IFC-National Bank of Belgium Workshop on "*Data needs and Statistics compilation for macroprudential analysis*"

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How should we measure residential property prices to inform policy makers?[1]

Jens Mehrhoff,
Eurostat

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[1] This paper was prepared for the meeting. The views expressed are those of the author and do not necessarily reflect the views of the BIS, the IFC or the central banks and other institutions represented at the meeting.

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Contents

1 Motivation and introduction

Data on house prices provide valuable information as a key macroeconomic indicator for identifying price signals, as an indicator for monetary policy impact analyses via the monetary transmission mechanism and, furthermore, as a tool for measuring an economy's real property assets. The data are also used to assess asset price bubbles as well as weaknesses and sources of potential risks in the financial sector, thus forming a basis for financial stability.

In order to make a statement about the residential real estate market as a whole, aggregation of the available price information is required. This can be done by forming the average using weights covering two different populations. On the one hand, the building stock – that is, all residential buildings existing in an economy – can be used as a basis; this results in a wealth perspective. On the other hand, the calculation can be made using transactions. This reflects market activity. It is appropriate to use different measurement approaches and weights depending on the specific analysis objective. Therefore, a single indicator cannot satisfy all user requirements equally.

This paper examines the various motivations for the analysis of house prices and the alternative measures to be applied in each case. Since for short-term business cycle analysis, the most recent developments are at the centre of attention, aggregation should be performed using transactions. In the case of national accounts, housing price data are needed to convert nominal values into real values. If the price-induced change in the property stock is to be measured, as a component of an economy's assets, and not just traded properties, it is appropriate to apply stock weighting. From a financial stability point of view, the potential build-up of asset price bubbles and the risks of banks' credit exposures associated to the financial soundness of private households are most relevant. Much like in short-term business cycle analyses, transactions can be used as a proxy for financings in order to provide valuable clues on the build-up of risks in banks' new business. It should be noted however, that important information on the regional heterogeneity is lost through aggregation.

2 Conceptual framework

The market value of a specific building depends on a variety of factors, such as the location, fittings, age and size of the property. The breakdown of this value[1] into its three main components – price, quality and quantity – can be shown as follows.

$$\underbrace{\text{Value} = \text{Price} \times \overbrace{\text{Quality} \times \text{Quantity}}^{\text{Volume}}}_{\text{Unit value}}$$

In the calculation, quantity is measured in square metres, for example. The unit value is calculated as the value divided by quantity, ie as the value in euro per square metre. It is thus dependent on the quality of the building concerned and contains not just pure price movements but also changes in quality over time. The quotient of value and price is termed volume and describes the real change in value, adjusted for pure price movements. It can also express, for example, an increase in effective expenditure if this comes about due to energy refitting or modernisation (ie improved quality).

The price in euro per square metre shown in the equation is given with all quality factors eliminated, so that quality appears as a dimensionless mark-up (or mark-down). The intertemporal comparison of prices therefore shows how much more or less would have to be spent today compared with previously under the assumption that the same property would have identical price-relevant fittings and characteristics.

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[1] The derivation of this breakdown is based to a lesser extent on theoretical model considerations, eg portfolio theory, on the value of a reproducible, durable consumer good such as a residential building, but more on the breakdown of the value into a price and quantity component while taking into account changes in quality, as is customary in index theory (and hence for consumer prices as well).

In order to make a statement about the residential real estate market as a whole, aggregation is required. This can be done by forming the average using weights covering two different populations. On the one hand, the building stock – that is, all residential buildings existing in an economy – can be used as a basis; this results in a wealth perspective. On the other hand, the calculation can be made using transactions. This reflects market activity.

3 Macroeconomic perspective

3.1 Identification of price signals to allocate resources

In a market economy, prices provide signals about relevant shortages through the balance of supply and demand. In this way, enterprises and consumers receive important indications for their production and purchase decisions. Prices and the changes in them thus play a role in the saving and investment decisions of households and commercial investors.

Housing prices are also a key macroeconomic indicator. Rising housing prices tend to stimulate construction activity. What is more, there are indications that inflation in housing prices is linked to transaction frequency. In particular, price rises for housing, which entail increases in value for the owners, can indirectly boost household consumption via wealth effects.

