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EMF/EAA JOINT PAPER ON THE USE OF AUTOMATED VALUATION MODELS IN EUROPE

Summary of Findings

Automated Valuation Models (AVMs) are statistical valuation solutions providing an estimate of value of any specified property at a specified date, using sophisticated modelling techniques in an automated manner and typically including a comparables-based approach similar to surveyor valuations. As they have been establishing themselves in more and more jurisdictions in recent years and have been the subject of increasing attention, the European Mortgage Federation (EMF) and the European AVM Alliance (EAA) have for the first time joined forces¹ to provide an overview of the key applications and features of AVMs and of the state of the industry across Europe.

III. Portfolio Valuation

- The primary use/application of AVMs across many jurisdictions is for **portfolio valuations**: *DK, DE, GR, IT, NL, NO, PT, RO, ES, SE, CH and UK*
- Portfolio valuations are typically carried out for the following purposes:
 - *Capital Requirement Purposes: DK, DE, GR, IT, NL, NO, ES, SE, CH and UK*
 - *Covered Bonds and Securitisation Transactions: DK, DE, NL, NO, SE, CH and UK*
 - *Investment Property Fund and Asset Management: DE, NL, SE and CH*
 - *Risk Management: DK, DE, IT, NL, NO, RO, SE, CH and UK*
 - *Accounting: DK, NL, SE and CH*
 - *Property Portfolio Transactions: DE, IT, NL, SE, CH and UK*
 - *Other: DK, NL (for the recent Asset Quality Review by the European Central Bank), NO, RO, CH and UK*
- Future Use of AVMs:
 - *DK, GR, NL, RO, SE and UK foresee an increase in use of AVMs with regard to one or several of the following purposes: portfolio valuation (including for monitoring), mortgage origination (especially remortgaging) and quality control.*

IV. Other Uses of AVMs (other than for portfolio valuations)

- AVMs are also used to determine a property value for a variety of other purposes depending on the Member State:

¹ See Annex III for list of contributors.

- *Mortgage Origination for Property Purchase: DK, DE, NL, NO, SE, CH and UK*
- *Underwriting of Non-Purchase Mortgage Loan Products, e.g. Remortgaging and Re-pricing of Mortgage Loans: DK, DE, NL, NO, SE, UK*
- *Quality Control Tool in the Mortgage Origination Process: DK, DE, IT, NL, NO, PT, ES, SE, CH and UK*
- *Arrears Management: NL, NO and UK*
- *Use by Mortgage Brokers, Estate Agents and/or Consumers: DE, NO, SE, CH and UK*
- *Taxation: PT and SE (historically)*

V. Shift in Use of AVMs

- Since the 2008 Global Financial Crisis, the use of AVMs has increased in DK (for multiple purpose), in DE (due to cost pressure and rationalisation of processes within the banking industry), in IT, in NL (due to mandatory quality control, risk management and loan-level data requirements), in NO (due to a growing need for transparency and better risk management), in ES and in UK.

VI. Rules, Guidance, Standards

- Legislative rules or guidance currently exist in DK (for mortgage origination and monitoring), DE (mortgage origination valuations produced by AVMs must comply with specific requirements for valuation reports), NL (AVMs are compulsory for the purpose of obtaining the National Mortgage Guarantee), RO (valuation standards) and CH. No specific rules / guidance on the use of AVMs are present in GR, IT, NO, PT, SE and UK.
- In DK, DE, GR, IT, NL, NO, ES, SE, CH and UK banks or professional associations have internal guidelines or procedures related to the use of AVMs.

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Annex I - Glossary of Terms and Definitions

Annex II - Summary of the Usage of Different Valuation Solutions in Selected Markets

Annex III – List of Contributors to this Publication

I. Defining Terms

Automated Valuation Model (AVM): A system that provides an estimate of value of a specified property at a specified date, using mathematical modelling techniques in an automated manner². Please see Annex I for further key remarks.

Portfolio Valuation: The circumstances where a large number of properties are being valued as a batch and for the same purpose, e.g. for capital modelling, provisioning, whole loan trading, surveyor management etc. Portfolio valuations may be conducted through various statistical, physical or hybrid valuation techniques, including AVMs³.

Mass Valuation: The practice of valuing multiple properties as of a given date by a systematic and uniform application of valuation methods and techniques that allow for statistical review and analysis of results⁴. Please note this definition is indeed similar to that of Portfolio Valuation, but the term Mass Valuation is typically used in a taxation context, while Portfolio Valuation is typically preferred in a Financial Services context, hence it is the term used throughout this report.

Statistical Valuation Technique: Any valuation methodology that produces a property valuation from a mathematical calculation. Examples include AVMs, HPIs, tables of average property prices by location, min/max prices per sqm etc.

House Price Index (HPI): A time series capturing the price development of residential properties over time¹. If multiplied by a Previous Known Value of a given property, it can be used as one of the most common Statistical Valuation Techniques, besides AVMs.

