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## Making available data more useable: compilation and publication of break-adjusted (historical) time series<sup>1</sup>

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# Making available data more useable: Compilation and publication of break-adjusted (historical) time series<sup>1</sup>

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Abstract

Time series are key for policy analysis and policy making. However their use can in practice be severely hampered by breaks. This is especially the case for data on outstanding amounts (or stocks, positions), for which break-adjusted time series are rarely published by central banks. This paper shows the policy towards and methodology for compiling break-adjusted monetary statistics at De Nederlandsche Bank (Netherlands Bank; DNB). DNB has recently increased its publication of such time series, as part of a wider program to increase the accessibility and value-added of its data to users. Breaks are mainly adjusted using a set of automated rules that do not require manual intervention. In specific cases, however, expert judgement is applied to increase quality and provide longer historical time series.

Keywords: Time series, break-adjusted, positions, mortgage loans

JEL codes: C82, G21

## Introduction:

For statisticians, breaks in statistical time series are a *fact of life*. For users, however, they can severely hamper the use of statistics for analytical, policy making and forecasting purposes.

Many statistical publications, amongst which those published by De Nederlandsche Bank (Netherlands Bank; DNB), are characterised by breaks. Breaks stem from updates of statistical frameworks and guidelines, changes in population and erroneous reporting. Put differently, breaks are caused by everything but real economic developments. Trend breaks in collected data reflecting such real economic developments, for example political or (monetary) policy announcements, are thus outside the scope of the breaks we focus on in this paper.

In the monetary statistics compiled and published by DNB, the most impactful breaks in time series stem from structural changes in the underlying data. For instance the largest breaks in balance sheet total stem from changing frameworks (e.g. December 1997, June 2010, December 2014), changing supervisory or accounting guidelines (e.g. March 2000, December 2016) and changing reporting population or consolidation scope (June 2005, June 2014). For these breaks reporting agents are generally not required to provide corrections in the preceding reference periods.

More numerous, but typically less significant are breaks involving erroneous reporting and the inability of reporting agents to revise their returns for all errors made in the past. One could think of an investment portfolio missing from the returns for some years, for which source data (e.g. the ledger) have already been moved to 'inactive' databases. The impact of such breaks on aggregated statistical figures is generally rather limited.

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<sup>1</sup> The views expressed are those of the authors and do not necessarily reflect those of De Nederlandsche Bank.

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Statisticians face the question whether they should adjust their data for such breaks, or leave such adjustments to users. This question involves a trade-off between actual observed data points and developments on the one hand and usability of the time series on the other hand. When source data (i.e. revised returns from reporting agents) are not available for all reference periods concerned, any break adjustment means another processing step of the observed data and, thus, an additional deviation between source data and output. The larger the difference between the observed data and published statistics, the more prone the data are to misinterpretation.

However, as stated by Dembiermont et al. (2013), 'both unadjusted and break-adjusted series are imperfect measures'. The unadjusted series are, prior to a break, implicitly incorrect or not in line with the framework used for recent periods (otherwise there would not be a break in the series), while the adjusted series assume the unobserved data develops in a similar fashion to the data collected for the respective periods. Hence, the chances of misinterpretation are (probably) comparable.

Moreover, the usability and user friendliness of statistics increase substantially when they are corrected for breaks. In principle, having more (detailed) information on specific breaks, statisticians should be better equipped to correct for breaks and, hence, break corrections by statisticians will probably increase the overall quality of the time series. This is especially the case when users will likely need to adjust time series for breaks anyway – and would do this by means of less sophisticated measures when left to their own devices.<sup>2</sup>

At the juncture of the introduction of its new statistics website, DNB's Statistics Division launched a project to extend the publication of time series adjusted for breaks. In this paper we elaborate on the policy behind the compilation and publication of break-adjusted monetary statistics and we demonstrate the methodology used to compile break-adjusted historical time series for one of our key monetary indicators: loans granted for house purchase to Dutch households.

The paper is structured as follows. Section 1 describes DNB-statistics' policy of publishing break-adjusted monetary statistics. In section 2 we focus on historical time series for mortgage loans granted to Dutch households. Finally, conclusions are drawn and the way forward is set out in section 3.

## **Section 1: Towards a new policy**

Policies towards the publication of monetary statistics adjusted for breaks vary between organisations. A stock-taking in 2017 amongst some peer institutions<sup>3</sup> shows that in general these institutions publish derived transactions (or flows)<sup>4</sup> only, while the positions are not corrected for breaks. Some institutions publish growth rates for selected series, which they calculate on the basis of derived transactions and observed positions. Break adjusted (notional) positions, are rarely published by central banks, some examples are the Banque de France (loans to NFC and households) and the Bank of England (monetary aggregates).

Reasons provided for the limited publication of break-corrected positions are, first, to avoid confusion amongst users, because there will be two different figures for one 'phenomenon' (e.g. mortgage loans to households or M3). Second, the arbitrary nature of break adjustment. Not all users will agree on the methodology used for the adjustments, the way to treat inconsistencies or the base period. Third, the adjustment for breaks requires considerable resources, more in particular when i) a very sophisticated (econometric) model is used or ii) breaks are revised on the basis of qualitative research and (fully) integrated by staff members (like in national/sector accounts).

Despite the (potential) drawbacks, in 2017 DNB's Statistics Division launched a project to compile and publish statistical series adjusted for breaks, as part of a wider program to increase the accessibility and

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<sup>2</sup> Such as multiplicative corrections or – as has been witnessed in some cases – by removing double observations marking breaks and thus assuming implicitly that these breaks do not exist.

<sup>3</sup> NCBs of Austria, Belgium, Germany, Spain, France, Italy and the United Kingdom as well as the ECB and the BIS.

<sup>4</sup> Transactions are calculated as the difference between the positions in period T and T-1, adjusted for revaluations, exchange rate variation, write-off/write-downs and other changes in volume (e.g. breaks).

value-added of its data to users. In the trade-off between the usability and user friendliness of statistics on the one hand and the reported data on the other hand the former prevailed. Besides break-adjusted tables for regular statistical publications, also the publication of key indicators for monetary statistics was introduced.<sup>5</sup>

To maximise value-added of the adjusted series and align with the unadjusted publications, it was ultimately decided to publish the break-adjusted positions rather than break-adjusted flows or (observed) growth rates. The publication of flows and growth rates, still requires users to compile adjusted time series for (notional) positions. Moreover, users encounter similar problems (e.g. inconsistencies) statisticians do when compiling the time series.