As an indicator for monetary policy, housing prices constitute a key component of headline inflation measurement.[2] By 31 December 2018, the Commission should prepare a report addressing the suitability of the owner-occupied housing price index for integration into the harmonised index of consumer prices coverage. As with other durable consumer goods, the net acquisition approach is also to be applied here. This takes as its basis expenditure on the acquisition of new housing and on the maintenance and insurance of existing apartments and houses.

Measuring prices based on constant quality and quantity of a well-defined good is crucial to identifying undistorted signals. The measurement objective of a price index is not to portray the development of average expenditure on the acquisition of houses and apartments, which also incorporates higher or lower spending on changes in quality or quantity. Rather, the measurement objective is to record pure price developments under the assumption of identical price-relevant fittings and characteristics. To do this, prices have to be normalised to a uniform standard, which means eliminating quality-related differences.

Aggregation on the basis of transactions, which only incorporates price information on properties actually sold, should be undertaken for business cycle analysis. Ideally, the relevant purchase transactions would be used here as a weighting matrix, which reflect structural differences in the transaction frequency for different property types or regions. Cyclical fluctuations in the weights should be avoided, however.

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[2]   The same applies to interregional and international comparisons.

3.2 Uses in the national accounts

Housing price data are also needed to convert nominal values into real values (deflating) in the national accounts.[3] In simplified terms,[4] the volume can be derived as follows.

$$\text{Volume} = \frac{\text{Value}}{\text{Price}}$$

This requires a pure price index for this asset class, which is also termed a deflator.

If the price-induced change in the property stock[5] is to be measured, as a component of an economy's assets, and not just traded properties, it is appropriate to apply stock weighting.[6] In conceptual terms, a prerequisite for this is the availability of price information on both sold and unsold properties. Depending on the source of the price data, it is possible that information will only be available for sold properties; however, their price development can differ from that of unsold properties.

Deflators are additionally used in other sections of the national accounts. First, for overall sales of housing, to depict the real production value of real estate and housing services. Second, a price index for the production value of new buildings is needed, which forms part of gross (fixed) capital formation.[7] Deflating these variables requires a transaction-weighted price index which comprises only the prices of new properties for the new buildings component.

4 Application to financial stability

From a financial stability perspective, besides the possible emergence of asset price bubbles, the market risk associated with households' debt sustainability posed to lending banks is of particular relevance. In this connection, the change in value of the financed properties must be noted, taking into account two dimensions: risks involved in newly granted loans and changes in the value of properties in the loan portfolio.

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[3] Naturally, the nominal figures are also justified in their own right as a key indicator.

[4] This document does not address the problem of breakdown into a land and structure component in further detail.

[5] The value of the property stock is a significant component of an economy's assets. In Germany, for example, gross domestic capital stock as reported at replacement cost at year-end 2016 in the area of dwellings constitutes around 266% of nominal gross domestic product for the same year.

[6] This approach would also be appropriate in terms of estimating wealth effects, as the values of households' individual asset portfolios are influenced by changes in housing prices, which diverge between regions.

[7] There is a link between the definitions of stock and transaction values. The stock value at the beginning of the period plus the net change in that period gives the stock at the beginning of the subsequent period. Depreciation (devaluations and disposals) and write-ups (owing to construction and renovation, for example) also have to be taken into account.

However, aggregation can result in important information about regional heterogeneity being lost.[8] After all, in line with the experiences of other countries with exaggerations in the housing market, regional trends can definitely develop systemic relevance. Ultimately, undesirable regional developments in lending that initially arise in isolation can multiply, allowing the rise in housing prices to continue gaining ground.[9] Disaggregated price levels are therefore required to examine geographical transmission channels in more detail.

4.1 Assessment of the emergence of asset price bubbles at the current juncture

The emergence of asset price bubbles is often associated with misallocations, for example on account of a significant increase in construction investment and the corresponding capacities which, in the case of a trend reversal, involves higher default risk in the non-financial corporate sector, amongst other things. However, the acquisition of housing by households, which is credit-financed to a significant degree, merits particular attention. In this context, the value of a property at the time of purchase plays a particular role in lending to households. Thus, for example, the initial ratio of the loan amount to the market value is a key figure in macroprudential analysis.[10] The price dynamics have to be assessed in connection with additional financing indicators. The concurrent increase in lending and easing of lending standards, which can be observed in typical house price booms, is especially risky.

