owner-occupied property and investment property.[10] Mortgage market regulations require Swiss lending banks to enter the definitive purchase price of properties they finance in their systems. They further filter the information by residential property and arm's length transaction. In order to check the market value of properties, they work with electronic valuation programs. The property details they feed into these tools are the same that interest the FSO.

[8] There is an interest on the part of the real estate sector and internationally (e.g. at Eurostat) to be able to observe whether the residential property market is split in two, into one segment for owner-occupied residential property and one market segment for single-family houses and condominiums that are acquired by private investors purely for investment purposes.

[9] The ranking of the 26 largest mortgage-lending institutions (banks) was compiled on the basis of outstanding mortgage volume. The comparison is based on the figures published in their 2017 annual reports for the Swiss market.

[10] Owner-occupied property and investment property are evaluated by the banks using different methods and are subject to different financing rules.

2.6.2 Public data on location quality

The FSO supplements the data from the banks on properties sold with various location information. In order to establish its micro-location (precise address and neighbourhood) and macrolocation (canton, municipality), the FSO draws on publicly-accessible administrative data collections (textbox).

Publicly-accessible databases with geolocation data:
- Tram and train noise (Federal Office for the Environment FOEN)
- Journey time, public transport quality, proportion of second homes in municipalities (Federal Office for Spatial Development ARE)
- Aircraft noise (Federal Office of Civil Aviation FOCA)
- Elevation model, lakes, rivers, high-voltage power lines, slope, exposure (Federal Office of Topography swisstopo)
- Tax burden (Federal Tax Administration FTA)
- Municipality type, statistical major regions (Federal Statistical Office FSO)
- Mountain and lake view (FSO's own view model)
- Administrative addresses of all buildings in Switzerland (Federal Register of Buildings and Dwellings RBD)

2.6.3 Land registers

Alongside the survey of mortgage institutes, the FSO conducts a second survey of cantonal land registers. Using the land registers, the FSO is the first to count the total number of property purchases per year. The FSO will calculate a regional weighting that is representative of the Swiss real estate market based on the number of transactions.[11] Through the survey of banks, the FSO only records purchases that came about with the help of credit financing. The FSO assumes that this is by far the most common type of transaction. Its actual share of the total market should be revealed by the land register survey, which is scheduled for launch in 2022. It will build on the annual long-term preservation of land register data. The survey automatically filters out the data required for the statistics from the land register data sets transferred by the cantons to the Swiss Federal Archives. The additional workload for the land registers is therefore minimal.

[11] The total volume of all real estate sold cannot be surveyed in the land registers for the time being. Up to now, purchase prices have only been included in the electronic land registers in a small number of cantons. Land register law also precludes a nationwide survey of prices from purchase agreements.

3 Survey method

3.1 Survey procedure

The transaction and structural data from banks› systems are enriched with the location characteristics from other sources by data suppliers. For this purpose, the FSO provides them with an IT application for data enrichment and anonymisation together with the enrichment data. This IT application (FSO IT module) produces an enriched, harmonised, anonymised data set for statistical purposes. It ensures that the data from all reporting mortgage institutions are comparable. The addresses are matched between the input data from the bank (section 3.2) and the location information from the RBD geodatabase (section 3.3). The addresses are deleted during the enrichment process. The resulting output file is then ready to be sent to the FSO (figure G 4).[12]

[12] The FSO's IT module is a standalone software. It does not need to be installed or integrated in the bank's IT system to be operated. The IT module is open source. The open source application website www.github.com is used by the FSO as a distribution platform for the IMPI tool and the enrichment data. The source code can also be found there. The module is a JavaScript application with the Angular and Electron framework in the version for Windows operating system and in the version for Linux.

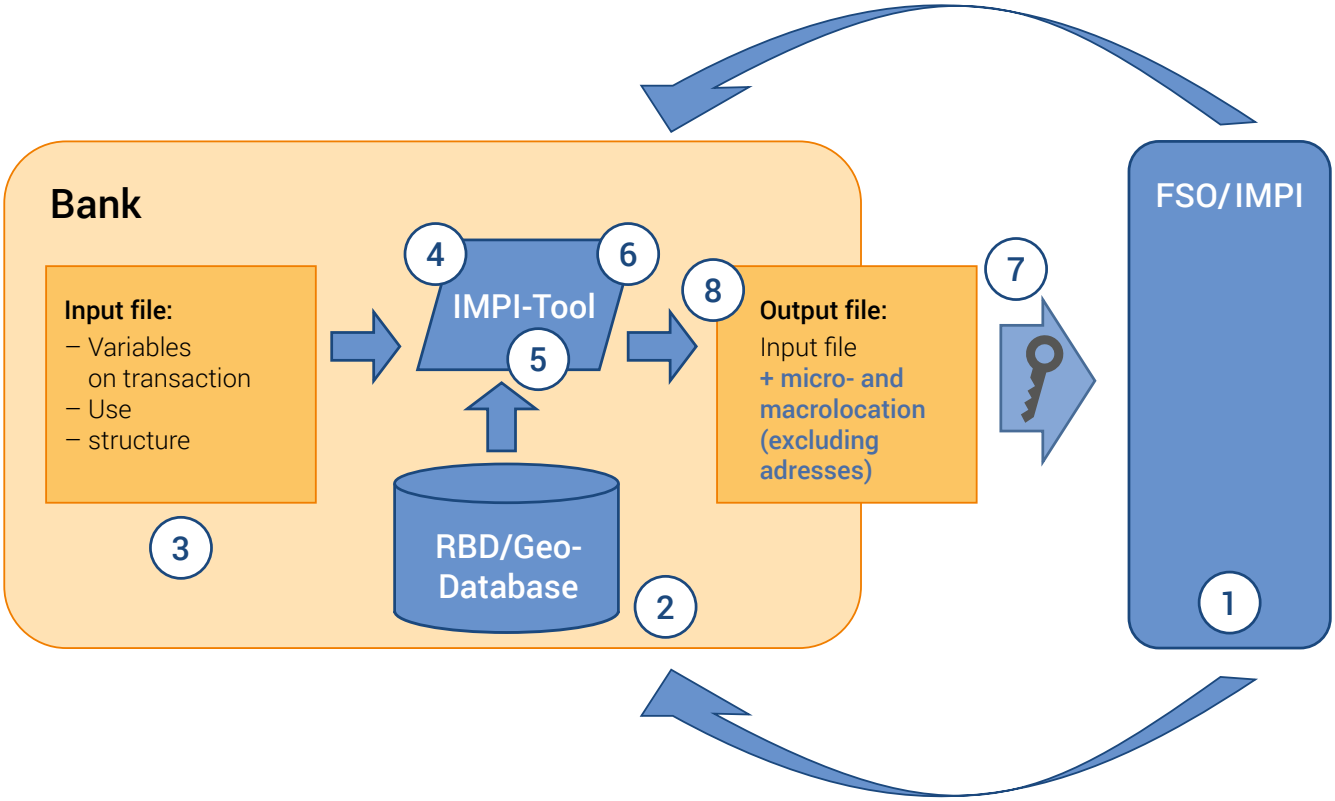
The survey takes place on a quarterly basis. It comprises the following steps (figure G 4):

1 Before the end of the quarter, the FSO sends a request with a link to download the updated RBD geodatabase from the internet platform Github.com.
2 The bank downloads the database with the enrichment data (every quarter). It has previously downloaded the FSO's IT module and put it into operation (one time).
3 The reporting bank prepares the input data (see section 3.2) appropriate to the period.
4 The bank then uploads the input file and database into the IT module.
5 The IT module validates the input data and enriches it with information from the RBD geodatabase.
6 Together with the output file, the IT module creates a log file with error analysis and protocol stating how well the address matching worked. The log file allows the FSO to make inferences about missing or implausible data and enables the bank to make amendments before sending the data.
7 The enriched and anonymised output data are sent to the FSO by the mortgage-lending institutions in encrypted form and on a secure channel of their choosing.
8 The data transmission process runs independently of the enrichment and anonymisation process. The bank therefore retains control of the input and output data.[13]

The deadline for mortgage-lending institutions to prepare and enrich the data and transmit them to the FSO is 10 working days from the end of the reporting period. The FSO estimates an additional 20 working days for validation, data cleaning and calculation of the index. This means that the results for the index will be published six weeks after the end of the quarter.

Quarterly survey with banks

Structure of the survey to collect anonymized data **G 4**



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[13] The FSO recommends mortgage-lending institutions use Sedex for data transfer. Sedex stands for secure data exchange and is a service provided by the Federal Statistical Office FSO (www.sedex.ch). Alternatively, they can use the file transfer service offered by the Federal Office of Information Technology and Systems FOITT. The FSO also receives the data via secure mail.

3.2 The input file

The input data file contains the data from the bank›s management system. It is a table in a .csv or .txt document format. In the table, every purchase of a single-family house or condominium that the reporting bank financed in the previous quarter gets its own row. For each purchase, the reporting bank enters values for 21 variables: the address of the residential property sold, the building structure (number of rooms, volume, land area) and the transaction itself (price, transaction date). The input variable specifications can be found in the appendix 10.1.