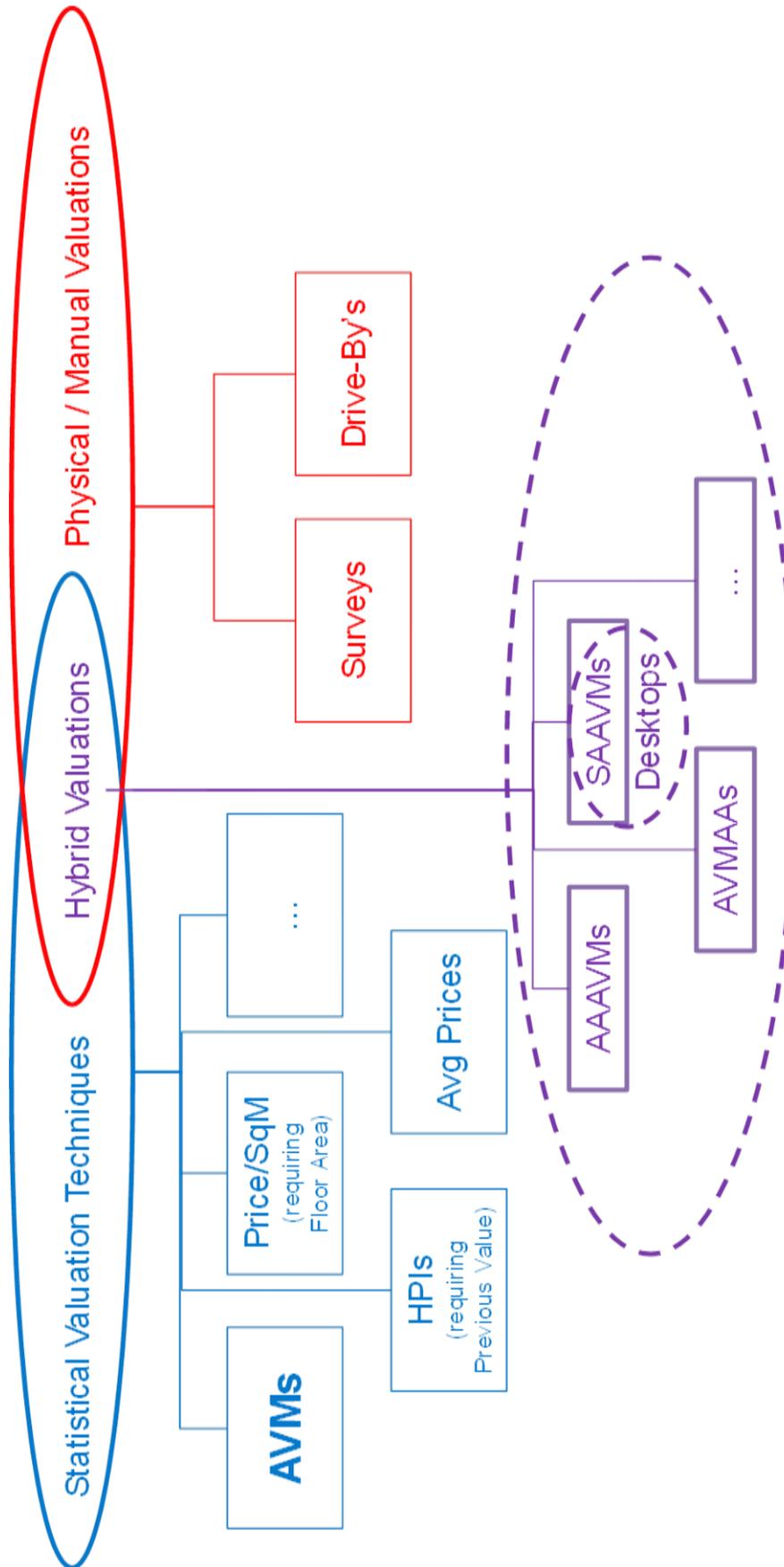
Desktop Valuation: Term used sometimes to indicate all types of Hybrid Valuations (part automated/statistical, part manual – See Annex I), sometimes to indicate only AVM-assisted surveyor valuations².

For further definitions, including some of those included in the following chart, please see Annex I.

²From “Glossary of Terms and Definitions” by the European AVM Alliance (EAA) – http://www.europeanavmalliance.org/media/default/pdf/eea_glossary.pdf

³Adapted from the same source as above

⁴Adapted from “Mass Appraisal for Property Taxation” – Exposure draft of proposed international valuation guidance note, International Valuation Standards Committee, February 2004



II. Uses / Applications of AVMs in the Market

AVMs are used for various functions in different Member States.

The primary use/application across many jurisdictions is for **Portfolio Valuations**, to which we are devoting the entirety of section III and its various sub-sections.

Other uses/applications are collectively reviewed in the section IV and they include:

- Provision of the primary value (potentially in support or as a replacement of other types of valuations) at **Mortgage Origination**, intended as the circumstances and purpose where an AVM is used to underwrite a new or amended mortgage, thus including all of the following transaction types:
 - Purchase
 - Remortgage
 - Equity Withdrawal / Further Advance etc⁵.
- **Quality Control** of other types of valuations, also known as Valuation Audit or Second Opinion
- **Other**, e.g. by consumers, for pre-screening of mortgage applications, for taxation purposes etc.

⁵For more details on these definitions please see "Glossary of Terms and Definitions" by the European AVM Alliance (EAA) – http://www.europeanavmalliance.org/media/default/pdf/eea_glossary.pdf

III. Use of AVMs for Portfolio Valuations

1. Overview

AVMs are used widely for the purposes of portfolio valuation in **Denmark, the Netherlands, Norway, Spain, Sweden, Switzerland and the UK**. They are also used for this purpose in **Germany, Greece, Portugal and Romania** but to a much lesser extent. In **Italy** AVM technology has been recently introduced and is being tested by several banks.

In **Germany**, at portfolio level, AVMs are used under certain circumstances: valuation of portfolios composed of standardised residential property, valuation of parts of portfolios and for the acquisition of property portfolios.

In **Italy**, AVM technology was introduced in 2014 and is progressively being used for portfolio valuations for the purposes of provisioning, capital modelling, reporting to the banking regulator and for securitisation. The applications being tested include portfolio revaluation, risk management secondary-level controls of collateral property values and quality control at origination.

In **the Netherlands**, several mortgage lenders use AVMs to revalue (mortgage and foreclosure value) the entire mortgage book on a quarterly, yearly or *ad hoc* basis. Results are for instance used for risk management (LGD calculations), covered bond reporting to investors and the national supervisor, informing customers on current LTV.

In **Norway**, AVMs are used for portfolio valuations of the entire mortgage book for most banks and every single covered bond issuer (except the smallest issuer). They are also used for the purpose of identifying mortgages that qualify for the covered bond pool, and for reporting to covered bond investors on the development of market values of the individual properties contained in the cover pool. The portfolio valuation is typically done on a quarterly basis to ensure updated valuations.

In **Romania**, AVMs were first used in 2012 exclusively for residential apartments and then extended to houses. The extent to which AVMs are used depends on the bank and on the bank's targeted clients. AVMs are used by banks for the mandatory periodical revolutions.

In **Spain**, AVMs are frequently used to compare the results obtained through mass valuations with a representative sample. The specific methodology differs depending on the valuation company/lender (using internal valuation services).

In **Sweden**, AVMs are widely used for portfolio valuation for properties with sufficient statistical accuracy.

In **Switzerland**, AVMs are extensively and regularly used for the purposes of portfolio valuation. They are completely integrated in banks' IT systems and in the surveyor industry and the Swiss Pfandbriefbank for example, one of the few remaining AAA rated banks, uses AVMs to analyse quarterly the collateral portfolios of the covered bond issuances they place to the public.

In **the UK**, AVMs are used very widely for portfolio valuation. At least 4 of the top 5 UK banks revalue the entirety of their mortgage book on a regular basis using AVMs. A large number of smaller players also employ AVM portfolio services on a regular or ad-hoc basis.

Portfolio valuations are typically carried out for the following purposes: capital requirements, covered bond & securitisation, investment property funds & asset management, risk management, accounting, property portfolio transactions & others.