Like the user requirements for business cycle and price analysis, transaction weighting of the properties sold on the market, as an approximation value for financing and construction investment,[11] can provide important information for assessing the build-up of risk positions in new business.

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[8]   For further details, see Deutsche Bundesbank, The determinants and regional dependencies of house price increases since 2010, Monthly Report, October 2013, pp 13-29.

[9]   For further details, see Financial Stability Committee, Erster Bericht an den Deutschen Bundestag zur Finanzstabilität in Deutschland, June 2014.

[10] This kind of monocausal analysis falls short of prudential practice in that there are more factors between property appraisal and customer rating than just the loan-to-value ratio, such as the posting of collateral. Furthermore, the normal loan-to-value ratio in Germany is not necessarily a good measure of a property's actual value, as this "may not exceed the value resulting from a prudent appraisal of the future marketability of a property" pursuant to section 16 (2) of the Pfandbrief Act (Pfandbriefgesetz).

[11] For the construction sector, however, there are vastly more suitable indicators available to directly measure activity.

4.2 Observation of the development of financed properties over time

Another relevant variable that is an important indicator is the change in value over time – changes in price including quality. This is because, with respect to the banks' default risk, the residual value of a property is only of interest when there is a default on loan payments (exposure), as the property would then revert to them and might have to be sold on the market.[12]

As shown above, the value of an individual property is made up of the three variables of price, quality and quantity. The quantity (eg living space) of a property is generally approximately constant over time. However, the price and quality change over time. Thus, the change in value from the time of house purchase until possible default of the loan amounts to:

$$\text{Change in value} = \text{Price change} + \text{Change in quality}$$

The condition of the house, ie its quality, is not a fixed variable in the equation, however; rather, a discount is subsequently assumed as a constant annual depreciation factor. A property's value is thus correlated with the price change on the market.[13]

Consequently, only the price developments of bank-financed properties would be relevant from a macroprudential perspective. Equally, the portfolio to be analysed should incorporate only these properties into the weighting scheme. This is crucial in that its composition changes over time. Newly financed buildings and apartments are added, and others are removed, as the loans granted for them were paid off.

For the purposes of financial stability, supplementary institution-specific data for the identification of sources of potential risk are therefore imperative.[14] The question of the breakdown's borders naturally cannot be answered using the available data. The weighting scheme which comes closest to the measurement objective discussed in this section is probably weighting based on the building stock.[15]

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[12] Of course, this is only weighed against the average probability of default in the loan portfolio. In principle, the market value of a property can also fall below the loan amount. As long as households can still make the interest and redemption payments, however, these non-defaulted loans do not play a role in the effectiveness of banks' risk management.

[13] In this context, the absolute residual value of the property is not the decisive factor, but rather the ratio to the outstanding loan amount at the time of the possible loan default. Particularly in the first few years of the mortgage term, however, the principal component of the annuity is very low, while the rate of depreciation here was assumed to be constant, which means that the outstanding loan amount/residual value ratio normally initially deteriorates compared with the time the loan was granted.

[14] In addition, developments broken down by year of loan granting are interesting as these can express the prevailing regime at the time in the form of lending standards.

[15] Nonetheless, this approximation is rough at best. For example, the situation regarding households' ownership of real estate property is as follows, based on the German income and consumption sample for 2008: just over half of all households live in rented housing and another fifth own the property without a mortgage loan on it; only around one-quarter of households own housing for which they still have to settle an outstanding loan.
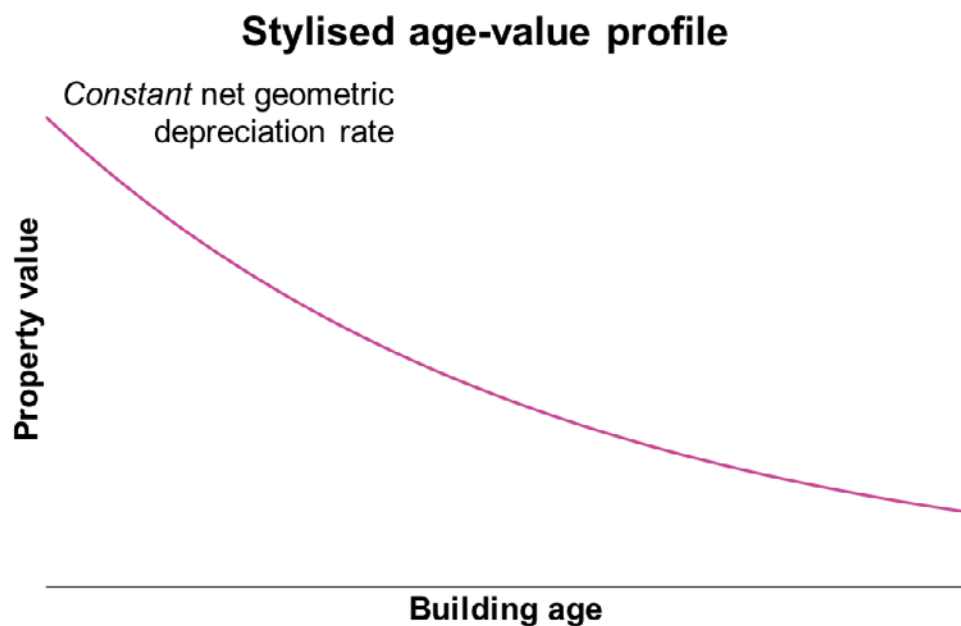
5 Conclusions and policy messages