List of variables from input file

- Transaction date
- Price
- Address: Street, street number, zip code, community
- Object type (single-family house, condominium)
- Single-family house type (for single-family houses only)
- Condominium type (for condominiums only)
- Primary or secondary home
- Owner-occupied or rented
- Year of construction
- Land area (for single-family houses only)
- Volume of building (for single-family houses only)
- Volume measurement standard (Sia 416, Sia 116, other)
- Net living area (mandatory for condominiums)
- Number of rooms
- Number of bathrooms
- Number of parkings
- Construction quality (rating)
- Property condition (rating)

3.3 The RBD geodatabase

The FSO regenerates the database with the enrichment data every quarter.[14] It therefore takes account of building activity, the merging of municipalities and new names of streets and squares. In the current survey, the bank receives a request from the FSO to download the latest database. It contains 15 pieces of location information (see textbox) on all building addresses in the Federal Register of Buildings and Dwellings RBD (October 2020: 2.284 million properties). The output variable specifications can be found in the appendix 10.2.

The location variable categories

- Cantons (26 categories)
- Major region (7 categories as per FSO nomenclature)
- Municipality type (9 categories as per FSO nomenclature)
- Proportion of second homes in the municipality (2 categories)
- Tax burden in the municipality (3 categories)
- Travel time to centres (3 categories)
- Public transport quality (5 categories)
- Noise exposure (3 categories)
- Slope (3 categories)
- Exposure (2 categories)
- Lake view (3 categories)
- Mountain view (3 categories)
- Distance to lakes (2 categories)
- Distance to rivers (2 categories)
- Distance to high-voltage power lines (2 categories)

The location characteristics come from publicly-accessible Federal Administration sources (section 2.6.2). The FSO calculates its own view model on the basis of the elevation model and swisstopo›s mapping of lakes and mountains. For each of the approximately 2.3 million buildings, the lake surface area and number of mountain peaks that would be visible from a height of two metres are calculated. This is assuming that there are no neighbouring buildings or vegetation obscuring the view. These elements are disregarded in the model as current computing capacities are too limited to carry out a nationwide calculation including regular updates within a reasonable time frame. This view model is also updated with information on new buildings on a quarterly basis.

[14] The database contains four tables: the main table «Buildings» and three auxiliary tables: The «Buildings» table contains address information. The three auxiliary tables «CenterStreets», «CenterCommunities» and «Alternative PLZ» are used for imputation of an alternative address if the address in the bank data is missing, incomplete or incorrect. It contains lists of building addresses that are closest to streets or municipality centres.

4 Quality adjustment

4.1 The need for quality adjustment

When developing a price index, the quality of properties needs to be considered in addition to prices. This is because a portion of the observed price difference between different periods is not be to a pure price change, but to a difference in quality between the two properties. Real estate is a highly heterogeneous good, and individual properties can be distinguished on the basis of many different attributes or characteristics. For this reason, the risk of qualitative distortion – i.e. that like will not be compared with like – is therefore accentuated in a property price index. In order to allow the prices of different properties to still be compared, quality adjustment processes are used. The aim of such processes is to cancel out the price differences that are purely due to differences in quality between two properties, and to extract the true price change. Various quality adjustment proceduresexist, which the FSO evaluated as part of the conceptual work. The property price index uses stratification and a hedonic repricing-type hedonic model. This is an approach that is widely-used internationally, that has already proven effective in the FSO's rental price index, and is also supported by the external feasibility study on statistical recording of property prices.[15]

4.2 Stratification and weighting

The stratification method involves dividing transactions into individual sub-groups, known as subsets or strata. For all sub-categories, sub-indices (or elementary indices) are calculated, which are then aggregated into a weighted overall index. By means of stratification, heterogeneity is reduced and quality adjustment is carried out along the selected stratification criteria. Stratification also allows sub-indices to be calculated for certain segments. In the case of the residential property price index, the transactions are structured on the basis of the two variables property type and municipality type. The latter is based on the nine municipality types in the official FSO typology,[16] which are then further aggregated into the following five categories: urban municipality of a large agglomeration, urban municipality of a medium-sized agglomeration, urban municipality of a small or outside agglomeration, intermediate municipality, rural municipality. Together with the two property type categories (single-family houses and condominiums), this results in a matrix with ten cells. For the calculation, the individual cells are weighted on the basis of their share of the total transaction volume from the previous year.

Ex-post stratification matrix and 2020 weighting of IMPI cells

	Single-family houses	Condominiums
Urban municipality of a large agglomeration	13,916%	17,405%
Urban municipality of a medium-sized agglomeration	7,463%	11,134%
Urban municipality of a small or outside agglomeration	3,785%	5,342%
Intermediate municipality	14,036%	12,080%
Rural municipality	8,940%	5,899%

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[15] ARGE EPFL, Econability and HEG (2012). Machbarkeitsstudie für die statistische Erfassung der Immobilienpreise.

[16] See (in French, German and Italian only): https://www.bfs.admin.ch/bfs/de/home/statistiken/querschnittsthemen/raeumliche-analysen/raeumliche-gliederungen/raeumliche-typologien.assetdetail.2543323.html

On the basis of the stratification shown above, sub-indices can be calculated and quality adjustment can be carried out along the two influential variables of property type and municipality type. However, because not all price-influencing variables can be considered in a simple ex-post stratification, not all quality differences can be adjusted with this method. For this reason, the stratification is also combined with a hedonic model.

4.3 Hedonic model

Hedonic models are based on the definition of properties as bundles of different features or characteristics.[17] The quality of a property includes information on its physical structure, use and location (section 2.5). The quality of a property can be determined on the basis of these characteristics. Consequently, property prices can also be estimated using the relevant characteristics, similar to a shopping basket whose price is determined by its contents, i.e. the prices of the products it contains. The only difference is that the prices of different property characteristics cannot be observed individually. However, the marginal or implicit prices can be determined on the basis of regressions, so that the hedonic regression equation optimally replicates the price of each property. Using the implicit prices, the quality of the sold property can be assessed and a quality adjustment carried out. The hedonic equation takes the following form:

$$p_{it} = \beta x_{it} + \mu_{it}$$

p_{it} = Transaction price of property i in period t
x_{it} = Vector of explanatory variables (structure, use, location) for property i in period t
β = Vector of explanatory variable coefficients (implicit prices)
μ_{it} = Error term for property i in period t

There are various ways of compiling a price index using hedonic models. Essentially, they can be broken down into the time-dummy method, the characteristics prices method, the hedonic imputation method and the hedonic repricing method.[18] Various tests have shown that the hedonic repricing method is the most suitable for the FSO's project. In this method, the price changes in the individual strata are adjusted through the removal of quality differences. For this purpose, a price change index and a quality change index are calculated for every stratification cell. The quotient of these two indices then equates to the quality-adjusted price change (see section 5.2). The quality change index is calculated using a hedonic equation in which the characteristics of all properties from the relevant cell for a period are inserted. Because the hedonic equation is only used to weight property characteristics and to derive the quality adjustment factors in the hedonic repricing method, it does not need to be recalculated in every period, unlike other hedonic methods that use the equation to estimate the quality-adjusted price changes. This means that a broader sample can be used to estimate the hedonic model. The stable model also allows the indices to be calculated exclusively with the period-specific prices and quality characteristics.

For the property price index, separate hedonic models were developed for single-family houses and for condominiums.[19] The modelling was based on collected transaction data from the period 2017 to 2019. This concerns a total of 83 324 transactions (35 724 single-family houses and 47 600 condominiums).

4.4 Revision and quality control

Although the econometric models can be left stable for a certain time in the hedonic repricing method, it should be noted that the implicit prices of quality characteristics may change in the mid- to long-term. In order to accommodate this, the intention is to recalculate the hedonic repricing model on a regular basis. In addition, the FSO will calculate a second index using the rolling time-dummy method alongside the hedonic repricing method. The rolling time-dummy method is a modification/extension of traditional time-dummy method in which besides variables on structure, use and location, period-specific dummy variables are also integrated in the hedonic model.[20] The hedonic model is then re-calculated in each period on the basis of the transactions from the current and three previous periods. The price change can be derived directly from the period-specific dummies. The rolling time-dummy index is not published and merely serves as an internal benchmark and to monitor the development of implicit prices.

[17] Triplett, J. (2006). Handbook on Hedonic Indexes and Quality Adjustments in Price Indexes: Special Application to Information Technology Products. Paris, OECD, Organisation for Economic Cooperation and Development.

[18] Eurostat (2013). Handbook on Residential Property Prices Indices (RPPIs).

[19] Both hedonic models are illustrated in the appendix. For further information on the hedonic models and how they were developed, please see the methodology report «Quality Adjustment Procedure».

[20] Eurostat (2013). Handbook on Residential Property Prices Indices (RPPIs).

5 Data processing and calculation method

5.1 Validation, imputation and plausibility checking of data

The data validation and plausibility checking are two very important stages as they guarantee the quality of results and eliminate certain false or implausible transactions. Imputation fills certain gaps (missing variables) and saves having to exclude transactions which are otherwise of good quality.