Capital requirements purposes: *Denmark, Germany, Greece, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland and the UK*

Covered bond & securitisation transactions: *Denmark, Germany (securitisation), the Netherlands, Norway (covered bonds), Sweden, Switzerland and the UK*

Investment Property Funds and Asset Management: *Germany, the Netherlands, Sweden and Switzerland*

Risk Management: *Denmark, Germany, Italy, the Netherlands, Norway, Romania, Sweden, Switzerland and the UK*

Accounting: *Denmark, the Netherlands, Sweden and Switzerland*

Property Portfolio Transactions: *Germany, Italy, the Netherlands, Sweden, Switzerland and the UK*

Other: *Denmark, the Netherlands, Norway, Romania, Switzerland and the UK.*

- In *Denmark*, portfolio valuations using AVMs are also carried out for **reporting and LTV monitoring purposes**.
- In *the Netherlands*, an AVM was used for the **Asset Quality Review (AQR)** conducted by the European Central Bank. The AVM was tested and approved by the Dutch National Bank (DNB) and the ECB.
- In *Norway and the UK*, AVMs are also used in the context of **portfolio valuations for arrears management, provisioning and reporting** to the banking regulator.
- In *Romania*, all banks have started to use AVMs for the quality control of portfolios only, either using internal resources or external providers.
- In *Switzerland*, AVMs are also used for portfolio valuations in the context of **promotional activities** for new projects.

2. Use of other techniques

Other techniques are also used for the purposes of portfolio valuation in: *Denmark, Germany, Greece, Italy, the Netherlands, Norway, Romania, Spain, Sweden, Switzerland and the UK.*

In **Denmark**, there are mortgage institutions that use both an AVM along with indexation of a previous physical valuation. The two techniques may be used for different purposes, e.g. capital requirements vs. reporting.

In **Germany**, index-based valuations are the more common instrument used to reflect market volatilities. Although indexed values may not be explicitly computed for all properties in a portfolio, HPIs are in fact used as a first measure in the context of so-called Market Fluctuation Analysis to identify properties where a new survey is required.

In **Italy**, HPI and price/sqm are also used.

In **the Netherlands**, indexation is also used for portfolio valuations surveyor valuation updates.

In **Norway and the UK**, national or regional house price indices (HPIs) are also used.

In **Romania**, the need for portfolio valuations without proper databases for AVM use has led to the appearance of simplified valuations methods which do not use indices, but rather zoning-based techniques (grouping by geographical area with similar market values) and the selection of a minimum of three comparable properties which are used as a benchmark for the properties in the area. The approach is a simplified market approach. Lately however banks have rather been oriented towards index based valuations generally created within the banks themselves. Simultaneously, the banking sector is awaiting HPIs produced by ANEVAR based on results from BIG (a collateral database that collects information from all banks). HPIs are intended to be used as a first measure in the context of so-called Market Fluctuation Analysis to identify properties where a new survey is required.

In **Spain**, multiple regression models and time series based on indices of house price evolution are used alongside AVMs for the purposes of portfolio valuation. When using indices of house price evolution, the historical series must be wide and consist of many sub-segments.

In **Sweden**, price-indexing is also used along with AVMs for the purposes of portfolio valuation.

In **Switzerland** portfolio valuations are mainly conducted by AVM. Indexing is used to a limited extent for benchmarking and economic scenario analyses. Data availability, accuracy, simplicity of use and low cost of AVM licenses in Switzerland makes indexing an obsolete and comparatively inaccurate approach. Additionally, integrated AVMs do not leave any room for manipulation. AVMs cannot however prevent fraudulent intentions.

3. Proportion of techniques used

In **Denmark**, two different techniques could be applied to the same portfolio. Typically, if an institution has an AVM available, it will be applied to the entire (private) real estate portfolio within a given country. However, for banks that operate within several countries, there will (most likely) be some countries where AVMs are not readily available and where indexation is the only approach applied.

In **Germany**, about 60% of standardised residential properties are valued with the support of AVM models.

In **Greece**, indices are mainly used for revaluation purposes.

In **Italy**, given the lack of alternatives, HPI is the traditional methodology. This is slowly starting to change as the ECB takes over direct supervision.

In **the Netherlands**, indexing is free so it was widely used in the past. Most lenders have started to use AVMs or are investigating their use because of the higher accuracy and more in depth collateral risk analyses needs. AVM providers are also typically capable of improving the collateral data quality (address, property characteristics, original valuation errors etc). One of the AVM providers was also approved by the ECB for use during the Asset Quality Review (AQR).

In **Norway**, portfolio services provided by just one AVM provider currently account for approximately 99% of all Norwegian mortgage books, while for the remainder freely available HPIs are typically used. Currently only the smallest issuer of covered bonds uses HPIs.

In **Romania**, banks use either index based valuations or zoning techniques for residential properties or AVMs.

In **Sweden**, the proportion of AVM use for portfolio valuation is generally 50%, although this is dependent on the individual valuer and the particular model. On some occasions, AVM use comprises 100% of the valuation methodology.

In **the UK**, portfolio services provided by just one AVM provider currently account for approximately 50% of all UK mortgage books, while for the remainder freely available HPIs are typically used. All of the top 6 UK banks have at various points used AVMs to revalue their entire mortgage book.

4. Relative merits of each technique

When deployed for the purpose of portfolio valuations, HPIs typically offer some key advantages, including:

- First and foremost they are typically free. Given the large number of properties involved in many portfolio valuations, coupled with the frequency of the exercise which might be as often as quarterly or even monthly, this is by far the key attraction of using HPIs. Even in those jurisdictions or for those suppliers where HPIs are not completely free, they are typically charged at a small cost and on a flat fee basis, not on a volume basis, making it still very economically attractive for banks.
- Even regardless of cost, in some jurisdictions HPIs are -or have been for a long time- the only available tool that could realistically be deployed for valuing quickly and consistently the large number of properties typically involved by portfolio valuations, hence their popularity due to lack of alternatives. In this context, the use of HPI for regularly updating portfolio values is of course much preferable to not applying any updates at all.
- Last but not least, many users also regard HPIs as providing greater transparency than other statistical valuation techniques, e.g. in the eventuality that the resulting property values were subjected to scrutiny by a third party, as their usage entails a trivial multiplication between a previous property value and a factor (or percentage change) that can be disclosed in full. However, this apparent simplicity in the *application* of HPIs is accompanied by an often

overlooked “black box” approach in their *production*, i.e. on how the HPI factors themselves are actually produced. Some of them in many jurisdictions are in fact based on anecdotal evidence, e.g. phone surveys of market sentiment or subjective views of interested parties like estate agents. Even when they are purely the result of quantitative computations, the methodologies deployed here may be in fact as proprietary (and therefore unknown to the user) as those deployed within other statistical valuation techniques and the data being used may also not be in the public domain, thus making any checks on the integrity of the calculation process impossible to conduct. In this light it becomes understandable why it is not unprecedented for HPI suppliers to occasionally re-state retrospectively entire sections of their HPI history, whenever significant changes to the methodology are introduced and/or any errors are uncovered.