The quality of the break-adjusted positions should equal at least the quality of time series adjusted by users on the basis of statistics published by DNB. In addition, if available, detailed (source) information of breaks is used to make more precise adjustments for past periods. This leads to three basic principles when eliminating breaks.

First, the quality of the adjustment is weighted against its complexity and cost. The following ranking applies for the approach taken:

1. Adjustments based on resubmissions from reporting institutions are preferred. From a quality perspective this is the preferred option, however it is relatively expensive (i.e. reporting burden and compilation) or (close to) impossible for the whole time series. Therefore resubmissions from reporting institutions are, in general required for some periods, resulting in a break in another period.
2. If resubmissions are not available or too expensive, adjustments based on additional qualitative information (e.g. from reporting institutions, literature or the market) are the second best option. Quality is probably a bit lower than under approach 1, but there is little (or no) additional reporting burden. In contrast, it is probably more costly in terms of resources from the statistics department.
3. If the first two approaches are not an option, we apply multiplicative adjustment (i.e. backward calculation applying growth rates or proportional up- or down scaling of data in earlier periods). The overall quality is most probably lower than the adjustments resulting from approaches 1 and 2, however the application is relatively cheap and also often employed by users. The technicalities behind the multiplicative break-adjustment are available in Annex I.<sup>6</sup>
4. In specific cases, for example where user demand or quality requirements are especially high, tailored solutions may be employed. Such solutions can entail a combination of the approaches mentioned above for specific series (e.g. historical time series for key monetary indicators).

Second, in principle, no adjustments are made for inconsistencies arising from multiplicative adjustments. The example provided in Annex II demonstrates the inconsistencies that arise from the methodology used (i.e. multiplicative backward calculation on the basis of the most recent observation). Maintaining the growth factors observed prevails and users can, if needs be, allocate inconsistencies in accordance with their own preferences.

Third, the most recent available (reference) period is used as base period for the adjustments. In other words, the past is aligned with the latest frameworks, definitions, reporting population and methodology.

Chart 1 presents the break-adjusted and unadjusted time series for Dutch MFI's total assets, as well as the difference (percentage points) between both series. In contrast to the findings for most series in Dembiermont *et al.* (2013), the differences become smaller again in the earlier periods after reaching its

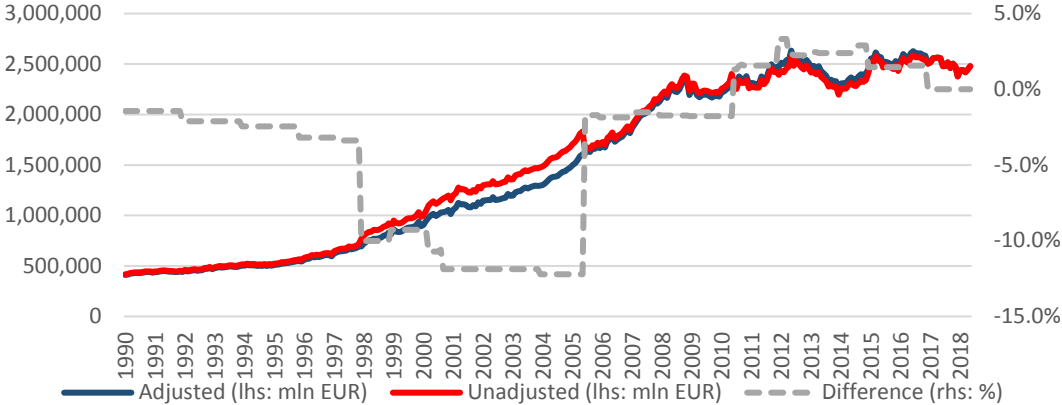
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<sup>5</sup> <https://statistiek.dnb.nl/en/downloads/index.aspx#/details/key-indicators-monetary-statistics-month/dataset/b698ca40-9cae-435b-954e-4fe2c5651370/resource/6c3650d4-3631-4964-9ef9-4d0505aeb48a>.

<sup>6</sup> Except for the exclusion of 'other changes' from the up and down scaling of the adjusted series, the method is similar to the adjustment described in Dembiermont *et al.* (2013). We exclude 'other changes' such as securitisations to mitigate the multiplier effect of the break factor on (significant) other changes which are (very likely) to be correct. Securitisation transactions are for example made known to the public at large (e.g. by means of investor reports).

maximum (-12.2 %) between December 2003 and May 2005. The divergence of the series in the earlier periods mainly comes from the fact that the substantial breaks in December 1997 (+EUR 52.745 mln) and June 2005 (-EUR 196.420 mln) as well as some –relatively smaller– breaks in between more or less balance each other.

Chart 1: Total assets of Dutch MFI, break-adjusted and unadjusted (monthly)



Source: DNB, authors’ own calculations

At the current stage the main tables<sup>7</sup> are adjusted for breaks, while work is still in progress for the more disaggregated tables. For some sector statistics (e.g. insurance companies and pension funds) more recent breaks have been eliminated and adjusted balance sheet data are available from 2002 onward. In the next stage the time series will be adjusted back to 1986. The ultimate goal is to adjust all tables for which break adjustments is deemed feasible, if needs be on a higher level of aggregation.

Besides the compilation and publication of adjusted series (and tables), DNB continues providing statistics to (inter)national organisations (i.e. the ECB, BIS, IMF and Statistics Netherlands) in accordance with the frameworks, formats and methodologies agreed.

**Section 2: Historical time series for mortgage loans granted by MFI to Dutch households**

Besides break-adjusted tables for regular statistical publications, DNB’s Statistics Division also started the publication of key indicators for monetary statistics, amongst which the *loans granted for house purchases*.<sup>8</sup> The aim is, provided the availability of source data, to compile and publish historical time series for these indicators. This section deals with the compilation and publication of time series at monthly frequency for mortgage loans granted by MFI<sup>9</sup> to Dutch households from December 1956 onward, for which a tailor made approach (method) was taken.