An initial validation is carried out by the IT software (FSO IT module) to enrich and anonymise the data (see section 3). The application validates the formats and values of variables. Likewise, a check is carried out on the quality of address matching. By means of a log file, suppliers are informed about potential errors and have the option of correcting the data before they are sent to the FSO.

Once the data have been sent to the FSO, they are validated again by the FSO's IT system and analysed. This analysis looks at, among other things, the number of transactions announced compared with previous quarters, the quality of enrichment, potential duplicate values and extreme values. During this phase, close collaboration with data suppliers is required and is essential to guarantee the quality of observations.

When the data are validated, it may be that a variable relating to a transaction is missing from the supplied data set, for example the number of rooms or number of bathrooms is missing. However, for a transaction to be considered, all the previously defined and required variables must be provided. Where possible, the missing variables are imputed (estimated). The stipulated imputation rules are the following:

- Price: no imputation possible, the transaction is removed;
- Transaction date: imputation of current survey quarter;
- Object type: imputation based on the variables «house type», «condominium type», «volume of building» and «net living area»;
- Year of construction: imputation of (arithmetic) mean values from the cell to which the transaction belongs;
- Land area (for single-family houses): imputation of a value according to the volume of the building and house type;
- Volume of building (for single-family houses): imputation of a value according to land area, number of rooms and number of bathrooms;
- Standard for the calculation of the building volume (for single-family houses): imputation of (arithmetic) mean values from the cell to which the transaction belongs;
- Net living area (for condominiums): imputation of a value according to number of rooms and number of bathrooms;
- Number of rooms: imputation of a value according to volume of building (for single-family houses), net living area (for condominiums) and number of bathrooms;
- Number of bathrooms: imputation of a value according to volume of building (for single-family houses), net living area (for condominiums) and number of rooms;
- Construction quality: imputation of a value according to property condition, period of construction and average area per room (for condominiums);
- Property condition: imputation of a value according to construction quality and period of construction.

Once the missing variables have been imputed, the combinations of implausible and extreme values are identified so they can be removed. An extreme value is one that is either false, improbable or which exceeds certain fixed limits. An extreme value can significantly distort the results, which is why this stage of processing is crucial.

The Cook's Distance method is used to evaluate the combination of transaction variables in relation to the hedonic quality adjustment model.[21] In this way, not only the outliers but also the implausible combinations of acceptable values are detected and the respective transactions are excluded from the calculation. For example, a transaction of a condominium with 7 rooms and 25 m^2 of net living area would be identified as implausible as the combination of the two variables (which are individually plausible) is highly unlikely.

[21] Cook's Distance is commonly used in statistics to estimate the influence of a multivariate data point when using least squares methods. It was introduced by the American statistician R. Dennis Cook, who was the first to describe the concept (Detection of Influential Observation in Linear Regression, Technometrics, Vol. 19, No. 1, February 1977). Cook's Distance measures the effect of deleting a data point in hedonic modelling. Data points with large residuals (outliers) and/or high leverage may distort the outcome and accuracy of a regression. The transactions with a significant Cook's distance value are considered implausible and are excluded from the calculation of the Swiss property price index.

Finally, transactions displaying extreme values are excluded, in other words:

- A transaction date outside of the survey period (quarter)
- A price < CHF 100 000 (for single-family houses) or < CHF 75 000 (for condominiums) or > CHF 10 000 000
- Land area < 50 m^2 or > 5000 m^2 (for single-family houses)
- Volume of building < 200 m^3 or > 3000 m^3 (for single-family houses)
- Net living area < 20 m^2 or > 300 m^2 (for condominiums)
- Number of rooms < 1 or > 15 (for single-family houses) or > 12 (for condominiums)
- Number of bathrooms > 8 (for single-family houses) or > 6 (for condominiums)

These extreme values were defined on the basis of three years of transaction data (2017 to 2019). To summarise, every quarter, an average of 2% of the data are excluded in the validation phase, around 1% are recovered through imputation and we eliminate around 5% of transactions in the phase of plausibility checking/ processing of extreme values. In total, around 6% of the data are not used to calculate the index.

5.2 Stages of aggregation

Once the data have been validated, imputed and plausibility checked (see section 5.1), they are regrouped into 10 corresponding strata by property type and municipality type (see section 4.2). For each real estate transaction, a fictitious value «at constant implicit prices» (see section 4) is calculated so that each observation has two prices: the actual transaction price (gross price) and an estimated value.

The first stage of aggregation involves calculating two mean prices per cell: a mean price for the gross price and a mean price for the estimated price. The formula employed is the geometric mean, which is already used in other price indices and is very popular in price statistics as it has interesting mathematical properties, such as transitivity,[22] which is very important in chaining. These means are calculated in each of the 10 cells:

$$\bar{p}_j^t = \left[\prod\nolimits_{i \in j} p_i^t\right]^{\frac{1}{n_j}} \quad (1)$$

$$\bar{p}_{est,j}^t = \left[\prod\nolimits_{i \in j} \hat{p}_i^t\right]^{\frac{1}{n_j}} \quad (2)$$

where:

$\bar{p}_j^t$ = the geometric mean of transaction prices of property in cell j in the quarter t
$\bar{p}_{est,j}^t$ = the geometric mean of the estimated property prices of property in cell j in the quarter t
j = the cell j (Propertytype X Type of Municipality)
t = the quarter t
n_j = the number of transactions in the cell j
p_i^t = the transaction price of property i in quarter t
$\hat{p}_i^t$ = the estimated price of property i in quarter t

In the second stage of aggregation, elementary indices are established with mean transaction prices (gross price index) and with mean estimated prices (quality index).

$$IP_j^{0,t} = \frac{\bar{p}_j^t}{\bar{p}_j^0} \times 100 \ (3)$$

$$IQ_j^{0,t} = \frac{\bar{p}_{est,j}^t}{\bar{p}_{est,j}^0} \times 100 \ (4)$$

where:

$IP_j^{0,t}$ = the gross price index calculated with the mean of the transaction prices in the cell j in the quarter t
$IQ_j^{0,t}$ = the quality index calculated with the mean of the estimated prices in the cell j (for one object and municipality type) j in quarter t
t = the current quarter
0 = the base quarter

In each cell, the gross price index is then divided by the quality

$$IPa_j^{0,t} = \frac{IP_j^{0,t}}{IQ_j^{0,t}} \times 100 \ (5)$$

index to cancel out the qualitative differences:
where:

$IPa_j^{0,t}$ = the quality adjusted price index for the current period t in cell j (property type and a municipality type) compared with base quarter 0. This calculation is carried out for all cells:

[22] The transitivity axiom requires us to be able to calculate an index between 0 and N via intermediate periods N-1, N-2, N-3.

Sub-indices	Single-family houses (SFH)	Condominiums (CONDO)
ULA – Urban municipality of a large agglomeration	$IPa_{(SFH,ULA)}$	$IPa_{(CONDO,ULA)}$
UMA – Urban municipality of a medium-sized agglomeration	$IPa_{(SFH,UMA)}$	$IPa_{(CONDO,UMA)}$
USOA – Urban municipality of a small or outside agglomeration	$IPa_{(SFH,USOA)}$	$IPa_{(CONDO,USOA)}$
INT – Intermediate municipalitie	$IPa_{(SFH,INT)}$	$IPa_{(CONDO,INT)}$
RUR – Rural municipality	$IPa_{(SFH,RUR)}$	$IPa_{(CONDO,RUR)}$

The third and final stages of aggregation allow the calculation of the property price index according to property type, municipality type and total. Each sub-index is weighted by the weight of its cell according to a Laspeyres-type formula (Young›s formula: weighted arithmetic mean).

$$IPa_C^{0,t} = \frac{\sum_{j\in C}\left[IPa_j^{0,t} \times g_{j,B}\right]}{\sum_{j\in C}\left[g_{j,B}\right]} (6)$$

$$IPa_O^{0,t} = \frac{\sum_{j\in O}\left[IPa_j^{0,t} \times g_{j,B}\right]}{\sum_{j\in O}\left[g_{j,B}\right]} (7)$$

$$IPa^{0,t} = \frac{\sum_j \left[IPa_j^{0,t} \times g_{j,B}\right]}{\sum_j \left[g_{j,B}\right]} (8)$$

where:

$IPa_C^{0,t}$ = the adjusted price index for municipality type C in quarter t compared with the base quarter 0

$IPa_O^{0,t}$ = the adjusted price index for a property type O in quarter t compared with base quarter 0

$IPa^{0,t}$ = the adjusted total price index in quarter t compared with the base quarter 0

$g_{j,B}$ = the weight of the cell j in the weighting year B (previous year)

Chaining: the weight of the cells ($g_{j,B}$) is updated every year so that the structure of the real estate market is as close as possible to reality. To produce long series of results, the indices are chained together. The chain quarter is the 4th quarter, which represents the new base period and the chain link for which an index is available in relation to the old and new base.

where:

IPa^{q4_{T-n},t_T} = the adjusted price index in quarter t of year T compared with the base period, the 4th quarter of year T-n

