Institution: University of Aberdeen

Unit of Assessment: 17 (Business and Management Studies)

Title of case study: Improving the transparency of housing markets in the UK and overseas

Period when the underpinning research was undertaken: 2014-2020

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Rainer Schulz	Senior Lecturer	2003-current
Martin Wersing	Lecturer	2013-current
Martin Hoesli	Professor	1996-current

Period when the claimed impact occurred: 2014-2020

Is this case study continued from a case study submitted in 2014? Y

1. Summary of the impact (indicative maximum 100 words)

Housing markets require reliable and accessible information on price trends and market values to work efficiently. The University of Aberdeen Business School has conducted methodologically robust research on house price indices and automated valuation models (AVMs) that has examined how such indices and valuation models should be constructed and implemented to be accurate and timely in order to address the needs of end-users. Property owners and would-be owners, solicitors, developers, and local politicians are all interested in *reliable* and *timely* information on price trends, market sentiment, and estimates of market values of specific properties. The University of Aberdeen Business School has also been actively involved in the development and production of price indices and valuation models in Scotland, more widely Switzerland and Germany.

2. Underpinning research (indicative maximum 500 words)

While there is no shortage of information on housing markets, the quality of this information can vary widely. As only *reliable* and *accurate* information can increase the transparency of housing markets, it is essential that price trends, market sentiment, and market values are estimated with accurate data and with the best scientific methods available. Research at the Business School, led by its Centre of Real Estate Research (CRER), develops methods to improve the reliability of data and the accuracy of indices and market value predictions. The research can be divided broadly into the following three areas:

1) Data sources and quality

The first area of research concerns the examination of data sources and quality [4], which explores whether listings data are able to substitute for transaction data, for instance in the prediction of market values. The researchers (Schulz, Wersing) use listings data from 'ImmobilienScout24' (a major internet platform for real estate search and brokerage in Germany) and transaction prices from the land registry and find that list price indices contain information on market sentiment that can help to predict transaction price trends. Importantly, they have found that list prices alone are not useful for the estimation of market values [4]. This insight is relevant for practice, as several internet platforms fit the AVMs for their automated valuation services (AVSs) with listings data. However, nor are transaction prices without issues and they too must be treated with care, as outliers can affect the performance adversely by causing implausible market value predictions. Both [1] and [5] investigate this in detail for AVMs. In [5], Hoesli shows that robust estimation has a positive impact on the performance of an AVM; [1] obtains the same result, using robust outlier

detection and deletion before the model fitting stage. In the context of transaction price indices, [2] shows that robust estimation improves accuracy.

2) Price indices

The second area concerns the statistical models that should be used for the construction of price indices. Price indices for submarkets at a high frequency, such as monthly, are of interest to market participants, but direct estimates will suffer – as observations are scarce – from excess volatility. [3] applies a model that aggregates and distributes information from a set of staggered low frequency repeat sale indices into a new series with higher frequency and find that the new series suffers less from excess volatility.

3) Development of automated valuation services (AVSs)

The third area concerns the development of AVMs and their implementation in AVSs. Following ideas of *machine learning*, this should happen ideally in a setting that mimics the actual application. This is achieved using training and validation samples for model selection and using cross-validation for the choice of tuning parameters. [1] and [5] show how the statistical model for an AVM should be selected. The machine learning literature provides many possible candidate models, and the best model is the one with the best out-of-sample predictions. The selected model might have an intuitive economic interpretation but might also remain a black box. In addition to the performance, other aspects are relevant, such as the number of property characteristics a user must provide for a market value estimate. If the AVM is used in an AVS targeted at the public, some characteristics are easy to understand and provide, such size and age, but others might not be (such as type of construction).

3. References to the research (indicative maximum of six references)

[1] **Schulz, R**., **Wersing, M**. and Werwatz, A. (2014). Automated valuation modelling: A specification exercise. *Journal of Property Research*, 31, 131-153.

[2] Bourassa, S.C., Cantoni, E. and **Hoesli, M**. (2016). Robust hedonic price indexes, *International Journal of Housing Markets and Analysis*, 9, 47-65

[3] Bourassa, S.C. and **Hoesli, M**. (2017). High frequency house price indexes with scarce data, *Journal of Real Estate Literature*, 25, 207-220

[4] Kolbe, J., **Schulz, R**., **Wersing, M**. and Werwatz, A. (2020). How useful is listings data for research?https://www.econstor.eu/bitstream/10419/213123/1/FORLand-2020-19.pdf, forthcoming as: Real estate listings and their usefulness for hedonic regression, *Empirical Economics*.

[5] Mayer, M., Bourassa, S.C., **Hoesli, M**. and Scognamiglio, D. (2019). Estimation and updating methods for hedonic valuation, *Journal of European Real Estate Research*, 12, 134-150

4. Details of the impact (indicative maximum 750 words)

Informing house price indices in Aberdeen/shire

CRER researchers (Schulz, Wersing) have produced the quarterly *Aberdeen Housing Market Report* (AHMR) since 2012Q2 to the present day [S1, S2]. This report is based on a cooperation between the CRER of the Business School and the Aberdeen Solicitors Property Centre (ASPC), the largest in Scotland (ASPC recorded 30,000 registered users and 1,360,000 views during August 2020). ASPC stores information relating to advertised properties electronically, including transaction prices, and has sought to use these data to make the market more transparent. This ambition was realised through the collaboration with the CRER of the Business School. In particular, ASPC is considering implementing an AVS based on Drs Schulz and Wersing's recommendations [S4]. Furthermore, since 2020Q2 the AHMR offers additional relevant information to market participants, such as a quality-controlled ask-to-sale price index. This index indicates the continuing value of the research and collaboration to users in the local region [S3].