On the other hand, the key advantages offered by AVMs when conducting portfolio valuations include:

- First and foremost an AVM does not require a previous property value as input and therefore it is able to value properties even where no previous history is known to the party requiring the valuation. In the specific context of portfolio valuations this can often be the case where data quality issues have resulted in missing values within the mortgage book, e.g. due to data transcription errors, system migrations, merger and acquisition of other banks’ portfolios etc. In the context of mortgage origination, if the valuation is being conducted upon request of the buyer / borrower, not the seller, any previous property values will also typically be unknown, making the usage of HPIs a technical impossibility.
- As it does not require or rely solely on a previous value, an AVM does not carry forward forever any bias that might have affected that previous valuation, e.g. due to fraud, business pressure, excessive optimism or other circumstantial reasons. On the contrary, by using fresh comparable evidence every time it is requested to provide a valuation, just like a surveyor would, the AVM is able to reset any such historic issues.
- AVMs operate at a much greater level of granularity than HPIs, typically selecting the most appropriate set of comparables upon which to base the valuation of each individual property. HPIs on the other hand are typically derived from average house prices across large regional areas (or across an entire country), without the ability to distinguish smaller regions within this area that might be subject to vastly different house price developments compared to the average.
- The accuracy of an AVM can be empirically and scientifically measured on very large property data samples, i.e. whenever a Benchmark Value (typically a Surveyor Valuation or Purchase Price) is available to compare against. On the other hand, HPI accuracy can only be measured when both a Benchmark Value and a Previous Value are available, the latter being required to compute an Indexed Value: this scenario is normally referred to as a Match Pair. Consequently, Match Pair samples can be used to directly compare AVM and HPI accuracy through simple scientific tests on an entirely like-for-like basis, where all findings are therefore purely factual, demonstrable and measurable, not the result of subjective considerations or debate. The members of the EAA regularly conduct such Match Pair analyses on large property data samples from various European jurisdictions and their detailed results can be obtained by any interested parties upon request, e.g. through the EAA website at www.europeanavmalliance.org.
- AVMs include a Confidence Level (CL) as output with each valuation result, thus providing risk managers with an indication of accuracy at a property-by-property level and allowing them to achieve much greater granularity in their models than with any other approach. Unique or non-standard properties are naturally harder to value than standard properties, which would typically result in an AVM result with low CL, whereas it would raise no flags when using HPIs. This is a critical piece of information for the user of these valuations, as it indicates to what

extent they can be relied upon and allows for example the filtering of only a subset of results on which sufficient confidence can be placed. This is not a feature provided by any HPI.

- For the reasons mentioned above Confidence Levels also form the basis of the Rating Agencies' published treatment of AVMs, resulting in typically much smaller "haircuts" than those applied to HPIs.
- Last but not least, as a mirror to the advantage afforded by HPIs in terms of greater perceived transparency, an AVM's "black box" approach affords the advantage that AVMs are subject to rigorous and regular model validation / accuracy testing & reporting, e.g. in compliance with regulatory validation standards, whereas HPIs are typically produced as an academic exercise or macro-economic tool and may therefore not be subject to such operational validation procedures.

5. Future AVM use in this area

In **Denmark**, the use of AVMs will increase in the future for the purpose of originate a new mortgage, monitoring property values and remortgaging.

In **Greece**, it is envisaged that AVMs could be used for revaluation of commercial property, not just residential.

In **the Netherlands**, the expectation is that lenders which do not use AVMs for portfolio valuation at the moment will do so in the future. Most stakeholders recognise and stress the importance of rigorous and regular collateral asset reviews.

In **Romania**, zoning techniques are used on their own or in conjunction with conventional valuation practices, where AVMs are not used. There is a great appetite for index based valuation, and despite the obvious advantages of AVMs the technique cannot be applied due to lack of comparability in transaction data. However, considering the stabilisation of the local real estate market, and the increased need to know the actual market value of portfolios, AVMs will be used on an extended level in the future.

In **Sweden**, the use of AVMs will increase for monitoring property values and remortgaging. Even to originate a new mortgage through an AVM will be more common in the future. HPI models will not be used in the same way as today because they are too general and do not provide sufficient information for banks.

In **the UK**, wherever AVMs are not yet used for portfolio valuations, indexation is typically used instead. More and more mortgage lenders appear to be shifting from the latter to the former, as they find the inaccuracy inherent in indexation to be no longer commercially acceptable.

IV. Other Uses of AVMs (besides Portfolio Valuations)

AVMs are currently used to determine property values for a variety of purposes in **Denmark, Germany, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the UK.**

AVMs are used to a very limited extent in the **Czech Republic, Greece** and **Romania**, although lately a few small banks in **Romania** have begun using AVMs, where there is currently only one provider of AVM valuations.

1. Mortgage Origination

Mortgage origination (purchase): *Denmark, Germany, the Netherlands, Norway, Switzerland and the UK.*

In **Denmark**, the general rule is that new mortgage loans are granted based on property valuations involving an on-site inspection. However, individual mortgage banks may be granted exemptions allowing them to carry out valuations without inspection in selected areas if they develop statistically sound property valuation models. Exemptions are subject to subsequent manual approval, which means that no value can be approved without prior critical assessment. Exemptions must be authorised by the Danish Financial Supervisory Authority (FSA). Some mortgage banks have been granted an exemption to carry out valuations without inspection, for example within a specified area (mortgage loans secured on owner-occupied dwellings) using a statistical projection model.

In **Germany**, AVMs are used for mortgage origination, but only as auxiliary tools supporting the valuation work of valuers. In other contexts, e.g. to obtain preliminary indications of value in the early stages of a mortgage application, they are also used by many private banks and Sparkassen without the intervention of valuers.

In **the Netherlands**, AVMs are used for mortgage origination, primarily in conjunction with the sales prices.

In **Norway**, AVMS are used for mortgage origination for an estimated 50% of all mortgages, primarily remortgages.