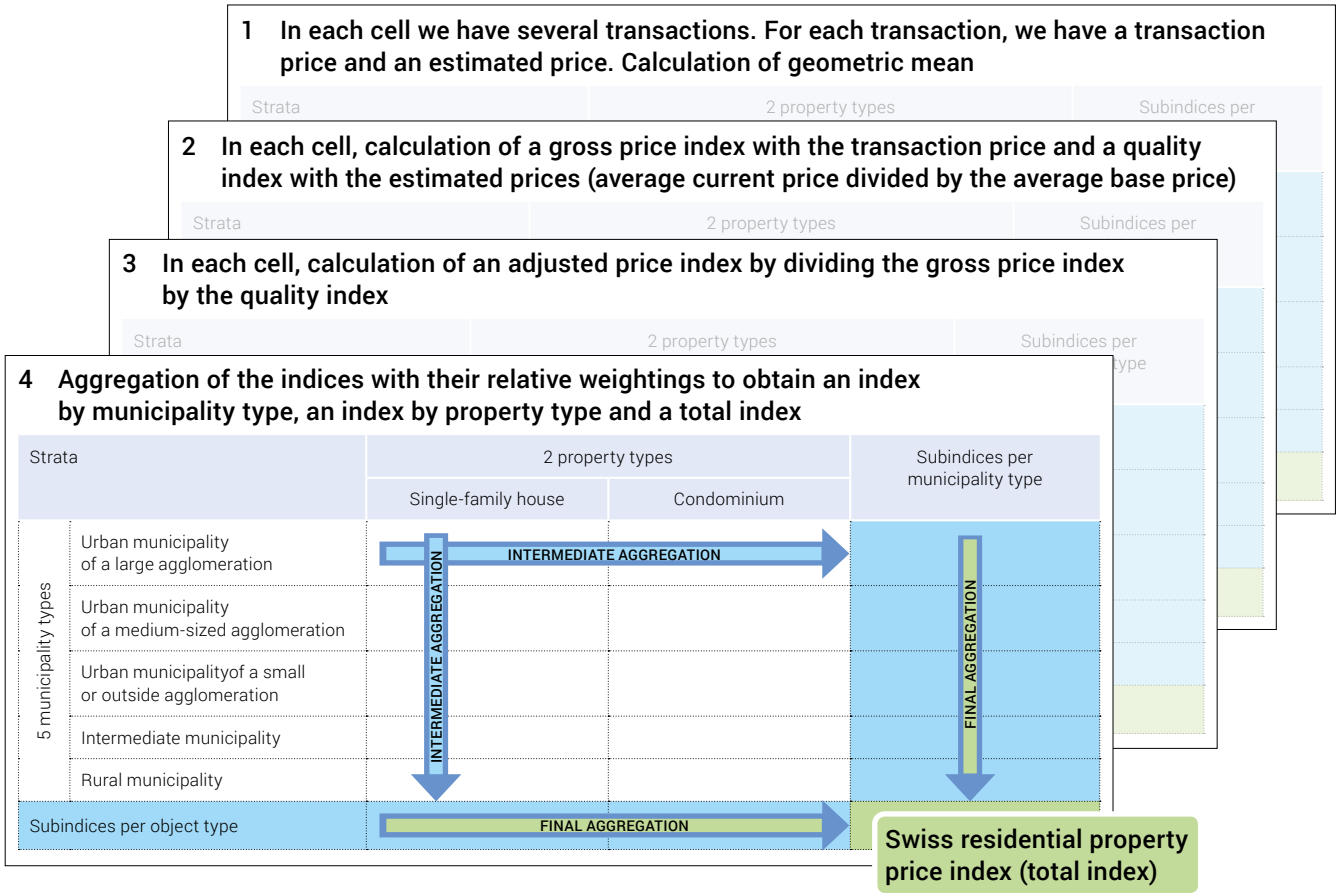
IPa^{q4_{T-1},t_T} = the adjusted price index in quarter t of year T compared with the base period, the 4th of year T-1

$IPa^{q4_{T-n},q4_{T-n+1}}$ = the adjusted price index in the 4th quarter of year T-n+1 compared with the base period, the 4th quarter of year T-n

n = the number of links (here: one link equals one year)

$$IPa^{q4_{T-n},t_T} = IPa^{q4_{T-n},q4_{T-n+1}} \times IPa^{q4_{T-n+1},q4_{T-n+2}} \times \ldots \times IPa^{q4_{T-1},t_T} \times \frac{1}{100^n} (9)$$

To summarise G5



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6 Quality management

The FSO's price indices are economic indicators that have a significant influence on the economy. An error can have considerable financial and social repercussions. For this reason, it is very important to ensure it is of good quality. As subsequent correction of a published index is not envisaged in the regular process, the FSO will do everything it can to guarantee quality throughout the production process.

All prices collected undergo controls before being validated definitively and entered in the index calculation. Various control functions are integrated in the PRESTA IT production platform (see section 5.1).[23]

At the end of each production cycle and before results are published, a meeting dedicated to quality is also organised to carry out a structured and documented assessment of the production and the initial results.

Figure 6 shows the quality management system set up for the IMPI.

The FSO places great value on the quality of the information it produces as well as on its credibility and the trust placed in it by its users. In terms of quality management, it adheres to international standards (Code of good practice and Eurostat recommendations on quality) and on the internal quality manual. The IMPI also follows these principles.[24]

[23] PRESTA for PREisSTAtistik

[24] Eurostat, *European Statistics Code of Practice*,
Luxembourg: Publications Office of the European Union, 2018.
United Nations, *Fundamental Principles of Official Statistics*, Resolution adopted by the General Assembly on 29 January 2014
Federal Statistical Office (FSO), *FSO quality, process and risk management policy*, Neuchâtel, March 2017
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Luxembourg: Publications Office of the European Union, 2013.

Quality assurance system for the IMPI production G6

Before the surveys

Instructions and support for data suppliers
- Detailed documentation for data suppliers on the variables required and on the survey method (data supplier guide).
- Assistance and support.

Electronic data collection

Checks by data suppliers
- Request data from suppliers, delivery of the latest version of the enrichment database and the latest version of the enrichment software (if adaptations).
- 46 validation rules are applied to the input data by the software (FSO IT module); rule violations are highlighted by a 'redflag' and the data supplier is asked to correct the most serious errors and to add the missing variables where possible.

Preliminary check of data by the FSO as soon as they are received
- Number of transactions received, quality of enrichment, descriptive statistics of quarterly data by supplier. If the data are valid on the whole, they are entered in the IT PRESTA application. If this is not the case, the supplier is contacted with the aim of improving the quality of the data.

The data are entered in the IT Presta 3 application

Validation, processing and plausibility checking of data
- Once the data have been inputed in the IT PRESTA application, the data are validated according to rules. Each transaction is assigned a status: plausible, to be processed implausible.
- The missing values are imputed (only the transaction price and the macro and micro location variables are not imputed if they are missing
- The extreme values are removed (according to the Cook's Distance method and based on the stipulated minimum and maximum values for the two property types
- The data are ready for the calculation.

IMPI results

Checking results
- Calculation in the IT PRESTA 3 application and in SAS/R; comparison of results.
- Plausibility checking of results compared with the previous quarter and the same quarter of the previous year.
- Quarterly quality meeting with the production team and head of section.

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7 Publication

The Swiss property price index IMPI is published quarterly. It is published six weeks after the end of the reporting period:

- Mid-May for Q1 of the current year
- Mid-August for Q2 of the current year
- Mid-November for Q3 of the current year
- Mid-February for Q4 of the previous year

The results are published in a press release. These are available online together with detailed results and further information on the property price index at: **http://www.impi.bfs.admin.ch**.