2.1 Data availability and preparation

DNB has been collecting data from financial institutions for the purpose of monetary analysis following the implementation of the banking law (‘Bankwet’) in 1948. Information was mostly collected by means of the returns for the purpose of prudential supervision, but additional monetary (or ‘social-economic)

<sup>7</sup> E.g. *Balance sheet of De Nederlandsche Bank (monetary presentation), Balance sheet of Dutch-based MFI (not including DNB), Combined balance sheet of DNB and Dutch based MFI and Dutch contribution to monetary aggregates in the euro area, Securities issue statistics.*

<sup>8</sup> <https://statistiek.dnb.nl/en/downloads/index.aspx#/details/key-indicators-monetary-statistics-month/dataset/b698ca40-9cae-435b-954e-4fe2c5651370/resource/6c3650d4-3631-4964-9ef9-4d0505aeb48a>.

<sup>9</sup> For the purpose of this paper, more in particular section 2 on historical time series for mortgage loans granted by MFI to Dutch households, the scope of MFI is limited to the ‘other MFI’ (i.e. deposit taking corporations), excluding the Central Bank.

data were collected from reporting agents via dedicated appendices. In 1982 DNB started the collection of complete balance sheets using the so-called 'social-economic reports', with more detailed counterparties and instruments (Van Straaten, 1989).

Currently the social-economic reports are collected from MFI. The MFI sector more or less consists of what used to be the *money creating sector* and *savings banks*.<sup>10</sup> Monthly and quarterly statistics for money creating institutions are available from 1957 onward, while yearly statistics go back to 1900. In contrast, savings banks had to submit their returns each quarter and, hence, no monthly source data is available. Historical time series, in accordance with the social-economic reports, were published on several occasions (DNB, 1973; 1980; 1985; 1987; 2000; 2003). Annex III provides an overview of the data we use to compile the monthly time series for mortgage loans granted by MFI to Dutch households.<sup>11</sup>

Between 1998 and 2003 data for mortgage loans for house purchases were collected on a quarterly basis only. For that period we assumed equal growth rates for all consecutive months in the respective quarter, in order to perform temporal disaggregation. For the compilation of monthly positions of mortgages granted by savings banks we apply Chow-Lin (1971) temporal disaggregation of the quarterly data from savings banks on the basis of the monthly developments of mortgage loans granted by money creating institutions.

Provided the substantial securitisations of Dutch mortgage loans in the past, reaching record high in November 2010 (EUR 168.060 mln), DNB adjusts MFI mortgage loans for true sale securitisation transactions<sup>12</sup> in some of its publications (see also section 2.2). Information on securitisation transactions and total amounts outstanding have been collected from January 2003 onward. Additional information on true sale securitisation transactions was collected from external sources (e.g. annual reports) to extend the time series back to the first true sale securitisation in September 1997. The positions on Special Purpose Vehicles' (SPV) balance sheets from September 1997 till December 2002 were estimated accumulating the securitisation transactions in that period. The break observed in January 2003 (see also Annex IV), at the juncture of the introduction of a new framework that allowed for the collection of more detailed information on securitisation transactions and SPV's balance sheets, is assumed to equal repayments of derecognised loans in the past.<sup>13</sup> These 'repayments' are deducted from the estimated positions.

Besides the time series, breaks in the series are in general well documented. Not only is the value of the break made available to the user, also (some) background information of the nature of the respective breaks is presented. Annex IV provides an overview of all breaks in the time series. Most of them are present within a specific source (or time series) used, except for the breaks in December 1982 (-EUR 12.755 mln), December 1997 (-EUR 3.392 mln) and December 1998 (-EUR 992 mln).

## 2.2 Methodology and assumptions

Similarly to the approach described by the ECB (2015) we aggregate the MFI and SPV balance sheets to capture total loans granted by MFI. The aggregation takes place before the break-adjustment in both balance sheets. Rational behind is the fact that some (significant) breaks on MFI balance sheets relate to securitisation and, hence, are balanced by breaks of similar or the same size on the SPVs' balance sheets. The pre-adjustment aggregation mitigates the impact on breaks originating from 'incorrectly allocated'

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<sup>10</sup> Money creating institutions include the central bank, general government, 'universal' banks, cooperative banks, trade banks, post office giro institutions and, from 1986 onward, savings banks. Section 2.2 provides more details for the classification of savings banks.

<sup>11</sup> More time series on mortgage loans are available in our database, but they usually have a lower frequency, cover only a short period or represent only a part of the population (e.g. trade banks, cooperative banks, specific individual institutions).

<sup>12</sup> True sale securitisations, involving loans or loan packages from the MFI balance sheet being sold and transferred (i.e. derecognized) to a non-banking entity specifically established for this purpose, i.e. an SPV. In addition to selling loans, MFIs may also repurchase previously securitised loans and add them to their balance sheet. Usually the MFI still services the loans, in other words, the costumers will not be able to tell whether or not their loans have been securitised.

<sup>13</sup> A repayment rate of 0.05% completely eliminates the break in 2009.

(true sale) securitisations, broadly in line with the ideas underlying the break-adjustment of other DNB monetary statistics publications.

For years DNB used multiplicative adjustment for its external publication of loans granted to households and non-financial corporations adjusted for breaks and securitisations.<sup>14</sup> For adjustment of the positions, the method is fully in line with Dembiermont *et al.* (2013), which also uses break factors to eliminate breaks in the past, aligning the level to the latest observation.<sup>15</sup>

Lastly, we combine the developments of the mortgage loans granted by savings banks and money creating institutions to calculate backward the positions from 1982 to 1956. Until 1986 savings banks were not part of the money creating sector, because they used to take savings deposits and make investments mainly on the capital market (Van Straaten, 1989). The kind of activities savings banks were allowed to engage in was restricted, it was for example by law forbidden for them to grant loans to business enterprises ('T Hart *et al.*, 1997). As a result of that, their balance sheet was –on the asset side– dominated by long term (government) securities and loans extended to government entities until mid-1970's. The need for i) flexibility to adjust (credit) interest rates and ii) alternative sources of income, lead savings banks to start servicing private households, amongst which by increasingly granting mortgages (Van Straaten, 1989; 'T Hart *et al.*, 1997). The increase of 'regular banking activities' lead to the reclassification of savings banks into the money creating sector in January 1986, the break was however calculated backward to 1982 and published as such.