In **Romania**, it is forbidden to use AVMs in case of mortgage origination.

In **the UK**, AVMs are used at mortgage origination for an estimated 30% of all mortgages, including purchases, although to a lesser extent than remortgages.

Mortgage origination (re-mortgaging and equity withdrawal/further advance): *Denmark, Germany, the Netherlands, Norway, Sweden, Switzerland and the UK.*

In **Germany**, AVMs are used for remortgaging for construction, modernisation and renovation purposes. A distinction between purchase and non-purchase mortgages does not exist. The criterion is if the funds are being invested in the property or not. The funds are invested in the property in the case of construction, purchase, renovation and/or modernisation. Funds are not invested in the property in the case of equity withdrawal.

In **the Netherlands**, AVMs are used for loan modification.

In **Norway**, AVMs are especially used in this context for remortgages, and when the consumer wants to change their bank and thus refinance.

In **the UK**, AVMs are used at mortgage origination for the majority of remortgages.

2. Quality Control

Quality control tool in the mortgage origination process: *Denmark, Germany, Italy (currently in the testing phase), the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the UK.*

In **the Netherlands**, the use of AVMs for quality control and fraud prevention was made mandatory in 2010 by the WEW ('Stichting Waarborgfonds Eigen Woningen') for every government guaranteed loan application (NHG loan, 'Nationale Hypotheek Garantie'). More recently, one of the available AVMs was approved by the national supervisor (Dutch National Bank) and the ECB (European Central Bank) so it could be deployed for the AQR (Asset Quality Review) of the four largest Dutch mortgage lenders.

In **the UK**, AVMs are used extensively as a detection tool against potentially fraudulent or simply negligent overvaluations.

3. Other

Other use of AVMs: *Czech Republic, Denmark, Germany, Greece, Italy, the Netherlands, Norway, Portugal, Sweden, Switzerland and the UK.*

In the **Czech Republic**, AVMs are sometimes used for monitoring of the real-estate market. Where decline is observed, AVMs can be used to re-value selected parts of the portfolio.

In **Denmark**, AVMs are used for the re-pricing of mortgage loans.

In **Greece**, AVMs are mainly used to revalue property at a later point in time after an initial value for residential real estate has been determined by means of on-site visits and valuations by bank specialists.

In **Italy**, the first AVM was launched in Q1 2014, the first customers are international banks with Italian branches, but most of the top 20 banks based in Italy are also currently testing the model on their own portfolios.

In **the Netherlands**, AVMs are used by every lender. AVMs are used for arrears management and informing clients about current LTVs. They are also used to assign property valuations for the mortgages that are pledged in covered bond programmes and for the validation of CRM-indexation models.

In **Norway**, AVMs are used by well over 95% of banks. AVMs are also used by agents and surveyors, almost every single agent and most surveyors utilise some sort of AVM. They are also used in the context of portfolio valuation for arrears management, provisioning, capital modelling, reporting to banking regulator etc.

In **Portugal**, AVMs are used in finance valuations for taxation purposes.



In **Switzerland**, AVMs have been in use since 1994 and have been servicing over 200 Swiss banks, ranging from the local mortgage and savings banks to the large international banks. The Swiss Pfandbriefbank, one of the few remaining AAA rated banks, uses one of the leading AVMs to analyse quarterly the collateral portfolios of the covered bond issuances they place to the public. This hedonic AVM is also used for market index calculation and mortgage risk management. The models and their derivatives (indices) are also used in the framework of solvency testing for institutional investors. These indices serve as a benchmark for the FINMA Swiss Solvency Test (Swiss Financial Market Supervisory Authority) and are used by the Swiss National Bank in their analysis of the dynamic of investments in real estate. Many banks use regional sub-indices for marketing and communication on regional real estate markets.

In **the UK**, AVMs are also used for portfolios for arrears management, provisioning, capital modelling, reporting to the banking regulator, purchase or sale of mortgage portfolios (whole loan trading).



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V. Shift in use of AVMs since 2008

Since the onset of the crisis, there has been an increase in the use of AVMs in **Denmark, Germany, Italy, the Netherlands, Norway, Spain and the UK.**

There has been no shift in the use of AVMs in **Portugal, Romania, Sweden** and **Switzerland** however.

In **Denmark**, AVMs have increasingly been used for multiple purposes.

In **Germany**, the increased share of AVM use is explained by cost pressure and rationalisation of processes within the German banking industry, as well as by the new banking supervisory regulation raising the need for reliable real estate market information. For this reason, since 2008 Pfandbrief banks have built an AVM on real transaction data, while other established providers have also focused on bringing to the market significant AVM performance improvements.

In **Italy**, as indicated above, the first AVM was launched in Q1 2014, during the crisis banks used only House Price Indices (HPI) for portfolio revaluation, a less accurate approach compared to AVMs, according to a CRIF accuracy study available upon request.

In **the Netherlands**, the use of AVMs for quality control and fraud prevention was made mandatory in 2010 by the government (WEW: Stichting Waarborgfonds Eigen Woningen) for every government guaranteed mortgage loan application. AVMs are also more in demand because of house price declines in recent years, due to risk management needs and loan-level data requirements.

In **Norway**, demand both for AVM portfolio services and for the usage of AVMs at origination has experienced a substantial increase, due to a growing need for greater transparency and better risk management, especially in terms identifying mortgages with an LTV eligible for inclusion in a covered bond pool. Since the financial crisis almost every single bank has made AVM valuation the most important source of valuation for origination when re-mortgaging and in their risk management.

In **Romania**, the status quo can be explained due to the small-scale use of AVMs.

In **Sweden**, more quality controls have been introduced internally by valuers regarding AVM use.

In **Switzerland**, AVMs were introduced during the last real estate bubble at the end of the 1980s in order to provide transparency as well as systematic and objective information on the crashing real estate market and possibly create conditions to prevent repeated risky mortgage financing and excessive LTVs and improve knowledge of collateral and the real estate market. Setting up data standards for the Swiss real estate market common to all banks was a major first step, soon followed by integrated IT solutions for banks. Today's technology allows banks to integrate, at very low cost, the quarterly updated models into their own or third party mortgage management software. Every time a mortgage is granted, the collateral is scrutinised using the AVM. Surveyor reports are normally required only for special cases on private residential property, in particular when the characteristics of the collateral are slightly or very atypical compared to the mass of the transactions observed. Today, the risk of the mistakes of the past being repeated are very low. However, in light of the historically low mortgage interest rates resulting from the financial crisis, the Swiss National Bank and the FINMA have regularly reiterated that the attractiveness of ownership should be tempered by banks,



particularly when the increase of new mortgages and rising property prices locally suggested the possible onset of a new real estate bubble. Market analysis has however shown that the increases observed in the various real estate markets could be explained by rational factors like net immigration, GDP and an increase in revenue-evolution, low interest rates and the evolution of the property stock (construction minus destruction).