8 Abbreviations

ARE	Federal Office for Spatial Development
ARGE	Working group (Arbeitsgemeinschaft)
CONDO	Condominium
CORSTAT	Swiss Conference of Regional Statistical Offices
Econability	Sustainable Economics in Research and Practice
EPFL	Swiss Federal Institute of Technology Lausanne
EUROSTAT	Statistical Office of the European Union
FADP	Federal Data Protection Act
FOCA	Federal Office of Civil Aviation
FOEN	Federal Office for the Environment
FSO	Federal Statistical Office
FStatA	Federal Statistics Act
FTA	Federal Tax Administration
GDP	Gross domestic product
GitHub	Online software development platform for open source applications
HEG	Geneva School of Business Administration
HYPO_B	SNB's new mortgage survey
IMPI	Swiss residential property price index
IPI	Import price index
IT	Information technology
MFH	Multi-family house
NOGA	General Classification of Economic Activities (nomenclature)
OECD	Organisation for Economic Cooperation and Development
PLZ	Postcode
PRESTA	PREisSTAtistik IT platform
RBD	Federal Register of Buildings and Dwellings
RPPI	Residential Property Prices Indices
SEDEX	Secure Data Exchange (IT service of the FSO)
SFH	Single-family houses
SIA	Swiss Society of Engineers and Architects
SNB	Swiss National Bank
swisstopo	Federal Office of Topography

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10 Appendix

10.1 Input variable specifications

Input file

Input file from the data supplier

Field	Type	Description	Nomenclature
TransactionDate	Date	Transaction date	
Price	Number(,2)	Final purchase price	
Street	String(200)	Street name	
StreetNumber	String(10)	Property identifier (house number)	
ZipCode	Number(4)	Property identifier (post code)	
Community	String(200)	Property identifier (municipality)	
ObjectType	Nomenclature	Property type	1 = single family house ; 2 = condominium
SingleFamilyHouseType	Nomenclature	House type (for houses)	e.g. 1 = single family house; 2 = semi-detached house; 3 = end of terrace house; 4 = mid-terrace house; 5 = hillside terraced house (determined by the data supplier)
CondominiumType	Nomenclature	Apartment type (for condominiums)	e.g. 1 = non-ground-floor apartment; 2 = top-floor apartment; 3 = apartment with garden; 4 = loft; 5 = other (determined by the data supplier)
PrimaryOrSecondaryHome	Nomenclature	Use: first or second home	1 = main residence; 2 = secondary residence
OwnerOccupiedOrRented	Nomenclature	Use: owner-occupied or rented	1 = owner-occupied dwelling; 2 = dwelling available to rent
YearOfConstruction	Number(4)	Year of construction	
LandArea	Number(6)	Plot area in m^2 (for houses)	
VolumeOfBuilding	Number(6)	Volume in m^3 (for houses)	
StandardOfVolume	Nomenclature	Standard of volume (for houses)	1 = GVA (building insurance); 2 = SIA 416, 3 = SIA 116
NetLivingArea	Number(6)	Net living space (for condominiums)	
NumberOfRooms	Number(2,1)	Number of rooms	
NumberOfBathrooms	Number(2)	Number of bathrooms	
NumberOfParkings	Number(2)	Number of parking spaces	
ConstructionQuality	Nomenclature	Quality of construction	e.g. 1 = poor; 2 = average; 3 = good; 4 = very good (determined by the data supplier)
PropertyCondition	Nomenclature	State of the property	e.g. 1 = poor; 2 = non-renovated; 3 = renovated; 4 = as new (determined by the data supplier)

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10.2 Output variable specifications

Output file

Output file from the BFS-IT module

Variable	Type	Description	Nomenclature
TransactionDate	Date	Transaction date	
Price	Number(,2)	Final purchase price	
ObjectType	Nomenclature	Property type	1 = house; 2 = apartment
SingleFamilyHouseType	Nomenclature	House type (for houses)	(determined by the data supplier)
CondominiumType	Nomenclature	Apartment type (for condominius)	(determined by the data supplier)
PrimaryOrSecondaryHome	Nomenclature	Use: first or second home	1 = main residence; 2 = secondary residence
OwnerOccupiedOrRented	Nomenclature	Use: owner-occupied or rented	1 =owner-occupied dwelling; 2 = dwelling available to rent
YearOfConstruction	Nomenclature	Year of construction (periods)	1 = before 1919; 2 = 1919 to 1945; 3 = 1946 to 1970; 4 = 1971 to 1990; 5 = 1991 to 2005; 6 = 2006 to 2015; 7= after 2015
LandArea	Number(6)	Plot area (for houses)	
VolumeOfBuilding	Number(6)	Volume (for houses)	
StandardOfVolume	Nomenclature	Stardard of volume (for houses)	1 = GVA (building insurance); 2 = SIA 416, 3 = SIA 116
NetLivingArea	Number(6)	Net living space (for condominiums)	
NumberOfRooms	Number(2,1)	Number of rooms	
NumberOfBathrooms	Number(2)	Number of bathrooms	
NumberOfParkings	Number(2)	Number of parking spaces	
ConstructionQuality	Nomenclature	Quality of construction	(determined by the data supplier)
PropertyCondition	Nomenclature	State of the property	(determined by the data supplier)
Canton	Nomenclature	Canton	1 = Zurich; 2 = Bern; 3 = Lucerne; 4 = Uri; 5 = Schwyz; 6 = Obwald; 7 = Nidwald; 8 = Glarus; 9 = Zug; 10 = Fribourg; 11 = Solothurn; 12 = Basel-Stadt; 13 = Basel-Land; 14 = Schaffhausen; 15 = Appenzell A. Rh.; 16 = Appenzell I. Rh.; 17 = St. Gallen; 18 = Graubünden; 19 = Aargau; 20 = Thurgau; 21 = Ticino; 22 = Vaud; 23 = Valais; 24 = Neuchâtel; 25 = Geneva; 26 = Jura
MajorStatisticalRegion	Nomenclature	Major region	1 = Lake Geneva Region; 2 = Espace Mittelland; 3 = Northwest Switzerland; 4 = Zurich; 5 = Eastern Switzerland; 6 = Central Switzerland; 7 = Ticino
CommunityType	Nomenclature	Municipality type according to FSO typology	1 = Urban municipality of a large agglomeration; 2 = Urban municipality of a medium-sized agglomeration; 3 = Urban municipality of a small or outside agglomeration; 4 = High density, peri-urban municipality; 5 = Medium-density, peri-urban municipality; 6 = Low density, peri-urban municipality; 7 = Rural centre municipality; 8 = Rural municipality in central location; 9 = Peripheral rural municipality
SecondAppartementQuota	Boolean (Oui / Non)	Proportion of second homes in the municipality (above or below 20%)	Yes = 20% or more; No = less than 20%
TaxBurden	Nomenclature	Tax burden in municipality (as a percentage)	1 = 0 ≤x ≤ 5.4; 2 = 5.4<x ≤ 6.8; 3 = 6.8<x
TravelTimeToCenters	Nomenclature	Travel time to centres (in minutes)	1 = 0 <x ≤ 11; 2= 11 <x ≤ 18; 3 = 18<x
PublicTransportQuality	Nomenclature	Public transport quality	1 = class A; 2 = class B; 3 = class C; 4 = class D; 5 = class E
NoiseExposure	Nomenclature	Noise exposure (in decibels): seclection of loudest noise source for the day and night from rail traffic, road traffic or aircraft, values then aggregated using the Day/Night Average Sound Level method, and split into 3 categories	1 = 0db <x≤ 45db; 2 = 45db <x≤ 52db; 3 = 52db <x
Slope	Nomenclature	Slope gradient of land	1 = 0<x≤4 degrees; 2 = 4<x≤9 degrees; 3 = 9 degrees <x
Exposure	Nomenclature	Exposure of land (cardinal points)	1 = north, nord-west, east, north-east; 2 = west, south-west, south, south-east

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Output file (end)

Output file from the BFS-IT module

Variable	Type	Description	Nomenclature
LakeView	Nomenclature	Visible lake area (in hectares)	1 = 0; 2 = 0 < x ≤ 100; 3 = 100 ≤ x
MountainView	Nomenclature	Number of visible mountain peaks	1 = 0 ≤ x ≤ 4 peaks; 2 = 5 ≤ x ≤ 13 peaks; 3 = 13 peaks < x
DistanceToLakes	Nomenclature	Distance to the nearest lake (in metres)	1 = 0 ≤ x ≤ 100m; 2 = 100 m < x
DistanceToRivers	Nomenclature	Distance to the nearest river (in metres)	1 = 0 ≤ x ≤ 100m; 2 = 100 m < x
DistanceToHighVoltage-PowerLines	Nomenclature	Distance to the nearest high voltage power line (in metres)	1 = 0 ≤ x ≤ 100m; 2 = 100 m< x
ErrorTypeValidation	Text	Code describing which rules were broken	
MatchingType	Nomenclature		0 = exact match; 1 = match with the building in the middle of the road; 2 = match with the building in the middle of the postal code area; 3 = no match possible

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Legend:

