2.3 DECOMPOSING LUXEMBOURG MORTGAGE FLOWS INTO LOAN ORIGINATION AND REPAYMENTS[70]

1. Introduction

This analysis decomposes flows in mortgage lending to Luxembourg households into new loans (loan origination) and loan repayments, following an approach proposed by Adalid and Falagiarda (2019)[71], who provided this decomposition for the euro area as a whole and the largest euro area countries. The approach consists of simulating an aggregate bank loan portfolio on the assumption that individual loans granted every month have a common maturity, monthly interest rate, and predetermined repayment schedule.

In order to understand credit market developments accurately, it is important to distinguish this concept of loan origination from the net mortgage flows that can be calculated from balance sheet data reported by banks.[72] In fact, repayments of past loans dampen growth in net flows as calculated from bank balance sheets, distorting the picture of credit supply. This is particularly relevant following credit booms and estimating loan originations may help to better identify any restriction in credit supply arising from bank difficulties during the ongoing COVID-19 crisis.

Simulation results confirm that mortgage loan repayments significantly reduced net loan growth in Luxembourg in recent years, much as in the euro area as a whole. In particular, over the past five years, loan origination in Luxembourg grew at an annual average of 13.2%. This is 5.5 percentage points more than would be suggested by calculating net flows from balance sheet data. We show that, as a share of GDP, mortgage loan origination currently stands at a historic high, while net mortgage flows are not yet growing as fast as before the 2008-2009 financial crisis. Loan origination in Luxembourg is growing faster than in the euro area as a whole, as was also the case before 2008. In the years immediately following the financial crisis, loan origination slowed less in Luxembourg than in the euro area as a whole. Finally, starting in 2009, we observe a clear discrepancy between our estimates of loan origination and new loan volumes as reported for the MFI interest rate statistics. This discrepancy suggests that the decline in interest rates lead to significant mortgage renegotiations in Luxembourg.

The following section describes the data used and section 3 discusses the main results. The methodology is detailed in the appendix, while section 4 concludes.

2. Data

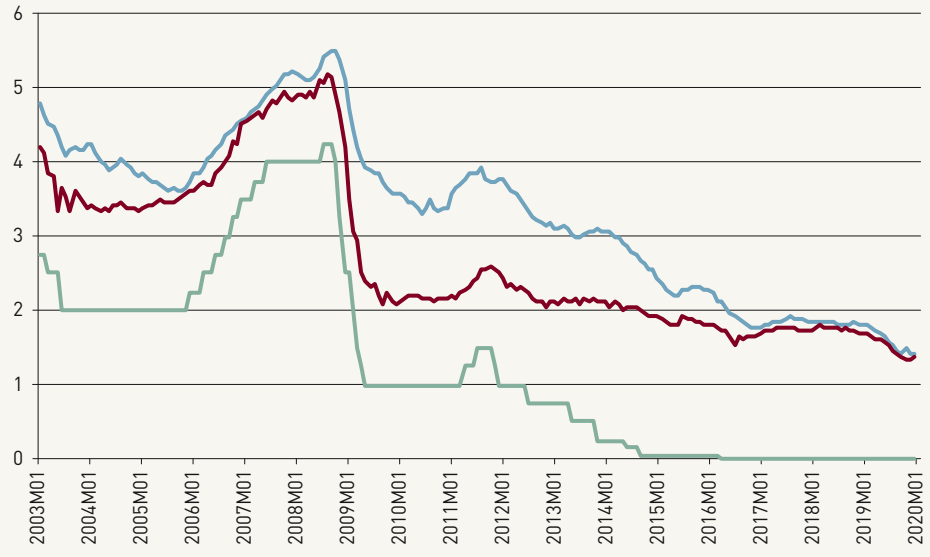
We use the algorithm proposed by Adalid and Falagiarda (2019) to decompose net mortgage flows into loan origination and loan repayments (see appendix A for more details on the methodology). This method requires monthly information on net mortgage flows, new lending volumes, average mortgage interest rates and maturities. The series on average mortgage maturity at origination is estimated using data from the Household Finance and Consumption Survey (HFCS), while all other series come from MFI statistical reporting to the BCL and ECB.

70 Analyse rédigée par Bob Kaempff et Giuseppe Pulina, économistes au département Économie et Recherche.

71 Ramón Adalid, Matteo Falagiarda, "How repayments manipulate our perceptions about loan dynamics after a boom", Journal of Economics and Statistics, 2019 (DOI: https://doi.org/10.1515/jbnst-2019-0034). Previously published as ECB Working Paper No 2211 / December 2018.