In **the UK** there has been a significant increase in AVM usage in recent years, continuing steadily also since 2008.



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VI. Rules, guidance, standards

1. Existence of rules/guidance in legislation on AVM use

Rules/guidance on the use of AVMs exist in **Denmark, Germany, the Netherlands, Romania and Switzerland** albeit in different formats.

No specific rules/guidance on the use of AVMs are present in **Greece, Italy, Norway, Portugal, Spain, Sweden and the UK**.

All 3 major rating agencies, Standard & Poor's, Moody's and Fitch, have published at various points over recent years their treatment of AVMs in the context of structured finance transactions.

In **Denmark**, Section 30 of the *Danish Executive Order on the valuation of security and loans granted against mortgages on real property provided as security for the issuance of SDRs and SDOs* stipulates the way in which mortgage banks should monitor property values on a regular, current basis to ensure compliance with LTV limits. Section 30(2) provides that the mortgage bank may use a documented valuation model approved by the Danish FSA for the continuous monitoring of property values. According to section 27, a property must be inspected prior to final valuation for origination, but section 27(3) states that the Danish FSA may grant exemptions from the inspection requirement based on a documented valuation model for owner-occupied dwellings for all-year habitation.

In **Germany**, there are no strict legal rules in place for portfolio valuations and quality control. However, the German Financial Supervisory Authority (BaFin) has communicated that for mortgage origination AVMs could only be used if they comply with all requirements for valuation reports. Therefore, they are a key part of the mortgage origination process, but they always need to be signed off by a surveyor.

In **Italy**, there is no specific guideline as yet. There are two national publications which address AVM usage entitled "*La gestione dei rischi durante la crisi: lesson learnt*" by G. Giudici & F. Marchetto, McGraw Hill, 2013 – Chapter 21 and "*L'evoluzione dell'asset management durante la crisi: lesson learnt*" by G. Guidici & F. Marchetto, McGraw Hill, 201 – Chapter 17.

In **the Netherlands**, the use of AVMs for quality control and fraud prevention was made mandatory in 2010 by the government (WEW: Stichting Waarborgfonds Eigen Woningen) for every government guaranteed mortgage loan application. AVMs are also more in demand because of house price declines in recent years, due to risk management needs and loan-level data requirements.

In **Norway**, the legislation for the issuance of covered bonds requires that the valuation of the house that acts as collateral be performed by an independent third party and explicitly endorses AVMs for this purpose. In addition the issuer must establish systems for keeping track of how the market value of the Individual houses in the cover pool develops. Again the legislation explicitly acknowledges that such a system can be based on AVMs ([Act on Financing Activity and Financial Institutions \(Financial Institutions Act\)](#), section 2-29).

In **Romania**, there is a set of Valuation Guidelines issued by the ANEVAR (included in Romanian valuation standards) which includes general indications referring to the use of AVMs. These guidelines are applicable exclusively for bank valuations.

In **Spain**, there are no rules, but guidance existed which has been provided by the National Association of Valuation Companies (AEV).

In **Sweden**, there are no specific guidelines on AVM use. Valuations in general are required to be carried in accordance with high professional standards. The AVM provider is obliged to establish a reliable model which must be possible to control.

In **the UK**, the national authorities, e.g. the Bank of England, have not formally issued any rules or guidance, but all organisations that have become or are looking to become AVM clients do typically conduct extensive accuracy tests and impact analyses before signing up and these may be shared with the national supervisor or other stakeholders.

2. Existence of internal guidelines within banks / professional associations on AVM use

In **Denmark, Germany, Greece, Italy** (international banks), **the Netherlands, Norway, Spain, Sweden, Switzerland and the UK**, banks and/or professional associations have internal guidelines/procedures related to the use of AVMs both for determining the value of a property, and in the context of portfolio valuation. Naturally these internal guidelines are bank specific.

In **Greece**, each bank applies its own internal guidelines regarding the use of AVM-like applications and methodology.

In **Italy**, for the time being only international banks have internal guidelines related to the use of AVMs.

In **Norway and the UK**, after conducting the extensive accuracy tests and impact analyses mentioned above, each client organisation tends to define and adopt its own specific AVM policy. The use of Confidence Levels as a reliable predictive estimate of AVM accuracy is typically at the core of any such policies, as CLs act as a filtering parameter to be deployed in different origination circumstances, e.g. at different LTVs, based on the bank's own risk management requirements. In the context of portfolio valuations, AVM policies tend to be a lot less stringent than at origination, due to the fact that the typical alternative in this circumstance, i.e. indexation, is actually less accurate than AVMs, thus removing any defensible rationale for limiting AVM usage.

In **Sweden**, guidelines exist to help users understand and use AVMs in a sound manner.

In **Switzerland**, the Swiss Bankers Association has made recommendations on the use of AVMs, as has the surveyor industry.

3. Time period for AVM usage to be replaced by on-site visit

In **Germany**, AVMs are generally not used for monitoring purposes. However, should the monitoring demonstrate a need for revaluation, AVMs could be used (even in combination with on-site visits). Generally, an on-site visit might become necessary when there is evidence to visit. Such evidence might be produced by vacancy of the property, state of repair, etc. Evidence levels are not defined or produced by supervisors but individually by credit institutions.

4. Scenarios which require immediate inspection of property

In **Germany**, immediate inspection might be required for instance when evidence is available of non-executed investments in properties (improvements, renovation, extensions etc.) although such

investments have been stipulated in the contract. Immediate inspection might also be triggered by a material decline of the property value (see Art. 208 CRR).

In **Greece**, one valuer has an internal rule in place which states that if the revaluation price obtained under an AVM exceeds the initial price of the property by 20%, the new recalculated price is not taken into account and an on-site visit by a specialist determines the price anew.