Information on transactions and structural variables supplied by the bank

Geolocisation information obtained following enrichment

Validation variables generated by the module

10.3 List of variables hedonic model for single family houses

Variable	Description
ln_volumeofbuilding	Natural logarithm building volume
standardofvolume_1	Dummy recording building volume according to GVA
standardofvolume_2	Dummy recording building volume according to SIA 416
standardofvolume_3	Dummy recording building volume according to SIA 116
ln_landarea	Natural logarithm land area
primaryorsecondaryhome_Quota_1	Dummy first home
primaryorsecondaryhome_Quota_2	Dummy second home in a municipality with more than 20% second homes
primaryorsecondaryhome_Quota_3	Dummy second home in a municipality with fewer than 20% second homes
yearofconstruction_1	Dummy year of construction pre-1919
yearofconstruction_2	Dummy year of construction 1919 to 1945
yearofconstruction_3	Dummy year of construction 1946 to 1970
yearofconstruction_4	Dummy year of construction 1971 to 1990
yearofconstruction_5	Dummy year of construction 1991 to 2005
yearofconstruction_6	Dummy year of construction 2005 to 2015
yearofconstruction_7	Dummy year of construction after 2015
numberofrooms_3	Dummy 3 rooms or fewer
numberofrooms_4	Dummy 4 rooms
numberofrooms_5	Dummy 5 rooms
numberofrooms_6	Dummy 6 rooms
numberofrooms_7	Dummy 7 rooms
numberofrooms_8	Dummy 8 rooms or more
numberofbathrooms_1	Dummy 1 bathroom
numberofbathrooms_2	Dummy 2 bathrooms
numberofbathrooms_3	Dummy 3 bathrooms
numberofbathrooms_4	Dummy 4 bathrooms
numberofbathrooms_5	Dummy 5 bathrooms or more
canton_1	Dummy canton Zurich
canton_2	Dummy canton Bern
canton_3	Dummy canton Lucerne
canton_4	Dummy canton Uri
canton_5	Dummy canton Schwyz
canton_6	Dummy canton Obwalden
canton_7	Dummy canton Nidwalden
canton_8	Dummy canton Glarus
canton_9	Dummy canton Zug
canton_10	Dummy canton Fribourg
canton_11	Dummy canton Solothurn
canton_12	Dummy canton Basel-Stadt
canton_13	Dummy canton Basel-Landschaft
canton_14	Dummy canton Schaffhausen
canton_15	Dummy canton Appenzell Ausserrhoden
canton_16	Dummy canton Appenzell Innerrhoden
canton_17	Dummy canton St. Gallen
canton_18	Dummy canton Graubünden
canton_19	Dummy canton Aargau
canton_20	Dummy canton Thurgau
canton_21	Dummy canton Ticino

Variable	Description
canton_22	Dummy canton Vaud
canton_23	Dummy canton Valais
canton_24	Dummy canton Neuchâtel
canton_25	Dummy canton Geneva
canton_26	Dummy canton Jura
communitytype_1	Dummy urban municipality of a large agglomeration
communitytype_2	Dummy urban municipality of a medium-sized agglomeration
communitytype_3	Dummy urban municipality of a small or outside agglomeration
communitytype_4	Dummy peri-urban municipality of high density
communitytype_5	Dummy peri-urban municipality of medium density
communitytype_6	Dummy peri-urban municipality of low density
communitytype_7	Dummy municipality of a rural centre
communitytype_8	Dummy centrally located rural municipality
communitytype_9	Dummy peripheral rural municipality
taxburden_1	Dummy municipalities with low tax burden (0 to 5.4%)
taxburden_2	Dummy municipalities with moderate tax burden (between 5.4% and 6.8%)
taxburden_3	Dummy municipalities with high tax burden (over 6.8%)
traveltimetocenters_1	Dummy municipalities with short journey time to centres (0 to 11min)
traveltimetocenters_2	Dummy municipalities with moderate journey time to centres (11 to 18min)
traveltimetocenters_3	Dummy municipalities with long journey time to centres (over 18min)
publictransportquality_1	Dummy public transport quality category A
publictransportquality_2	Dummy public transport quality category B
publictransportquality_3	Dummy public transport quality category C
publictransportquality_4	Dummy public transport quality category D
publictransportquality_5	Dummy public transport quality category E
noiseexposure_1	Dummy low noise exposure (0 to 45 decibels)
noiseexposure_2	Dummy moderate noise exposure (between 45 and 52 decibels)
noiseexposure_3	Dummy high noise exposure (over 52 decibels)
slope_1	Dummy gentle slope (0 to 4 degrees)
slope_2	Dummy moderate slope (between 4 and 9 degrees)
slope_3	Dummy steep slope (over 9 degrees)
exposure_1	Dummy exposure north, northwest, east, northeast
exposure_2	Dummy exposure west, southwest, south, southeast
lakeview_1	Dummy no visible lake area (0 hectares)
lakeview_2	Dummy little visible lake area (up to 100 hectares)
lakeview_3	Dummy extensive visible lake area (over 100 hectares)
mountainview_1	Dummy 0 to 4 visible mountain peaks
mountainview_2	Dummy 5 to 13 visible mountain peaks
mountainview_3	Dummy more than 13 visible mountain peaks
distancetolakes_1	Dummy 100 metres or less to nearest lake
distancetolakes_2	Dummy more than 100 metres to nearest lake
distancetorivers_1	Dummy 100 metres or less to nearesr river
distancetorivers_2	Dummy more than 100 metres to nearest river
distancetohighvoltagepowerlines_1	Dummy 100 metres or less to the nearest high voltage power line
distancetohighvoltagepowerlines_2	Dummy more than 100 metres to the nearest high voltage power line
year_2017	Dummy transactions from 2017
year_2018	Dummy transactions from 2018
year_2019	Dummy transactions from 2019

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10.4 List of variables hedonic model for condominiums

Variable	Description
ln_netlivingarea	Natural logarithm net living area
primaryorsecondaryhome_Quota_1	Dummy first home in a municipalitywith more than 20% second homes
primaryorsecondaryhome_Quota_2	Dummy first home in a municipality with fewer than 20% second homes
primaryorsecondaryhome_Quota_3	Dummy second home in a municipality with more than 20% second homes
primaryorsecondaryhome_Quota_4	Dummy second home in a municipality with fewer than 20% second homes
yearofconstruction_1	Dummy year of construction pre-1919
yearofconstruction_2	Dummy year of construction 1919 to 1945
yearofconstruction_3	Dummy year of construction 1946 to 1970
yearofconstruction_4	Dummy year of construction 1971 to 1990
yearofconstruction_5	Dummy year of construction 1991 to 2005
yearofconstruction_6	Dummy year of construction 2005 to 2015
yearofconstruction_7	Dummy year of construction after 2015
numberofrooms_1	Dummy 1 room
numberofrooms_2	Dummy 2 rooms
numberofrooms_3	Dummy 3 rooms
numberofrooms_4	Dummy 4 rooms
numberofrooms_5	Dummy 5 rooms
numberofrooms_6	Dummy 6 rooms or more
numberofbathrooms_1	Dummy 1 bathroom
numberofbathrooms_2	Dummy 2 bathrooms
numberofbathrooms_3	Dummy 3 bathrooms
numberofbathrooms_4	Dummy 4 bathrooms or more
canton_1	Dummy canton Zurich
canton_2	Dummy canton Bern
canton_3	Dummy canton Lucerne
canton_4	Dummy canton Uri
canton_5	Dummy canton Schwyz
canton_6	Dummy canton Obwalden
canton_7	Dummy canton Nidwalden
canton_8	Dummy canton Glarus
canton_9	Dummy canton Zug
canton_10	Dummy canton Fribourg
canton_11	Dummy canton Solothurn
canton_12	Dummy canton Basel-Stadt
canton_13	Dummy canton Basel-Landschaft
canton_14	Dummy canton Schaffhausen
canton_15	Dummy canton Appenzell Ausserrhoden
canton_16	Dummy canton Appenzell Innerrhoden
canton_17	Dummy canton St. Gallen
canton_18	Dummy canton Graubünden
canton_19	Dummy canton Aargau
canton_20	Dummy canton Thurgau
canton_21	Dummy canton Ticino
canton_22	Dummy canton Vaud

Variable	Description
canton_23	Dummy canton Valais
canton_24	Dummy canton Neuchâtel
canton_25	Dummy canton Geneva
canton_26	Dummy canton Jura
communitytype_1	Dummy urban municipality of a large agglomeration
communitytype_2	Dummy urban municipality of a medium-sized agglomeration
communitytype_3	Dummy urban municipality of a small or outside agglomeration
communitytype_4	Dummy peri-urban municipality of high density
communitytype_5	Dummy peri-urban municipality of medium density
communitytype_6	Dummy peri-urban municipality of low density
communitytype_7	Dummy municipality of a rural centre
communitytype_8	Dummy centrally located rural municipality
communitytype_9	Dummy peripheral rural municipality
taxburden_1	Dummy municipalities with low tax burden (0 to 5.4%)
taxburden_2	Dummy municipalities with moderate tax burden (between 5.4% and 6.8%)
taxburden_3	Dummy municipalities with high tax burden (over 6.8%)
traveltimetocenters_1	Dummy municipalities with short journey time to centres (0 to 11min)
traveltimetocenters_2	Dummy municipalities with moderate journey time to centres (11 to 18min)
traveltimetocenters_3	Dummy municipalities with long journey time to centres (over 18min)
publictransportquality_1	Dummy public transport quality category A
publictransportquality_2	Dummy public transport quality category B
publictransportquality_3	Dummy public transport quality category C
publictransportquality_4	Dummy public transport quality category D
publictransportquality_5	Dummy public transport quality category E
noiseexposure_1	Dummy low noise exposure (0 to 45 decibels)
noiseexposure_2	Dummy moderate noise exposure (between 45 and 52 decibels)
noiseexposure_3	Dummy high noise exposure (over 52 decibels)
slope_1	Dummy gentle slope (0 to 4 degrees)
slope_2	Dummy moderate slope (between 4 and 9 degrees)
slope_3	Dummy steep slope (over 9 degrees)
exposure_1	Dummy exposure north, northwest, east, northeast
exposure_2	Dummy exposure west, southwest, south, southeast
lakeview_1	Dummy no visible lake area (0 hectares)
lakeview_2	Dummy little visible lake area (up to 100 hectares)
lakeview_3	Dummy extensive visible lake area (over 100 hectares)
mountainview_1	Dummy 0 to 4 visible mountain peaks
mountainview_2	Dummy 5 to 13 visible mountain peaks
mountainview_3	Dummy more than 13 visible mountain peaks
distancetolakes_1	Dummy 100 metres or less to nearest lake
distancetolakes_2	Dummy more than 100 metres to nearest lake
distancetohighvoltagepowerlines_1	Dummy 100 metres or less to the nearest high voltage power line
distancetohighvoltagepowerlines_2	Dummy more than 100 metres to the nearest high voltage power line
year_2017	Dummy transactions from 2017
year_2018	Dummy transactions from 2018
year_2019	Dummy transactions from 2019