Whether or not a price index should be adjusted for depreciation depends on the use. From a macroeconomic point of view, the pure, i.e. quality adjusted, price change is desirable as the target (and also as the headline). Having said that, however, for macroprudential purposes one might need to take into consideration deprecation since this affects the collateral value, too. This is exactly why the recommendation of the European Systemic Risk Board on closing real estate data gaps (ESRB/2016/14) demands the "application of a suitably chosen mark-down to account for the depreciation of the property" in the estimation of its current loan-to-value ratio when a price index is used.

Hence, for macroprudential purposes we need something like the age-price profile in the System of National Accounts. According to the *basic builder's model*[16] the value of the property decreases as the structure ages one additional period:

$$p_i^t = \beta^t L_i^t + \gamma^t (1 - \delta^t)^{A_i^t} S_i^t + \varepsilon_i^t,$$

where the parameter δ^t reflects the net geometric depreciation rate. The graph visualises this relationship, for simplicity ignoring major renovations and vintage effects.

Stylised age-value profile

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[16]   For further details, see Eurostat, Handbook on Residential Property Prices Indices (RPPIs), 2013 edition.

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     and other institutions represented at the meeting.

How should we measure residential (and commercial) property prices to inform policy makers?

Jens Mehrhoff, Eurostat
IFC – NBB Workshop
Brussels, 18 – 19 May 2017

Structure of the presentation

1. Motivation and introduction

2. Conceptual and methodological framework

3. Conclusion

"*Nowadays people know the price of everything and the value of nothing.*"
(Oscar Wilde in *The Picture of Dorian Gray*)

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1. Motivation and introduction

- Recommendation of the European Systemic Risk Board on closing real estate date gaps (ESRB/2016/14):
  - [T]he **current value of the property** can be estimated using a **real estate <u>value</u> index** sufficiently granular with respect to geographical location and type of property; if such real estate value index is also not available, a **real estate <u>price</u> index** sufficiently granular with respect to geographical location and type of property can be used after application of a suitably chosen **mark-down to account for the depreciation** of the property.

European Commission

1. Motivation and introduction

- The observation of **values and prices generally yields different results**.
- The change in market values between two consecutive periods does not necessarily reflect the **pure, i.e. quality-adjusted, change in prices**.
- It is rather a *mixtum compositum* **of quality changes** due to depreciation and renovation as well as the **quality-adjusted change in prices**; if quantities remain the same.

European Commission

1. Motivation and introduction

- Let, for example, the **population be equal in the two periods** under consideration.
- **Due to depreciation the quality of all buildings will be lower** on average.
- Comparing the value of the same house over time is **not comparing apples with apples**, or it is **but a fresh apple with a rotten apple**.
- While **values might have decreased** due to depreciation, **quality-adjusted prices would have remained the same**.

European Commission

2. Conceptual and methodological framework – Setting the stage

- The **market value provides a nominal measure** for residential property. If quantities in square metres, say, are available, dividing the value in euro by that quantity yields a so-called **unit value in euro per square metre**. Thus, the value can be split up as follows:

(1)   Value = Unit Value   x   Quantity.

- However, the unit value in Equation (1) **depends on the quality of the building and not only its size**.