Annex I – Glossary of Terms and Definitions

Term	Definition	Remarks
Automated Valuation Model (AVM)	A system that provides an estimate of value of a specified property at a specified date, using mathematical modelling techniques in an automated manner.	<p>- As it only requires a property to be specified, an AVM can function merely based on property address, or cadastral reference or other forms of unique property identification (and possibly a few basic property characteristics), but it does <u>not necessarily require any previous values</u> of the property to be provided as input. An AVM, just like a Surveyor Valuation, can therefore value even properties that have never transacted before or whose history is not known to the user. This feature is one of the key differentiators between AVMs and HPIs.</p> <p>- As it deploys modelling techniques, hence the "M" in the acronym, an AVM is typically a lot more complex and therefore more accurate than just applying a simple factor to a previous value: again this is one of the key differentiators between AVMs and HPIs. Typically an AVM consists of sophisticated mathematical formulae requiring the deployment of bespoke technology and it includes elements of a comparable-based valuation approach, similar to Surveyor Valuations.</p> <p>- As it is an automated solution, hence the "A" in the acronym, an AVM operates without any human intervention post-initiation, making it an entirely objective tool, whose results are completely independent of the circumstances of the valuation. Clearly this rules out, for example, any manual selection of Comparables or any other ad-hoc subjective adjustments and it is one of the key differentiators between AVMs and Surveyor Valuations.</p>
AVM Accuracy	Collective term referring to the ability of an AVM to produce results close to the respective Benchmark Values.	<p>AVM Accuracy incorporates the following broadly separate dimensions:</p> <ul style="list-style-type: none"> - Bias (typically quantified by the Average Error or preferably by the Median Error) - Dispersion (typically quantified by the Standard Deviation, or the Average Absolute Error, or the percentages of AVM results within 5%, 10% etc of the Benchmark Value). <p>Please note some widely used accuracy measures may capture elements of both dimensions, e.g. the percentages of AVM results less than 5%, 10% etc above the Benchmark Value.</p>
Confidence Level	A predictive measure (usually given on an AVM provider's proprietary scale) expressing the estimated accuracy of each AVM result and as such directly translatable into a Forecast Standard Deviation.	Please note the degree to which the Confidence Level actually correlates with the accuracy of the AVM result when compared with the Benchmark Value is key to the assessment of AVM accuracy.
Benchmark Value (BV)	The property value against which the accuracy of an AVM result is measured.	It is intended as the Open Market Value, hence it typically consists of either a Surveyor Valuation or a Sale Price, often depending on the established

market practice in different jurisdictions.

Open Market Value (OMV) The notional price that a property would achieve in an arm's length transaction between a willing buyer and a willing seller

House Price Index (HPI) A time series capturing the price development of residential properties over time.

It can be computed following different methodologies, e.g. Repeat Sales, Hedonics, Weighted Averages or other techniques adjusting for differences in location, characteristics and condition of the properties available as data: this often results in contrasting figures from different HPI suppliers. Also It can be used within an Indexation Model as a set of multipliers to be applied to a previous property value in order to update it to a subsequent point in time: clearly this requires a previous value and date to be known for the Subject Property to be provided as input and therefore it cannot be applied to properties that have never transacted before or whose history is not known to the user. This feature is one of the key differentiators between AVMs and HPIs.

Comparable Based Model An analysis that seeks to identify recent Comparables that resemble the Subject Property in terms of location and attributes, possibly adjusting their values to compensate for any dissimilarities, to produce an estimate of Open Market Value.

Comparable A property used during the valuation process as evidence in support of a valuation of a different property.

The description of the comparable will typically include its address, some value information such as sale price at a particular date and some indication of the similarities with, or differences from, the Subject Property.

Hedonic Model An analysis of how various Property Characteristics influence property value in a given time period and geographic area. These models typically describe property value as a function of the attributes of both the property itself and of its location.

Analyst Assisted AVM (AAVM) A Hybrid Valuation that relies on the experience and judgment of a professional, but not necessarily a qualified surveyor, to validate and supplement the output of an AVM.

Please note the modifications or manipulations introduced by the analyst onto the AVM output and/or the Comparable Evidence removes the objectivity and integrity of the fully automated process and it may compromise its unbiased nature.

Surveyor Assisted AVM (SAAVM) A Hybrid Valuation that relies on the experience and judgment of a qualified surveyor, to validate and supplement the output of an AVM.

Please note the modifications or manipulations introduced by the surveyor onto the AVM output and/or the Comparable Evidence removes the objectivity and integrity of the fully automated process and it may compromise its unbiased nature.

AVM Assisted Appraisal (AVMAA) A Hybrid Valuation that relies on the experience and judgment of a qualified surveyor, to translate the output of an AVM into a legally compliant valuation. Please note this is obtained without conducting a physical inspection of the subject property,

Please note the modifications or manipulations introduced by the surveyor onto the AVM output and/or the Comparable Evidence removes the objectivity and integrity of the fully automated process and it may compromise its unbiased nature.

although it is supported by Comparable Evidence, which may or may not incorporate data from the AVM.

Hybrid Valuation	Generic term used to include for example all of AAAM, SAAAM and AVMAA	
Surveyor Valuation (SV)	The valuation produced by a qualified surveyor following the full internal physical inspection of a property	
Appraisal	Same as Surveyor Valuation	In American English
Mortgage Origination	The underwriting of a new or amended mortgage. It therefore includes all of the following Transaction Types: Purchase, Remortgage and Further Advance.	
Purchase	A transaction where a property is sold. It comprises both cash transactions and transactions financed through a mortgage,	Mortgage originations for a Purchase attracts the strictest underwriting procedures, because the property (and often the borrower as well) are typically unknown to the lender, who tends to pass all costs onto the borrower.
Remortgage	A transaction where a new mortgage is originated because the borrower changes lender and/or product, e.g. for a new interest rate, new terms and conditions etc.	In this case the property has been inspected and valued before at the time of purchase and the borrower already has some mortgage history often resulting into a lower LTV, hence remortgages are regarded as a lower-risk scenario and lenders compete fiercely in this space, e.g. by offering no fees deals, creating an incentive to minimise valuation costs.
Further Advance	A transaction where an existing mortgage is amended to merely increase the loan amount.	Here, both the property and the borrower are already well known to the lender, hence the least strict of all possible underwriting procedures apply, e.g. often just using HPI.
Second Opinion	The circumstance where an AVM is used at origination as a check for, not as a replacement to, a Surveyor Valuation.	