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10.5 Hedonic model single-family houses

Variable	Estimate	Std.Error	t-value	Pr(>|t|)
Intercept	9,0315657	0,04179125	216,111	<0,00000000000000002 ***
Ln_VolumeOfBuilding	0,47398024	0,00564127	84,02	<0,00000000000000002 ***
StandardOfVolume_1	0,07421288	0,00394849	18,795	<0,00000000000000002 ***
StandardOfVolume_2	0,08329522	0,00422233	19,727	<0,00000000000000002 ***
Ln_LandArea	0,14654441	0,00262138	55,904	<0,00000000000000002 ***
PrimaryOrSecondaryHome_Quota_2	0,22913116	0,0107528	21,309	<0,00000000000000002 ***
PrimaryOrSecondaryHome_Quota_3	−0,11580631	0,01160152	−9,982	<0,00000000000000002 ***
YearOfConstruction_2	0,13364008	0,00649185	20,586	<0,00000000000000002 ***
YearOfConstruction_3	0,15375814	0,00570923	26,932	<0,00000000000000002 ***
YearOfConstruction_4	0,23412193	0,00558198	41,942	<0,00000000000000002 ***
YearOfConstruction_5	0,3092231	0,00602537	51,32	<0,00000000000000002 ***
YearOfConstruction_6	0,37843752	0,00686483	55,127	<0,00000000000000002 ***
YearOfConstruction_7	0,3383864	0,00729143	46,409	<0,00000000000000002 ***
NumberOfRooms_4	0,07382005	0,00789634	9,349	<0,00000000000000002 ***
NumberOfRooms_5	0,11566851	0,00789912	14,643	<0,00000000000000002 ***
NumberOfRooms_6	0,14000158	0,00831512	16,837	<0,00000000000000002 ***
NumberOfRooms_7	0,16201799	0,00921115	17,589	<0,00000000000000002 ***
NumberOfRooms_8	0,1701903	0,01012952	16,801	<0,00000000000000002 ***
NumberOfBathrooms_2	0,05775446	0,00308096	18,746	<0,00000000000000002 ***
NumberOfBathrooms_3	0,10995569	0,0048095	22,862	<0,00000000000000002 ***
NumberOfBathrooms_4	0,17138035	0,0105044	16,315	<0,00000000000000002 ***
NumberOfBathrooms_5	0,61796326	0,0275311	22,446	<0,00000000000000002 ***
ConstructionQuality	0,00325168	0,0000699	46,522	<0,00000000000000002 ***
PropertyCondition	0,00082646	0,00006111	13,524	<0,00000000000000002 ***
Canton_1	0,51358608	0,01920283	26,745	<0,00000000000000002 ***
Canton_2	0,27419527	0,01540323	17,801	<0,00000000000000002 ***
Canton_3	0,50668523	0,01669259	30,354	<0,00000000000000002 ***
Canton_4	0,36709181	0,04601584	7,978	0,00000000000000154 ***
Canton_5	0,49904647	0,02223519	22,444	<0,00000000000000002 ***
Canton_6	0,69902152	0,03537493	19,76	<0,00000000000000002 ***
Canton_7	0,48610032	0,03917479	12,408	<0,00000000000000002 ***
Canton_8	0,35433787	0,0267348	13,254	<0,00000000000000002 ***
Canton_9	0,87675578	0,02488961	35,226	<0,00000000000000002 ***
Canton_10	0,24816734	0,01733942	14,312	<0,00000000000000002 ***
Canton_11	0,27104698	0,01590651	17,04	<0,00000000000000002 ***
Canton_12	0,62712209	0,01926245	32,557	<0,00000000000000002 ***
Canton_13	0,4583321	0,01771147	25,878	<0,00000000000000002 ***
Canton_14	0,32454673	0,01958518	16,571	<0,00000000000000002 ***
Canton_15	0,39960485	0,02087386	19,144	<0,00000000000000002 ***
Canton_16	0,55255587	0,07829395	7,057	0,00000000000173191 ***
Canton_17	0,31430402	0,01773879	17,718	<0,00000000000000002 ***
Canton_18	0,41525643	0,01937179	21,436	<0,00000000000000002 ***

Variable	Estimate	Std.Error	t-value	Pr(>|t|)
Canton_19	0,34442079	0,01730893	19,898	<0,00000000000000002 ***
Canton_20	0,34591512	0,01790865	19,316	<0,00000000000000002 ***
Canton_21	0,21384552	0,02080995	10,276	<0,00000000000000002 ***
Canton_22	0,49545262	0,01584552	31,268	<0,00000000000000002 ***
Canton_23	0,11524008	0,02036098	5,66	0,00000001528603916 ***
Canton_24	0,30459629	0,02039254	14,937	<0,00000000000000002 ***
Canton_25	0,5846959	0,02071608	28,224	<0,00000000000000002 ***
CommunityType_2	−0,18488423	0,00506899	−36,474	<0,00000000000000002 ***
CommunityType_3	−0,27443007	0,00578743	−47,418	<0,00000000000000002 ***
CommunityType_4	−0,16528598	0,00563255	−29,345	<0,00000000000000002 ***
CommunityType_5	−0,19815456	0,00493073	−40,188	<0,00000000000000002 ***
CommunityType_6	−0,25998289	0,006051	−42,965	<0,00000000000000002 ***
CommunityType_7	−0,31751818	0,00785078	−40,444	<0,00000000000000002 ***
CommunityType_8	−0,34812416	0,00616471	−56,47	<0,00000000000000002 ***
CommunityType_9	−0,41491464	0,00943306	−43,985	<0,00000000000000002 ***
TaxBurden_2	−0,13175254	0,00869791	−15,148	<0,00000000000000002 ***
TaxBurden_3	−0,19010493	0,01159549	−16,395	<0,00000000000000002 ***
TravelTimeToCenters_2	−0,09467984	0,00353978	−26,747	<0,00000000000000002 ***
TravelTimeToCenters_3	−0,15340326	0,00489575	−31,334	<0,00000000000000002 ***
PublicTransportQuality_2	−0,08153461	0,00792745	−10,285	<0,00000000000000002 ***
PublicTransportQuality_3	−0,13211196	0,00761033	−17,36	<0,00000000000000002 ***
PublicTransportQuality_4	−0,16864596	0,00767559	−21,972	<0,00000000000000002 ***
PublicTransportQuality_5	−0,19563253	0,00803267	−24,355	<0,00000000000000002 ***
NoiseExposure_2	−0,02432109	0,00303219	−8,021	0,00000000000000109 ***
NoiseExposure_3	−0,05743664	0,00340711	−16,858	<0,00000000000000002 ***
Slope_2	0,0213533	0,00300983	7,095	0,00000000000132614 ***
Slope_3	0,02340586	0,00338482	6,915	0,00000000000477233 ***
Exposure_2	0,00807342	0,00274147	2,945	0,00323 **
LakeView_2	0,0294696	0,0031221	9,439	<0,00000000000000002 ***
LakeView_3	0,14125793	0,00365238	38,676	<0,00000000000000002 ***
MountainView_2	0,03589583	0,00339559	10,571	<0,00000000000000002 ***
MountainView_3	0,03912677	0,00372321	10,509	<0,00000000000000002 ***
DistanceToLakes_2	−0,08781904	0,01024465	−8,572	<0,00000000000000002 ***
DistanceToRivers_2	0,03529945	0,00733159	4,815	0,00000148119852766 ***
DistanceToHighVoltagePowerLines_2	0,02620769	0,01101495	2,379	0,01735 *
Year_2018	0,02798861	0,00301712	9,277	<0,00000000000000002 ***
Year_2019	0,06654407	0,00305893	21,754	<0,00000000000000002 ***

Signif. codes: 0 '***' 0,001 '**' 0,01 '*' 0,05 '.' 0,1 ' ' 1

Residual standard error: 0,2155 on 30 594 degrees of freedom
Multiple R-squared: 0,813
Adjusted R-squared: 0,8125
F-statistic: 1705 on 78 and 30 594 DF, p-value: <0,00000000000000022
Mean Absolute Error: 0,1673825

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10.6 Hedonic model condominiums