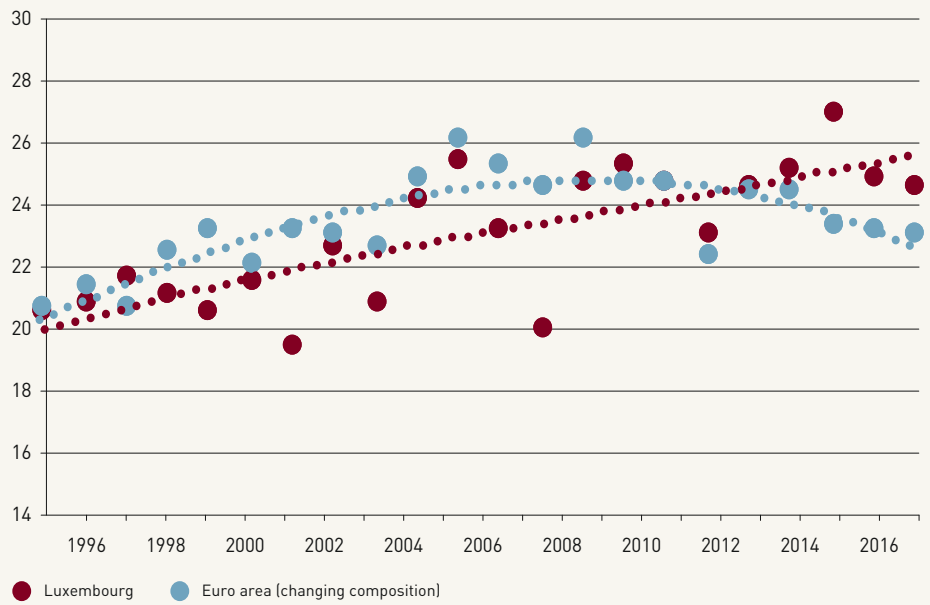
72 Net loan flows are defined in the MFI Balance sheet items (BSI) as the difference in loan stocks corrected for loan transfers, loan revaluations and write offs, reclassifications and exchange rate effects.

Figure 1a
Mortgage interest rates
(in percentage)



Source: ECB MFI interest rates; Note: All maturities combined with weights based on new business volumes.

Figure 1b
Estimated mortgage loan maturities
(in years)



Source: HFCS; own calculation using all three available survey waves; Estimates from 1996 to 1999 use the 2011 survey wave, from 2000 to 2003 use the 2014 survey wave and since 2004 use the 2017/18 Survey. Data from Finland is missing for all years and data from Spain from 2004.
Note: dotted lines are 3rd order Lagrange interpolations.

In particular, the BSI dataset on MFI balance sheet items provides information on monthly net mortgage flows. Mortgage loan data for Luxembourg was only collected starting in 2003. Before this date, the BSI contains estimates based on aggregate loans to the private sector. However, this series is mainly driven by loans to the financial sector, which make it very volatile and not appropriate for our purpose. Therefore, before 2003 we extend the series on net mortgage loan flows using the growth rate of *crédits immobiliers consentis*, a statistic on new mortgage lending collected by the BCL.[73]

The MIR dataset on MFI interest rates includes new lending volumes, which provide an upper bound for our estimates of loan origination (see appendix A). However, this data on new lending volumes includes loan renegotiations. These do not affect the stock of mortgage loans in bank balance sheets and therefore should not count as loan origination. In addition, until 2009 Luxembourg data on new lending volumes only covered variable rate mortgages. This is a serious limitation as MIR data between 2009 and 2010 indicates that fixed-rate loans accounted for around 15% of new mortgage lending. Therefore, when using new lending volumes as an upper

73 A drawback of the *crédits immobiliers consentis* is that they include mortgage applications that were approved but never actually disbursed. Households often apply to several banks for a given mortgage (e.g., to compare loan conditions), which may lead to multiple mortgage approvals although only one is finally disbursed. The *crédits consentis* series may still be informative if the ratio of loans approved to loans disbursed is relatively stable over time.

bound on loan origination, we scaled up observations before 2009 by 15% to account for the missing fixed rate loans.[74]

The MIR dataset also provides a monthly series on average mortgage interest rates, but only since 2003 (Figure 1a). We extend this series using retail interest rate statistics[75] from 1994 to 2003 and a 3-month interbank lending rate going back to 1980.