Annex II – Summary of the Usage of Different Valuation Solutions in Selected Markets

UNITED KINGDOM

	HPIs and other Statistical Valuation Techniques	AVMs	Hybrid Valuations (incl. Desktops)	Physical Valuations (i.e. Surveys)
Portfolio Valuations	- Only one of the top5 banks (and only two of the top 10) still entirely reliant on HPI - No significant use of any other Statistical Valuation Techniques	- All of the top 6 (and many of the smaller) banks have used AVMs to revalue the entirety of their book - 4 of the top 5 have done so every quarter for at least the last 3 years and one of them for more than 10 years now - Used for provisioning, capital modelling, arrears mgmt, whole loan trading etc	No	No
Mortgage Origination	- HPIs occasionally used for Further Advances	- Used for approx 1 in 4 of all mortgages, especially for the majority of re-mortgages	- Used for the cases where the bank's policy does not allow the use of AVM alone	- Used for the majority of mortgage originations, especially at high LTVs and/or where an AVM falls outside acceptability rules
Quality Control	No	- Deployed "on-the-spot" for Fraud Detection & Quality Assurance - Deployed "offline" for the management of survey suppliers	- First line assessment of cases where an AVM has flagged potential issues with an incoming survey	- Second line assessment of cases where both AVM and desktop have flagged potential issues
Other	No	- Extensive usage by the vast majority of mortgage brokers - Small usage by consumers	n/a	n/a

GERMANY

	HPIs and other Statistical Valuation Techniques	AVMs	Hybrid Valuations (incl. Desktops)	Physical Valuations (i.e. Surveys)
Portfolio Valuations	- Used for monitoring purposes (technically called Market Fluctuation Analysis), in order to identify market segments experiencing substantial price declines	Yes	Yes	- Used to produce a new valuation for those properties that HPI has identified as belonging to a segment experiencing substantial price declines
Mortgage Origination	No	- Used for preliminary indications of value and as auxiliary tools	As regulation for mortgage origination imposes that AVMs cannot be used in isolation, many originations are conducted as SAAVMs	Yes
Quality Control	No	Yes	Yes	Yes
Other	No	- Used by Estate Agents & to a small extent by consumers	n/a	n/a

ITALY

	HPIs and other Statistical Valuation Techniques	AVMs	Hybrid Valuations (incl. Desktops)	Physical Valuations (i.e. Surveys)
Portfolio Valuations	- Most banks use HPI's or other Statistical Valuations Techniques based on price/sqm	- In testing phase with several of the top20 banks	- Limited use	- Used for securitization for high value properties and by regulation (EU) No 575/2013 on a frequent basis where the market is subject to significant changes in conditions
Mortgage Origination	No	- No, self-regulation by banking industry doesn't allow AVMs for mortgage origination	No	Yes
Quality Control	- Used by some banks and some survey providers	- Yes, one of the top5 banks especially for data quality in terms of checking provider's performance	- Limited use	No
Other	No	No	No	- Legal purposes

NETHERLANDS

	HPIs and other Statistical Valuation Techniques	AVMs	Hybrid Valuations (incl. Desktops)	Physical Valuations (i.e. Surveys)
Portfolio Valuations	- Most banks use HPI's - No significant use of any other Statistical Valuation Techniques	- A large number of banks use AVMs to revalue the entire mortgage book, most annually, some quarterly - Used for provisioning, capital modelling, arrears mgmt, whole loan trading, customer mgmt etc - Also used to improve portfolio data quality	- Very limited use	- Some banks perform physical valuations on a very small sample of the portfolio every 3 years
Mortgage Origination	- Some banks use WOZ (a statistical property valuation determined by municipalities for fiscal purposes) for low LTV mortgage origination.	- Mortgage banks use AVMs (sometimes in combination with Sale Price) for a certain part of their mortgage origination	No	- Yes. Most are checked with AVMs for QC and fraud prevention purposes - For new builds the sales price is accepted
Quality Control	No	- Used by all mortgage lenders at origination	No	No
Other	No	- Used by a large number of banks for arrears mgmt & to inform clients on current LTV	- Very limited use	n/a

SWEDEN

	HPIs and other Statistical Valuation Techniques	AVMs	Hybrid Valuations (incl. Desktops)	Physical Valuations (i.e. Surveys)
Portfolio Valuations	- Most banks are using HPIs. No significant use of any other Statistical Valuation Techniques	Yes	No	No
Mortgage Origination	No	- Used frequently by one of the biggest banks and to a lesser extent by other banks	Occasionally	- Second line assessment when AVM flagged a potential issue
Quality Control	No	Yes	No	No
Other	No	- Small usage by consumers - Used extensively by government for over 30 years to obtain taxation value (not Open Market Value) for each property in Sweden	No	No

NORWAY

	HPIs and other Statistical Valuation Techniques	AVMs	Hybrid Valuations (incl. Desktops)	Physical Valuations (i.e. Surveys)
Portfolio Valuations	No	- All of the Norwegian banks use AVMs to revalue the entirety of their book, most of them doing so every quarter - Used for updating LTV ratios, capital modelling, etc	No	No
Mortgage Origination		- Used for approx 1 in 4 mortgages (especially re-mortgages (1 in 2)) More common for origination for Cover Bond Programs	- Used for the marginal cases where an AVM has narrowly failed the bank's AVM policy rules	- Used for about half of mortgage originations (remortgages), especially at high LTVs or high value properties. - Also used where AVMs indicate high uncertainty score
Quality Control	No	- AVMs frequently used as benchmark for surveyor values. - AVMs used as modelling for LGDs	- First line assessment of cases where an AVM has flagged potential issues with an incoming survey	- Second line assessment of cases where both AVM and desktop have flagged potential issues
Other	No	- Used by mortgage brokers	n/a	n/a

SWITZERLAND

	HPIs and other Statistical Valuation Techniques	AVMs	Hybrid Valuations (incl. Desktops)	Physical Valuations (i.e. Surveys)
Portfolio Valuations	- Indexing is used to a limited extent for portfolio valuation, benchmarking and economic scenarios	- Used by many banks to revalue the entirety of their book, several doing so every quarter - Used for automated processing of periodical mortgage reviews	- Used mainly by insurance companies, pension and investment funds to revalue their investment properties	- Used mainly by insurance companies, pension and investment funds to revalue their investment properties
Mortgage Origination	No	- Used extensively for single-family homes and apartments by most of the banks, insurance companies and pension funds	- Used as an alternative method where an AVM has flagged potential issues (i.e. objects with unusual characteristics)	- Used as an alternative method where an AVM has flagged potential issues (i.e. objects with unusual characteristics)
Quality Control	- Indexing is partially used as a second opinion	- Deployed for inspection of data quality and fraud detection	- Used for randomized checks of AVM appraisals	- Used for randomized checks of AVM appraisals
Other	- Indexing is used by Market Supervisory Authority and National Bank to analyse the market dynamics and for derivatives	- Used by agencies and private customers	No	No

ANNEX III – List of Contributors to this Publication

We would like to thank the following contributors for their input and support in the preparation of this Joint Paper.

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