Adjusting the break stemming from the reclassification of savings banks into the money creating sector (hereafter MFI sector) in December 1982, implies we assume the savings banks were part of the MFI sector. Provided they took deposits or other repayable funds from the public and granted credits for their own accounts, nowadays they would classify as credit institutions and, hence, be part of the MFI sector. For that reason we include them in our adjusted series, using the reported data (with its own specific developments).<sup>16</sup>

Table 2 in Annex III provides an overview of the data sources used for specific periods. In general we use only data collected by reporting agents, except for the securities transactions mentioned under 'G'. Most data are available at monthly frequency, for those reference periods for which only quarterly source data are available, we made adjustments (see section 2.1).

## 2.3 Results and application

Chart 2 shows the historical developments of both the positions and corresponding annualised growth rates between December 1956 and May 2018.<sup>17</sup> Except for the period between 1983 and mid-1993, mortgage loans granted by MFI to Dutch households have grown considerably since the 1950's. The considerable increase (and level) of mortgage debt of Dutch households can to a large extent be explained by the policy instruments to stimulate home ownership in the Netherlands: the mortgage interest tax relief. The way it is designed, stimulates higher debt levels rather than repayments. Also the economic growth, demographic factors (e.g. higher employments rates, double income and more households) relatively generous borrowing limits play a role (Kakes *et al.*, 2017).

Kakes *et al.* (2017) provide also some explanations for the growth of MFI's balance sheets (rather than other financial institutions). First, the strict delineation between activities of 'specialised' banks disappeared over time. All 'types of banks' increasingly competed on each other's markets and inter-sectoral takeovers and mergers took place, resulting in very comparable bank institutions. Second, against the background of increased demand for loans, banks were able to adjust trends easier than

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<sup>14</sup> <https://statistiek.dnb.nl/en/downloads/index.aspx#/details/residential-mortgages-extended-by-dutch-mfis-to-dutch-households-adjusted-for-securitisations-month>.

<sup>15</sup> The break factor is defined as:  $1 + (\text{Break value } T / \text{position } T)$

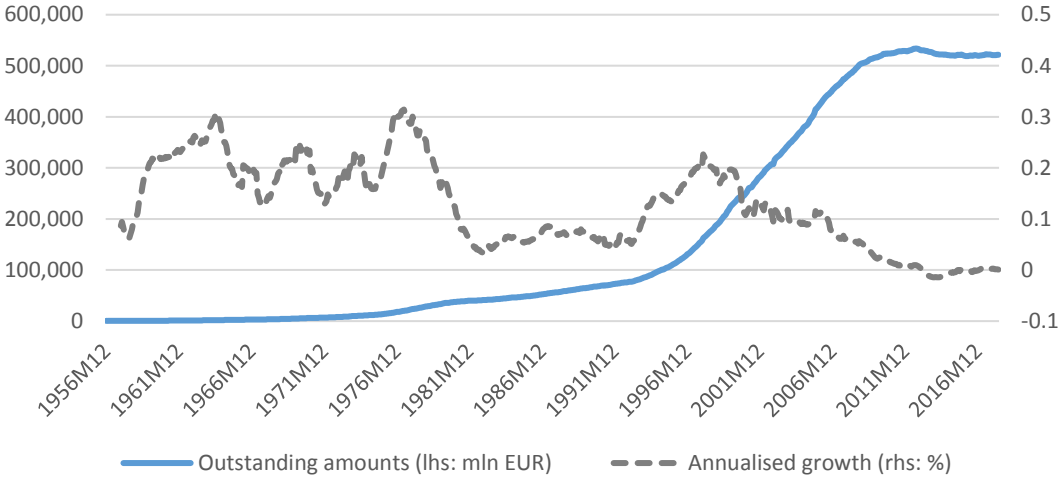
<sup>16</sup> Mortgage banks also granted mortgage loans to households, but they mainly financed their activities issuing bonds. Second, mortgage banks were not reclassified like savings banks (except when they merged with/were taken over by banks). For that reason they remain out of scope and, hence, their data are not used for the backward calculation.

<sup>17</sup> Vintage 23 July 2018.

their competitors on the mortgage market (i.e. institutional investors). The latter also started to look for new opportunities abroad (after bans on investments abroad by pension funds were lifted) or on other markets (e.g. commercial real estate). Last but not least, financial deregulation. Rules for loan-to-value (LTV) and loan-to-income (LTI) limits became less stringent (De Haas et al., 2000), the policy on credit restrictions was discontinued in the 1990's and over time the capital requirements for mortgage loans decreased.

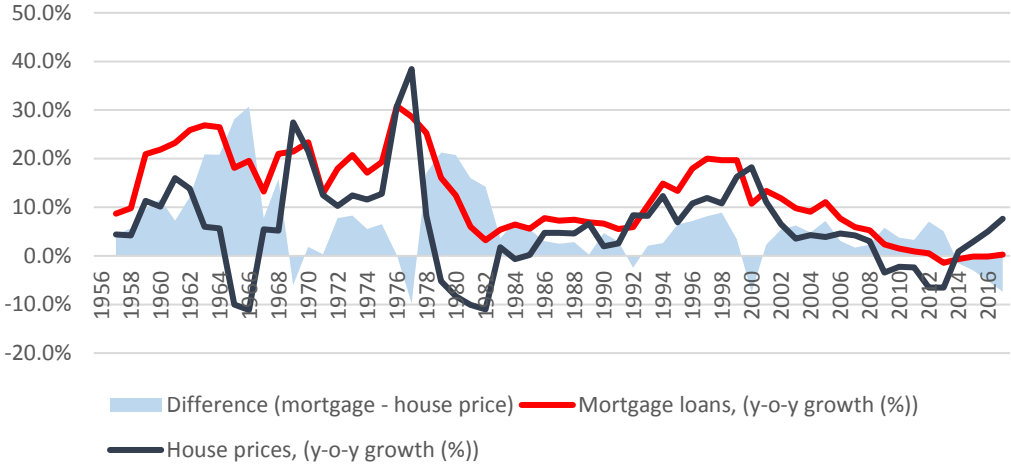
When comparing annual growth rates of mortgage loans granted by MFI to Dutch households with house prices developments (see chart 3), we find the developments follow –overall- a similar pattern. However, mortgage growth is significantly higher until 1969 and between 1978 and 1982 (following the housing bubble in 1977 (ESB, 2017)). Against the back of the second oil crisis, high interest rates and economic recession (in 1981 and 1982), both mortgage growth and house prices deteriorate, the latter turning negative. In contrast, financial deregulation, relatively high real economic growth and demographic changes boast both mortgage growth and house prices again until 2000. After 2000 mortgage growth gradually declines, followed by the start of the financial crisis in 2007. In 2013, for the first time since 1956, the annual growth rates are negative, where house prices dropped already in 2009.