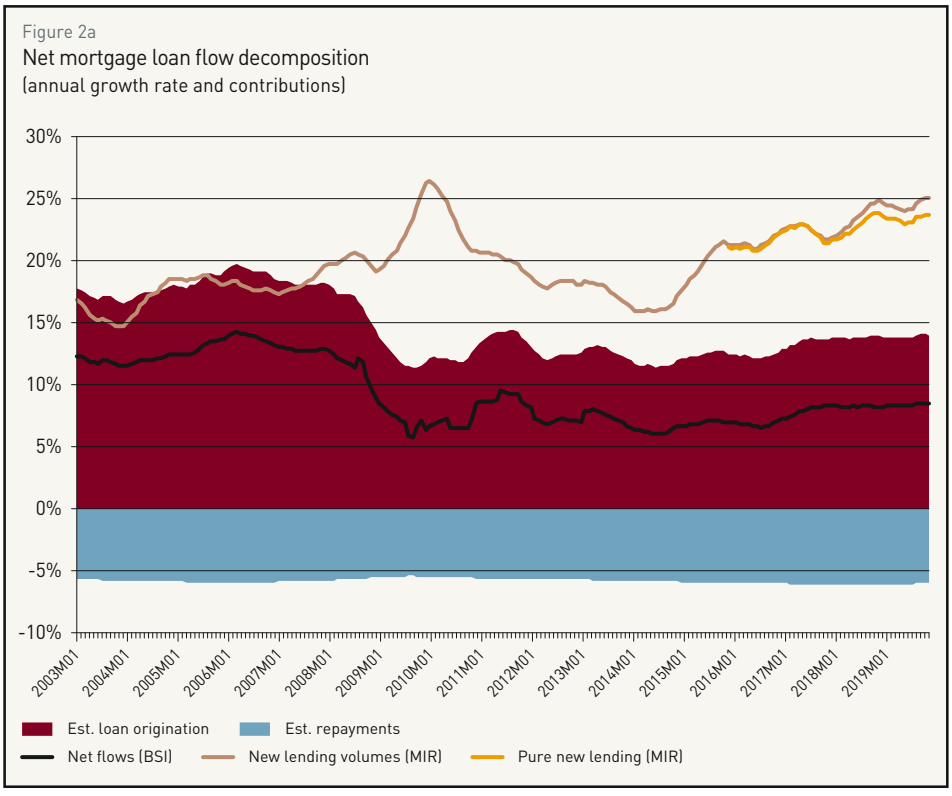
Finally, data from the HFCS can serve to estimate the evolution of initial mortgage loan maturities over time. The HFCS only collects information on outstanding loans at the time of the survey, so the average mortgage length may be biased upwards, especially for earlier years in the sample. As in Adalid and Falagiarda (2019), we enhance comparability by only considering mortgages with an initial maturity of at least 15 years. We also restrict our HFCS sample to mortgages to purchase, build, or renovate real estate property, and exclude all loan renegotiations and refinancing. Unlike Adalid and Falagiarda (2019), who use data from the second wave of the HFCS, we consider all available weighted and imputed observations, to obtain a representative sample of the population in each survey year. In addition, we focus on the main mortgage secured on the household main residence. In this way, we avoid potentially overstating the importance of mortgages with unusual maturities. Finally, as in Adalid and Falagiarda, we assume a 10-year maturity in 1980 and use a Lagrange polynomial to interpolate the average maturity in each month (Figure 1b).[76] Note that the estimated trends suggest that the average mortgage maturity lengthened in the euro area until the 2008-2009 financial crisis, after which it appears to shorten. In Luxembourg, instead, it appears that the average mortgage maturity has continued to lengthen after the crisis.

3. Results

Since average mortgage maturities are quite long, we initialise the simulated loan portfolio using monthly data back to January 1980. However, we only analyse results starting in 2003 to decompose reported flows rather than estimated flows (Figure A1 in appendix B provides our complete estimates since 1980).