European Commission

2. Conceptual and methodological framework – Setting the stage

- Since price indices aim for a quality-adjusted indicator **prices here denote a constant quality *numéraire***. It is possible to decompose the value into a **constant-quality price** and a volume measure that inherits quality changes:

(2)   Value = Price   x   Volume.

- Therefore, an index for property prices in its pure form will reflect **movements in prices that are stripped of quality changes**. The latter are included in the volume as shown in Equation (2).

2. Conceptual and methodological framework – Setting the stage

- Eventually, the ultimate statistical goal is splitting up the value into a **quality-adjusted price**, the quality component itself and a quantity measure independent of quality:

$$
(3) \quad \text{Value} = \underbrace{\text{Price} \quad \times \quad \overbrace{\text{Quality} \quad \times \quad \text{Quantity}}^{\text{Volume}}}_{\text{Unit Value}}
$$

European Commission

2. Conceptual and methodological framework – Setting the stage

- Following Equation (3), the value is obtained via **multiplying the constant-quality price of a unit by a dimensionless mark-up (or mark-down) for the desired level of quality and the nominal quantity** of the structure or the land.

- This **mark-up can reflect characteristics such as the age of the building or its year of construction**.

European Commission

2. Conceptual and methodological framework – Macro-economic use

- In a market economy, **prices give signals about relative scarcities** through equilibria between supply and demand.
- In this way, both enterprises and consumers gain important insights into their production and consumption decisions, respectively, so that **scarce resources are allocated to where they are most efficiently used**.
- Real estate prices are a significant economic indicator and **rising house prices are often associated with economic growth**.
- They **stimulate construction activity and promote house sales**. Not least, price increases **support private consumption via the wealth effect**.

European Commission

2. Conceptual and methodological framework – Macro-economic use

- For **monetary policy making, house price indices** are an **integral part of inflation measurement**.
- By 31 December 2018, the Commission should prepare a report addressing the suitability of the **owner-occupied housing** price index for **integration into the harmonised index of consumer prices coverage**.
- For the **identification of pure price signals**, a **price index at constant quality is a condition *sine qua non***.
- Since for **short-term business cycle analysis**, the most recent developments are at the centre of attention, **aggregation** should be performed **using transactions** (albeit not necessarily in terms of chain-linked indices).

European Commission

2. Conceptual and methodological framework – Macro-prudential use

- Apart from the **potential build-up of asset price bubbles**, the **risks of banks' credit exposures** associated to the **financial soundness of private households** are most relevant.

- Here, the **change in values of financed objects** needs to be tracked over time – from newly granted loans to properties in the credit stock.

- An important indicator is the **change in values – price changes including quality changes – of financed objects over time**.

European Commission

2. Conceptual and methodological framework – Macro-prudential use

- This is because, from the banks' perspective, the **residual value of a home is of interest only should the debtor default**, since then the bank would have to sell the home on the market (possibly in a forced sale).

- Since the quantity, i.e. floor space or number of bedrooms, is constant in general, the **change in the property's value between the time of purchase and a potential foreclosure** is:

(4)   Value change = Price change + Quality change.

2. Conceptual and methodological framework – Macro-prudential use

- The **quality of the house**, however, is not fixed but it is assumed to be **subject to a constant annual depreciation rate**.

- The **sole exogenous variable in the model** then would be the **quality-adjusted price**.

- Still, it is **not the absolute residual value of the house** that matters **but its ratio to the residual mortgage in the event of credit default**.

- In the **first years of the life of the loan**, though, the **amortisation rate of the annuity is rather low**, so that the **loan-to-value ratio worsens**.

European Commission

2. Conceptual and methodological framework – Macro-prudential use

- From a macro-prudential view, **only prices of financed objects** would be relevant.

- A **bank's credit portfolio** would, furthermore, have a **changing composition**; newly financed objects enter, others exit due to repayments of the loans.

- For financial stability purposes, additionally, **institution-specific figures are indispensable** for the identification of risk potentials.