Chart 2: Mortgage loans granted by MFI to Dutch households: adjusted for breaks and securitisations



Source: Refer to table 1 and Annex III, authors' own calculations

Chart 3: Mortgage loans and house prices developments (annual growth (%))





Source: Refer to table 1 and Annex III, CBS Statline<sup>18</sup>, Jordà et al. (2017), Knoll et al., authors' own calculations

However, a user should note that the multiplicative adjustment have two (potential) drawbacks. First, as mentioned in section 1 and Annex II, the method causes inconsistencies between individual series and aggregates. Second, depending on the numerator/denominator used, the adjustment will impact on ratio's that are calculated on the basis of the adjusted series. For example, if we use the adjusted positions to calculate Dutch households' mortgage debt as a percentage of GDP, a break of 10% of the outstanding amount not equalled by a similar revision of GDP, will have a significant impact on the respective ratio.

Table 2 provides an overview of the average differences between the adjusted and unadjusted figures for specific periods. The periods are chosen in such way that the differences within the period are 'homogeneous'. For example, between 1975 and 1982 the difference (defined as adjusted *minus* unadjusted) is negative for all periods concerned, while between 1982 and 2000 the difference is at least double digit positive.

Table 2: Average, maximum and minimum difference (%) between break-adjusted and unadjusted figures

Period	Dec 1956 - Sep 1975	Oct 1975 - Sep 1982	Dec 1982 - Aug 2000	Sep 2000 - Sep 2010	Oct 2010 - May 2018
Average	2.05%	-12.43%	20.30%	4.16%	0.49%
Maximum	2.87%	-8.84%	25.71%	5.74%	1.31%
Minimum	-0.02%	-13.25%	12.42%	2.50%	0.00%

Sources: see annex III, authors' own calculations

### Section 3: Conclusions and way forward

Breaks in statistical time series are a *fact of life*, but they hamper severely the use of statistics for analytical, policy making and forecasting purposes. This paper describes DNB-statistics' policy of publishing break-adjusted statistics. Despite the possible drawbacks of compiling and publishing break-adjusted series, DNB has recently increased its publication of such time series, primarily to improve the usability of its statistics.

To decide on an approach to eliminate breaks, the costs (e.g. reporting burden for reporting agents and resources required at DNB's Statistics Division) are weighted against the benefits. Users were for example queried after their preferences and priorities. Following these principles, breaks are mainly adjusted using an automated procedure that scales up or down the observed data on the basis of break factors. In specific cases, however, a tailor made solution is applied to increase quality and provide historical time series.

Besides adjusting regular statistical publications for breaks, DNB's Monetary and Banking Statistics department also started the publication of key indicators for monetary statistics, amongst which mortgage loans granted by MFI to Dutch households. In the paper we demonstrated the (tailor made) methodology and assumptions underlying the compilation of a time series for mortgage loans granted by MFI to Dutch households at monthly frequency along with the results.

In line with other publications on the historical development of mortgage loans granted to households, we find that mortgage loans granted by MFI to Dutch households have grown considerably since the 1950's. Growth was exceptionally high before 1982 and during the 1990's, while it was fairly stable (ranging between 4 and 10% annually) between 1982 and 1990. Following the financial and sovereign

<sup>18</sup> Statistics Netherlands' online database (<https://opendata.cbs.nl/statline/#/CBS/en/>)

debt crisis (2007-2014) and the considerably dropping house prices in the Netherlands, the annual growth rates turned negative for the first time since 1956.

In future we plan to publish a broader set of extended historic time series on DNB's statistics website, prioritizing time series included in the set of key indicators. Furthermore we plan to reach out to a broader group of users, by including those that are harder to interact with – e.g. users downloading data from the DNB Statistics website. This way we can take their preferences and priorities on break-adjusted time series into account in our follow-up work.

On the methodology, where available we see merits to adjust breaks on the individual institution level. The current (aggregated) approach implies that i) errors made by, ii) the impact of framework changeovers on and iii) mergers/acquisitions involving bank A impact total banks' balance sheet and, thus, other banks' balance sheets in periods preceding the break.

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## Annex I: Technical annex to breaks adjustments under 'approach 3' (multiplicative adjustments)

To determine a position change (SM), the following applies:

$$SM_t = S_t - S_{t-1} \quad (1)$$

Where:

$S$  = position observed

To determine the break (B) and the break factor (BF), the following applies<sup>19</sup>:

$$B_t = S_t - SB_t \quad (2)$$

$$BF_t = \frac{S_t}{SB_t} \cdot BF_{t+1} \quad (3)$$

Where:

$S$  = position observed after the break<sup>20</sup>

$SB$  = position observed before the break

To determine the derived transaction (T), the following applies:

$$T_t = SM_t + OM_t - HW_t - B_t \quad (4)$$

Where:

$SM$  = position change

$OM$  = other change (e.g. securitisations)

$HW$  = revaluation<sup>21</sup>

$B$  = Break

To calculate adjusted transactions (T'), the following applies:

$$T' = T \cdot BF_t \quad (5)$$

Where:

$T$  = derived transaction

$BF$  = break factor (for  $t$  = most recent observation, the following applies:  $BF = 1$ )

To calculate adjusted positions (S'), the following applies:

$$S'_t = S'_{t+1} - T'_{t+1} + OM_{t+1} \quad (6)$$

Where:

$S'$  = adjusted position

$T'$  = derived transaction

$OM$  = other change

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<sup>19</sup> Note: For the most recently observed period,  $BF_{t+1}$  equals 1, and for periods where no breaks are observed the following applies:  $S = SB$

<sup>20</sup> In other words, there is a double observation for period  $T$ , and the difference equals the size of the break.