Variable	Estimate	Std.Error	t-value	Pr(>|t|)
Intercept	9,20087438	0,02841157	323,842	<0,0000000000000002 ***
Ln_NetLivingArea	0,86263109	0,00622994	138,465	<0,0000000000000002 ***
PrimaryorSecondaryHome_Quota_2	−0,076381	0,00546883	−13,967	<0,0000000000000002 ***
PrimaryorSecondaryHome_Quota_3	0,31668503	0,00680817	46,515	<0,0000000000000002 ***
PrimaryorSecondaryHome_Quota_4	−0,1073321	0,00791314	−13,564	<0,0000000000000002 ***
YearOfConstruction_2	0,00824964	0,01217776	0,677	0,498134
YearOfConstruction_3	−0,0684441	0,00834722	−8,2	0,000000000000000248 ***
YearOfConstruction_4	−0,0590597	0,00761163	−7,759	0,000000000000008755 ***
YearOfConstruction_5	0,02761908	0,00777509	3,552	0,000382 ***
YearOfConstruction_6	0,13275662	0,00799518	16,605	<0,0000000000000002 ***
YearOfConstruction_7	0,15184701	0,00830411	18,286	<0,0000000000000002 ***
NumberOfRooms_2	0,08948845	0,00851304	10,512	<0,0000000000000002 ***
NumberOfRooms_3	0,0901545	0,00916526	9,837	<0,0000000000000002 ***
NumberOfRooms_4	0,09172111	0,01008831	9,092	<0,0000000000000002 ***
NumberOfRooms_5	0,11025005	0,01112246	9,912	<0,0000000000000002 ***
NumberOfRooms_6	0,11722841	0,01305282	8,981	<0,0000000000000002 ***
NumberOfBathrooms_2	0,0644601	0,00285163	22,605	<0,0000000000000002 ***
NumberOfBathrooms_3	0,1711669	0,00729767	23,455	<0,0000000000000002 ***
NumberOfBathrooms_4	0,47160824	0,03520233	13,397	<0,0000000000000002 ***
ConstructionQuality	0,00235584	0,00005518	42,697	<0,0000000000000002 ***
PropertyCondition	0,00099975	0,00006044	16,54	<0,0000000000000002 ***
Canton_1	0,2788336	0,0062737	44,445	<0,0000000000000002 ***
Canton_2	0,21927124	0,0107079	20,478	<0,0000000000000002 ***
Canton_3	0,42065575	0,00979163	42,961	<0,0000000000000002 ***
Canton_4	0,55840587	0,04624944	12,074	<0,0000000000000002 ***
Canton_5	0,23957816	0,00877487	27,303	<0,0000000000000002 ***
Canton_6	0,51938675	0,0198951	26,106	<0,0000000000000002 ***
Canton_7	0,39931335	0,01658133	24,082	<0,0000000000000002 ***
Canton_8	0,19955684	0,0289925	6,883	0,000000000005945232 ***
Canton_9	0,54830761	0,00984245	55,708	<0,0000000000000002 ***
Canton_10	0,17240194	0,01002999	17,189	<0,0000000000000002 ***
Canton_11	0,14017876	0,01231949	11,379	<0,0000000000000002 ***
Canton_12	0,43692846	0,01320424	33,09	<0,0000000000000002 ***
Canton_13	0,28601087	0,01011827	28,267	<0,0000000000000002 ***
Canton_14	0,19081751	0,01636749	11,658	<0,0000000000000002 ***
Canton_15	0,32311504	0,01797504	17,976	<0,0000000000000002 ***
Canton_16	0,38392974	0,11706597	3,28	0,001040 **
Canton_17	0,18617694	0,00844055	22,057	<0,0000000000000002 ***
Canton_18	0,41153021	0,00877191	46,915	<0,0000000000000002 ***

Variable	Estimate	Std.Error	t-value	Pr(>|t|)
Canton_19	0,20346723	0,00843763	24,114	<0,0000000000000002 ***
Canton_20	0,17912603	0,00936491	19,127	<0,0000000000000002 ***
Canton_21	0,09028801	0,00729469	12,377	<0,0000000000000002 ***
Canton_22	0,46944891	0,0111812	41,986	<0,0000000000000002 ***
Canton_24	0,16970302	0,01575227	10,773	<0,0000000000000002 ***
Canton_25	0,39325776	0,00814853	48,261	<0,0000000000000002 ***
Canton_26	0,02758039	0,02252821	1,224	0,220861
CommunityType_2	−0,1733526	0,00404403	−42,866	<0,0000000000000002 ***
CommunityType_3	−0,2361069	0,00456633	−51,706	<0,0000000000000002 ***
CommunityType_4	−0,1590807	0,00459521	−34,619	<0,0000000000000002 ***
CommunityType_5	−0,2066412	0,00432611	−47,766	<0,0000000000000002 ***
CommunityType_6	−0,2619576	0,00636455	−41,159	<0,0000000000000002 ***
CommunityType_7	−0,219518	0,0063784	−34,416	<0,0000000000000002 ***
CommunityType_8	−0,309327	0,00578645	−53,457	<0,0000000000000002 ***
CommunityType_9	−0,3595389	0,00815003	−44,115	<0,0000000000000002 ***
TaxBurden_2	−0,1428704	0,00633073	−22,568	<0,0000000000000002 ***
TaxBurden_3	−0,2589482	0,00896097	−28,897	<0,0000000000000002 ***
TravelTimeToCenters_2	−0,0745974	0,00285017	−26,173	<0,0000000000000002 ***
TravelTimeToCenters_3	−0,1356675	0,00439335	−30,88	<0,0000000000000002 ***
PublicTransportQuality_2	−0,0507863	0,00403437	−12,588	<0,0000000000000002 ***
PublicTransportQuality_3	−0,0791149	0,00399183	−19,819	<0,0000000000000002 ***
PublicTransportQuality_4	−0,0947679	0,00421151	−22,502	<0,0000000000000002 ***
PublicTransportQuality_5	−0,1210709	0,00508201	−23,823	<0,0000000000000002 ***
NoiseExposure_2	−0,0266268	0,00246713	−10,793	<0,0000000000000002 ***
NoiseExposure_3	−0,0437301	0,0025929	−16,865	<0,0000000000000002 ***
Slope_2	0,05316386	0,00255377	20,818	<0,0000000000000002 ***
Slope_3	0,09854547	0,00311621	31,623	<0,0000000000000002 ***
Exposure_2	0,00610517	0,00224429	2,72	0,006525 **
LakeView_2	0,04104882	0,00272956	15,039	<0,0000000000000002 ***
LakeView_3	0,15505632	0,00296262	52,338	<0,0000000000000002 ***
MountainView_2	0,0330689	0,00291352	11,35	<0,0000000000000002 ***
MountainView_3	0,03826563	0,00332001	11,526	<0,0000000000000002 ***
DistanceToLakes_2	−0,0680977	0,00687699	−9,902	<0,0000000000000002 ***
DistanceToHighVoltagePowerLines_2	0,01737588	0,01070091	1,624	0,104431
Year_2018	0,0288674	0,00254526	11,342	<0,0000000000000002 ***
Year_2019	0,05375467	0,00253236	21,227	<0,0000000000000002 ***

Signif. codes: 0 '***' 0,001 '**' 0,01 '*' 0,05 '.' 0,1 ' ' 1

Residual standard error: 0,2023 on 39696 degrees of freedom
Multiple R-squared: 0,8574
Adjusted R-squared: 0,8571
F-statistic: 3225 on 74 and 39 696 DF, p-value: <0,00000000000000022
Mean Absolute Error: 0,159704

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The FSO's publications

As the central statistical agency of the Confederation, the Federal Statistical Office (FSO) has the task of providing Swiss statistical information to a wide range of users. Dissemination is done by topic with different information media via several channels.

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00 Statistical basis and overviews
01 Population
02 Territory and environment
03 Work and income
04 National economy
05 Prices
06 Industry and services
07 Agriculture and forestry
08 Energy
09 Construction and housing
10 Tourism
11 Mobility and transport
12 Money, banks and insurance
13 Social security
14 Health
15 Education and science
16 Culture, media, information society, sports
17 Politics
18 General Government and finance
19 Crime and criminal justice
20 Economic and social situation of the population
21 Sustainable development, regional and international disparities

The key publications

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Individual inquiries

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With the Swiss Residential Property Price Index (IMPI), the Swiss Federal Statistical Office (FSO) is closing a gap in public price statistics. Real estate is a very important economic sector that is closely linked to the economy. As a new economic indicator, the IMPI is used to monitor financial market stability, monetary policy and inflation, as well as property price developments.

The development of transaction prices for single-family homes and condominiums is published quarterly and broken down into five types of municipalities (urban municipalities of a large, medium or small agglomeration or outside of an agglomeration, intermediate and rural municipalities). The results are published around six weeks after the end of the observation period in the form of a press release and on the Internet. In addition, a didactic brochure, a methodological report and a detailed documentation of the hedonic modeling are available on the website. www.IMPI.bfs.admin.ch.

Switzerland's price statistical system also includes the Swiss Consumer Price Index (CPI), the harmonised consumer price index (HCPI), the rental index (RPI), the producer and import price index (PPI), the construction price index (BAP) and the measurement of international purchasing power parities.

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