- The **tails of the distribution need close examination** as do **credit vintages which reflect then-effective lending standards**.
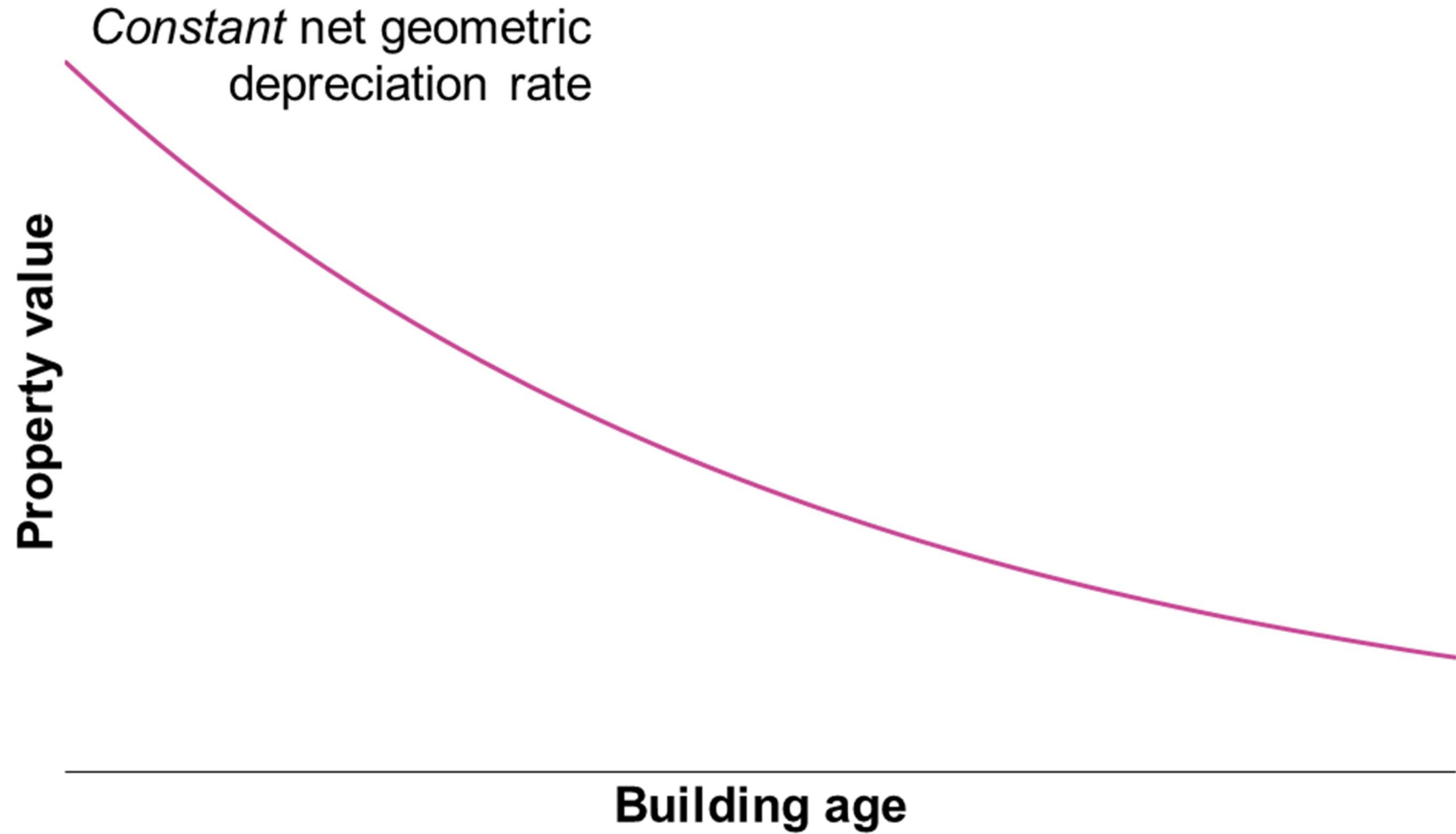
European Commission

3. Conclusion

- **For macro-prudential purposes we need something like the age-price profile** in the SNA.
- **Basic builder's model** (see Eurostat, 2013, *Handbook on Residential Property Prices Indices*):

$$(5) \qquad p_i^t = \beta^t L_i^t + \gamma^t \left(1 - \delta^t\right)^{A_i^t} S_i^t + \varepsilon_i^t,$$

where the parameter δ^t reflects the ***net* geometric depreciation rate** as the structure ages one additional period.

Stylised age-value profile

Constant net geometric depreciation rate

Property value

Building age

European Commission

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