<sup>21</sup> Revaluations are not included in the adjustment to allow the "price index" (revaluation as a percentage of positions outstanding) to be maintained.

## Annex II: Inconsistencies arising from break-adjustments

DNB use the introduction of the new monetary framework in December 2014 to enforce the gross reporting of *notional cash pooling activities*.<sup>22</sup> For most positions vis-à-vis counterparty sectors, amongst which the insurance corporations and pension funds, gross treatment meant a substantial upward revision (see table 3). The break value (difference between figures for 2014-12B and 2014-12) for both the short term maturity and the total equals around EUR 16.500 mln. After multiplicative break-adjustment, keeping the original growth rates, the periods preceding the December 2014 break show significant inconsistencies between the directly (total) and indirectly (sum of maturity breakdown) adjusted series (see table 4).

Table 3: MFI positions vis-à-vis insurance corporations and pension funds before break-adjustment

<i>mln EUR</i>	< 1 year	1-5 year(s)	>5 years	Total	<i>Of which Notional cash pooling</i>
2014-07	1.137	788	1.755	3.680	
2014-08	1.129	873	1.780	3.782	
2014-09	1.370	755	1.900	4.025	
2014-10	1.253	869	1.817	3.939	
2014-11	1.203	955	1.840	3.998	
2014-12	2.706	418	1.519	4.643	
2014-12B	19.286			21.223	17.455
2015-01	24.913	419	1.506	26.838	22.698
2015-02	21.551	419	1.532	23.502	19.369
2015-03	24.911	419	1.638	26.968	22.271

Table 4: MFI positions vis-à-vis insurance corporations and pension funds after break-adjustment

<i>mln EUR</i>	< 1 year	1-5 year(s)	>5 years	Total	Sum of maturities	<i>Difference</i>
2014-07	8.103	788	1.755	16.821	10.646	6.175
2014-08	8.046	873	1.780	17.287	10.699	6.588
2014-09	9.764	755	1.900	18.398	12.419	5.979
2014-10	8.930	869	1.817	18.005	11.616	6.389
2014-11	8.574	955	1.840	18.275	11.369	6.906
2014-12	19.286	418	1.519	21.223	21.223	0
2015-01	24.913	419	1.506	26.838	26.838	0
2015-02	21.551	419	1.532	23.502	23.502	0
2015-03	24.911	419	1.638	26.968	26.968	0

<sup>22</sup> More information on the 'The statistical classification of cash pooling activities' is available in Colangelo (2016)

### Annex III: Data availability and sources

Table 1: Data availability and features of mortgage loans and securitisations

Code	Time series	Instrument	Reporting agents	Counterparty sector	Framework	Frequency	Source
A	1956M12 - 1997M12	Mortgage loans	Money creating sector (e.g. trading banks, cooperative banks)	All sectors	Supervisory / Monetary*	M	Monthly returns from reporting agents. Time series (quarterly) are also published in DNB (1985).
B	1956M12 - 1982M12	Mortgage loans	Savings banks (until 1986 not part of the money creating sector, corrected backward to 1982)	All sectors	Supervisory / Monetary**	Q	Quarterly returns from savings banks received and compiled by DNB and Statistics Netherlands (1957 figures partly estimated). Time series are also published in DNB (1985).
C	1982M12 - 1997M12	Housing mortgages (with or without government guarantee)	Total banks (money creating sector incl. savings banks)	Private households	Monetary	M	Monthly returns from reporting agents. Regular publication in DNB's 'Jaarverslag' and from 1969 in 'Kwartaalbericht'
D	1997M12 - 1998M12	Housing mortgages	Monetary Financial Institutions (MFI: excluding the central bank)	Households	Monetary	M	Monthly returns from reporting agents. Regular publication in DNB's 'Jaarverslag' and from 1969 in 'Kwartaalbericht'
E	1998M12 - 2002M12	Housing mortgages	Monetary Financial Institutions (MFI: excluding the central bank)	Households	Monetary	Q	Quarterly returns from reporting agents. Regular publication on DNB's statistics website ***
F	2002M12 - 2018M06	Housing mortgages	Monetary Financial Institutions (MFI: excluding the central bank)	Households	Monetary	M	Monthly returns from reporting agents. Regular publication on DNB's statistics website.
G	1996M09 - 2009M12	Securitisations (true sale) of loans for house purchases	Special Purpose Vehicles (SPV)/ MFI	MFI	Monetary	M	Internal data: time series of securitisation transactions and (from 2003 onward) amounts outstanding on the SPV's balance sheets
H	2009M12 - 2018M06	Securitisations (true sale) of loans for house purchases	Special Purpose Vehicles (SPV)/ MFI	MFI	Monetary	M	Monthly returns from reporting agents. Regular publication on DNB's statistics website.

\* In 1982 the social-economic reporting (for 'monetary supervision' purposes) was fully implemented, before 1982 key series were collected besides prudential supervisory data (Van Straaten, 1989)

\*\* In 1983 the social-economic reporting (for 'monetary supervision' purposes) was fully implemented, before 1982 key series were collected besides prudential supervisory data (Van Straaten, 1989)

\*\*\* DNB Statistics website: <https://statistiek.dnb.nl/en/statistics/index.aspx>

Table 2: Overview of data sources used for the compilation of adjusted positions for mortgage loans granted by MFI to Dutch households

Reference period	1956 - 1982	1983 - 1996	1997	1998	1999 - 2002	2003-2009	2010 - 2018
Data sources	<b>A, B</b>	C	C, G	D, G	<b>E, G</b>	F, G	F, H

Codes (capital letters) refer to the overview of sources presented in table 1, bold capitals indicate quarterly frequency