ASPC themselves have attested to the value of the research of the Business School's CRER to their work, particularly the extended *Aberdeen Housing Market Report*: *'Over time, the CRER has suggested, and the Centre [ASPC] has willingly accepted, improvements to the report. Since 2020, the report has included further information, such as the quality-controlled ask to sale index […] The Centre benefits from this cooperation through the exposure gained in the local area. New reports are featured in the press and all issues of the report are available on the Centre's web platform. The methods underlying the report are transparent and available to read on the CRER webpage. The information contained in the report is trustworthy*.' Chairman, ASPC Ltd [S4].

The reports, which are available from the ASPC, the University of Aberdeen Business School, and are listed as an official source of house price information by Aberdeenshire Council for the North East of Scotland, can be accessed by users in the public domain [S5]. They are regarded with high esteem by local press, such as the BBC, as well the *Scottish Legal News* (readership c.12, 521 in 2019) [S5]. Given its status as a trusted source, users of the index have become increasingly diversified and now include local councils for planning decisions, surveyors, housing associations, and financial institutions [*text removed for publication*] [S6].

Demonstrating the wider application of the AHMR to new users

CRER researchers have given presentations to facilitate usage of the *Aberdeen Housing Market Report* (AHMR) – for instance, within the workshop on *Local Governance in Scotland and Malaysia*, 2017, which was held at the University of Aberdeen. This workshop included participants from Aberdeenshire Council and from the Malaysian Ministry of Urban Wellbeing, Housing and Local Government, the Valuer Society, and from several other local councils [S7].

Improving automated valuation models and services for the main hedonistic index for the Swiss market

The Swiss Informations- und Ausbildungszentrum für Immobilien AG (IAZI, https://www.iazicifi.ch/markt/immobilien-indizes/) provides transaction and list price indices for many different segments of the Swiss housing market. The SWX IAZI Real Estate Indices are the main hedonic index for the Swiss market; these hedonic indices are published quarterly in cooperation with *Six-Group*. The IAZI indices are highly regarded, both regionally and nationally [S8i]. Prof. Hoesli was pivotal in the establishment of IAZI and continues to chair the annual meetings at which all statistical models and data procedures are reviewed. The meetings discuss both the quality of data and the statistical models used to estimate the indices and facilitate annual improvements to the models. Important inputs to the reviews are Prof. Hoesli's reports on research on index construction methodology, leading to critical analysis and validation of the hedonic property pricing models for Switzerland [S8ii]. He has further informed these models by developing approaches to construct indices that are robust to outliers and that are viable in a scarce data environment.

The IAZI also runs AVSs for the majority of residential properties in Switzerland, covering approximately 80% of transactions [S8i, iii]. Automated valuations are offered by the IAZI to property buyers and sellers, banks and professional landlords. Prof. Hoesli's research on these estimators has had a direct impact on how these AVMs are estimated from transactions [S8iii], ensuring that the statistical models that are used for AVMs are fitted with estimators that are robust towards outliers.

The chairman of the IAZI Board of Directors has stated, '*At IAZI, with the collaboration of Prof. Martin Hoesli and other academics, we want to continue our efforts to understand better the dynamics of real estate markets in Switzerland. By providing research and training to professionals throughout the Swiss real estate industry, we contribute to a higher transparency and appropriate/best usage of the limited information available […] [Hoesli's] broad knowledge of the current and ongoing academic papers and research, of which he provides to IAZI a very valuable in-put in our regular exchanges, invite us to try out and apply the latest findings of other markets to our market*' [S8iii].

Introducing AVS to the Berlin real estate market

Drs Schulz and Wersing developed an automatic web-based valuation service for single-family houses with the Expert Committee for Property Values, a public and independent institution of the State of Berlin, in order to increase the transparency of the Berlin real estate market. Drs Schulz and Wersing have been pivotal in the establishment of the resulting AVS md*immo (https://bit.ly/2N9tBtC). Their continuing research has led to improvements in the statistical model for the AVM used in this AVS, as confirmed by the Head of the Expert Committee for Property Values. The Head of the Committee also added that '*the [AVS] md*immo project was definitely a success […] we continue to follow the research of Dr Schulz and Dr Wersing to automated rating systems. We hope that this research will also fertilize md*immo, which is now being carried out by the TU [Technische Universität] Berlin*.' [S9]

5. Sources to corroborate the impact (indicative maximum of 10 references)

[S1] Aberdeen Housing Market report 2012Q2 (https://bit.ly/2NQb461)
[S2] Aberdeen housing market report 2020Q2 (https://bit.ly/3ba9Qv8)
[S3] Local users of housing index
[S4] Testimonial from Chairman of the ASPC, Aberdeen
[S5] Evidence of Housing index on ACC website and articles from local media: BBC News 25.01.2015; Scottish Legal News 29.07.2015; Independent 05.03.2016; STV 21.07.2015
[S6] [*text removed for publication*]
[S7] Aberdeen City Council press release (2017), visit from Malaysian Delegation, link to article: https://bit.ly/3bcQzt1 (2017)
[S8 (group)] (i) Articles in German media reporting IAZI indices; (ii) Validation Certificates 2017/18 for IAZI (confidential, available upon request); (iii) testimonial CEO of IAZI in Switzerland confirming value of Prof. Hoesli's research
[S9] Testimonial from Head of Expert Committee, State of Berlin, Germany