## Annex IV: Overview of the breaks (size and background) in the time series

Period	Amount (mln EUR)	MFI (including savings banks prior to 1982) Explanation	Amount (mln EUR)	Special Purpose Vehicle (SPV) Explanation
1965-Dec	23			
1967-Sep	25			
1975-Dec	1617			
1976-Dec	978			
1979-Mar	-274			
1979-Dec	-7			
1980-Dec	364			
1982-Dec	-12755	New framework/methodology/change in the reporting population		
1985-May	-1966			
1985-Dec	-11			
1986-Jun	2			
1987-Mar	-272			
1990-Dec	1112	New framework/methodology		
1991-Dec	724	Change in the reporting population/bank's restructuring		
1993-Dec	1766	Change in the reporting population/bank's restructuring		
1995-Nov	4148	Change in the reporting population/bank's restructuring		
1997-Mar	1268	Change in the reporting population/bank's restructuring		
1997-Sep	-908	Reclassification: first true sale securitisation	908	Reclassification: first true sale securitisation
1997-Dec	-3392	New framework/methodology		
1998-Dec	-992	Change in the reporting population/bank's restructuring		
2000-Sep	23253	Change in the reporting population/bank's restructuring		
2002-Dec	5270	Reclassification		
2003-Jan			-1976	Start of a new series owing to a change in the reporting framework
2003-Oct	-375	Reclassification		
2004-Dec	-1266	Reclassification		
2005-Nov	-425	Reclassification		
2005-Dec	-7367	New methodology and reclassification		
2006-Mar	455	Reclassification		
2006-Dec	-3624	New methodology and reclassification		
2007-Sep	1100	Change in the reporting population/bank's restructuring		
2007-Dec	2315	New methodology and reclassification		
2009-Dec			1360	Start of a new series owing to a change in the reporting framework
2010-Jun	-46304	New framework/methodology and reclassification	43819	Reclassification
2010-Aug	2831	Change in the reporting population/bank's restructuring	4740	Reclassification
2010-Sep	6	Change in the reporting population/bank's restructuring		
2010-Oct	6885	Change in the reporting population/bank's restructuring	4568	Reclassification
2011-Mar	380	Change in the reporting population/bank's restructuring	2019	Reclassification
2011-Nov	1229	Reclassification		
2012-Apr	-560	Change in the reporting population/bank's restructuring		
2012-Jul			-60	Reclassification
2012-Dec	-1054	Reclassification	1055	Reclassification
2014-Dec	2512	New framework/methodology		
2016-Dec	37417	Reclassification	-36168	Reclassification



Irving Fisher Committee on  
Central Bank Statistics

BANK FOR INTERNATIONAL SETTLEMENTS

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Ninth IFC Conference on "Are post-crisis statistical initiatives completed?"

Basel, 30-31 August 2018

Making available data more useable:  
compilation and publication of break-adjusted (historical) time series<sup>1</sup>

Ruben van der Helm and Jan Bartman,  
Netherlands Bank

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<sup>1</sup> This presentation was prepared for the meeting. The views expressed are those of the authors and do not necessarily reflect the views of the BIS, the IFC or the central banks and other institutions represented at the meeting.





Making available data more useable:  
Compilation and publication of break-adjusted  
(historical) time series

*R. van der Helm and J. Bartman*

IFC 9th biennial Conference, 30-31 August 2018, Basel

DeNederlandscheBank

EUROSYSTEEM

# Motivation and objectives

A break is '***an interruption of continuity or uniformity***'

(<https://en.oxforddictionaries.com>)

- Direct request from internal users to adjust for breaks
- Strong wish to improve the value added of DNB's statistics

The objectives of our paper are to:

- Describe DNB's policy for the publication of break-adjusted data
- Present the methodology underlying break-adjusted data
- Show results for break-adjusted (historical) time series

# Way towards a new policy

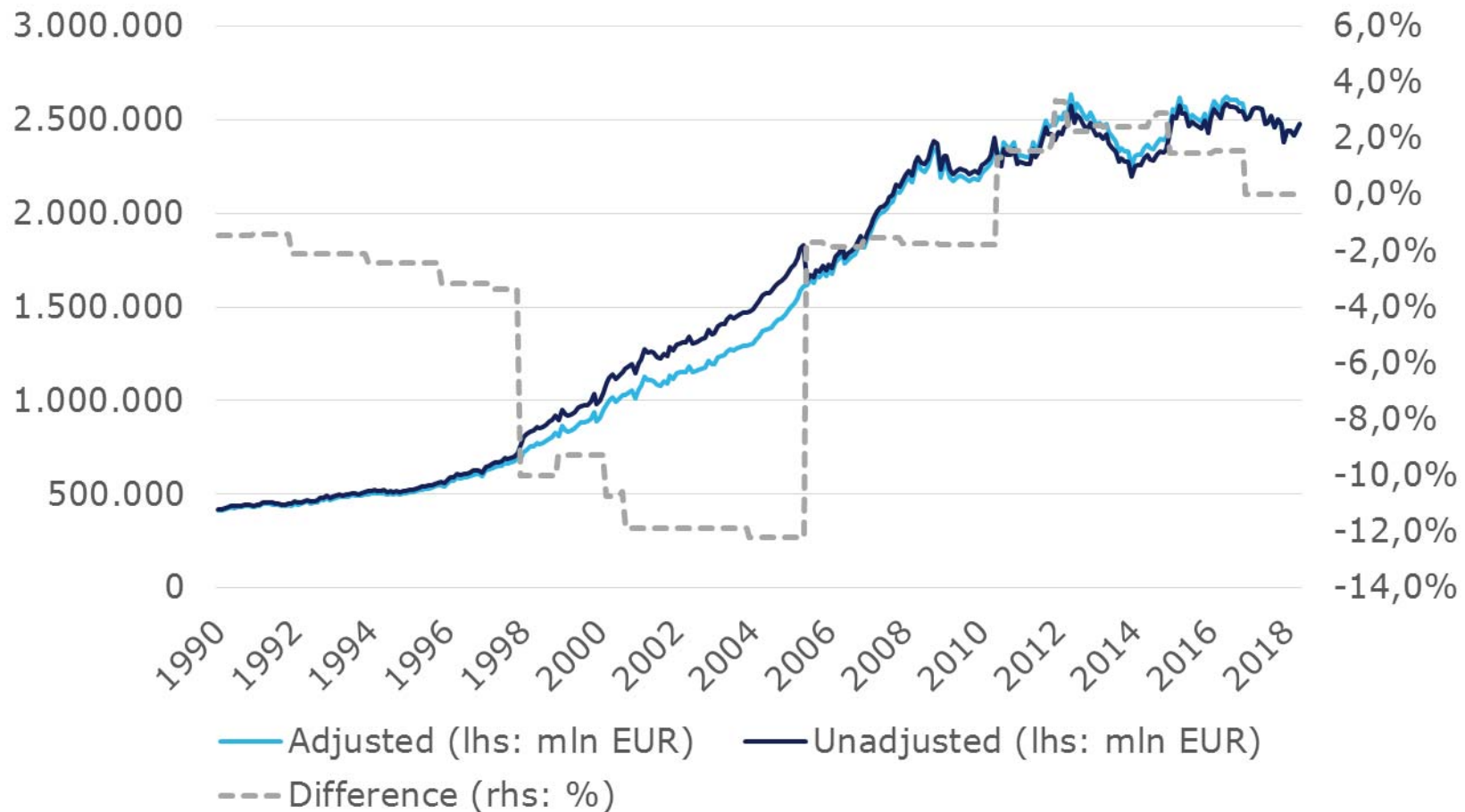
- Some important issues for discussion
  - Scope
  - Methodology
  - Quality
  - Publication
  - Resourcing

# New policy for break-adjusted data

- Costs and benefits weighted: ranking of methods/approaches
  1. Adjustments based on data adjusted by reporting institutions
  2. Adjustments based on additional qualitative information
  3. Automated (i.e. multiplicative) adjustment for positions and flows
  4. Tailored solutions
- Minimal viable product: what could a user achieve?
- No adjustment for inconsistencies
- Publication of both adjusted and unadjusted series
- Start publication of *key monetary indicators*

# Break-adjusted series: MFI's total assets

Break-adjusted and unadjusted data for MFI's total assets; a comparison

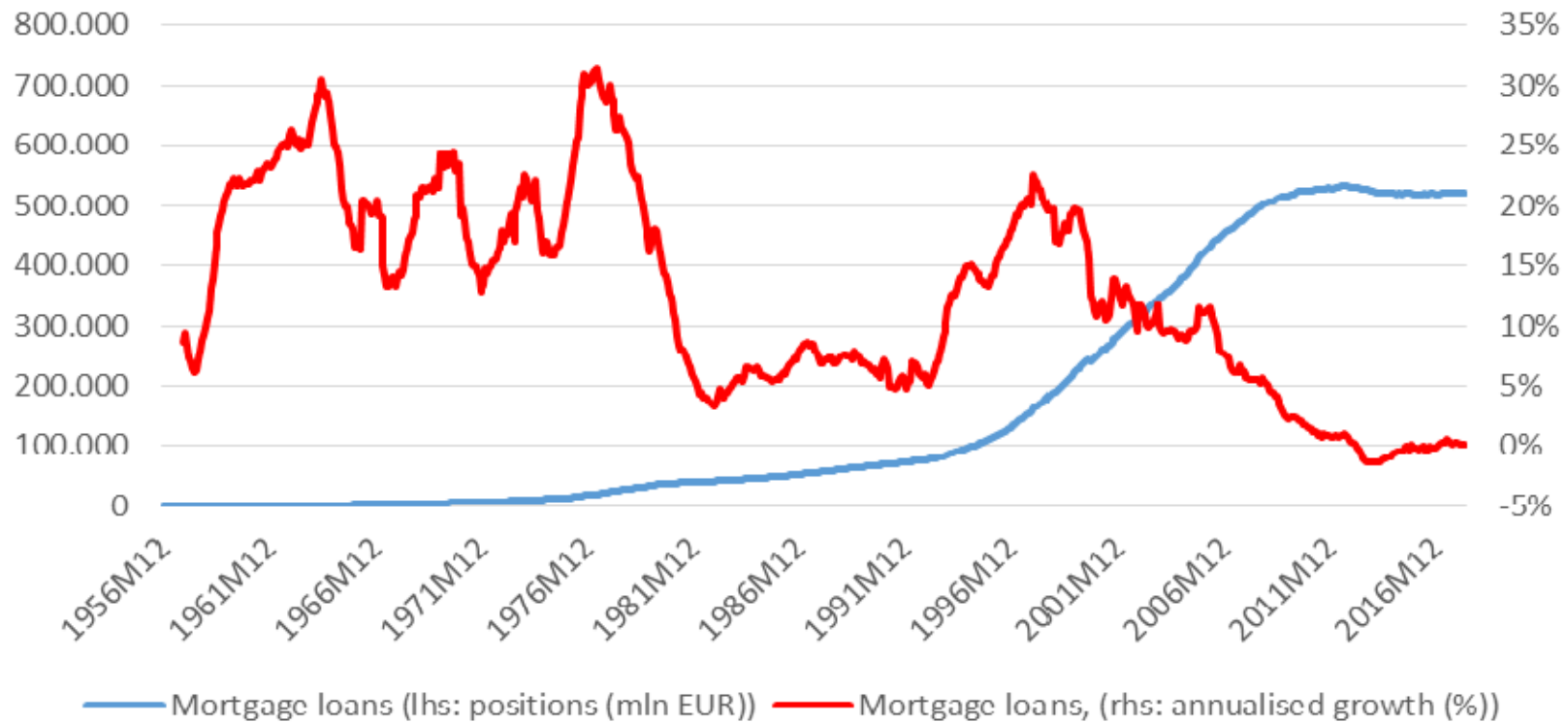


# Historical time series for mortgage loans (1)

- Data availability
  - `Social-economic reporting`
  - Publication of historical time series
  - External sources (securitisations)
- Tailor-made approach: combination of different approaches
- Adjustment for securitisations and savings banks' balance sheets developments

# Historical time series for mortgage loans (2)

Break-adjusted data for MFI mortgage loans granted to Dutch households



# Conclusions and way forward

- Break-adjusted statistics increase the value added of data
- The policy recently introduced fosters the compilation and publication of break-adjusted data
- Breaks are mainly adjusted automatically, historical time series require more tailor-made solutions
- Way forward:
  - Assess 'unknown users' preferences
  - Develop and assess adjustment on individual institution level
  - Extend the publication of historical time series