Figure 2a decomposes net mortgage loan flows into loan origination and loan repayments, with new lending volumes included for comparison. During the 2008-2009 financial crisis, annual growth in

Figure 2a
Net mortgage loan flow decomposition
(annual growth rate and contributions)



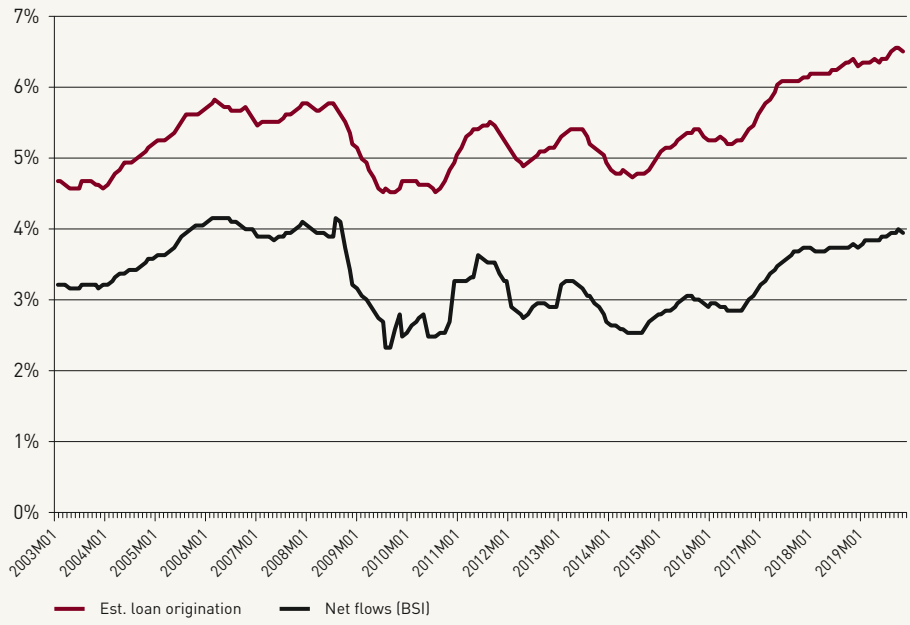
Source: BCL, own calculation. Note: Loan origination, repayments and new lending volumes are expressed as 12-month cumulated flows divided by the loan stock in t-12. Pure new lending excludes loan renegotiations (as reported by banks).

74 We experimented with higher values but 15% was the maximum compatible with plausible loan origination estimates.

75 Retail interest rate data is not harmonized across different EU central banks. At the BCL, these statistics cover household mortgage lending, consumption loans and overnight deposits.

76 Figure A2 in appendix B compares our estimates of average maturity to those following Adalid and Falagiarda (2019).

Figure 2b
Mortgage loan flows relative to GDP
(accumulated 12-month flows as a share of annual GDP)



Source: BCL, own calculation.

mortgage loan origination slowed in Luxembourg, from a 2006 peak around 19% of the loan stock to a 2009 trough around 12%. Net flows calculated from bank balance sheets also slowed during the crisis. However, net flows and loan origination responded differently to the crisis. This is more visible in Figure 2b, which reports annual flows as a share of GDP. During the financial crisis, loan origination decreased less as a share of GDP than did net flows, whose recovery starting in 2014 was also more timid. In fact, net flows from bank balance sheets suggest that mortgage lending have not yet reached their level before the 2008-2009 financial crisis. Instead, our estimate of loan origination accelerated relative to GDP to exceed pre-crisis levels in 2017 and currently stands at a historic high. This suggests that loan repayments exert a drag on net flows that increased during and after the financial crisis. Finally, over the past five years, loan origination in Luxembourg grew at an annual average of 13.2%. This is 5.5 percentage points more than the growth suggested by net flows calculated from the balance sheet data reported by banks.

Comparing loan origination to new lending volumes, the former grew faster in 2003-2004 and again in 2006-2007, probably reflecting the exclusion of fixed rate mortgages from the reporting (as explained in the previous section). After the financial crisis, new lending volumes accelerated to a peak in 2010, following the rapid drop in the Eurosystem rate on main refinancing operations (Figure 1a), while loan origination and net loan flows were slowing. This discrepancy suggests substantial loan renegotiations during this period. More recently, loan origination rose to 14% of the loan stock, while new lending volumes rose even more to reach 25% of the loan stock in 2019. This gap suggests that loan renegotiations continue to account for a substantial share of new lending reported by banks.[77]

77 The MIR data also includes a series on "pure new loans", which should exclude loan renegotiations. However, this does not differ much from new lending loans. Moreover, the large gap between pure new loans (excluding loan renegotiations) and our loan origination estimates suggests that MIR statistics do not include many renegotiations. One possible explanation is that individual loan renegotiations may involve several banks.

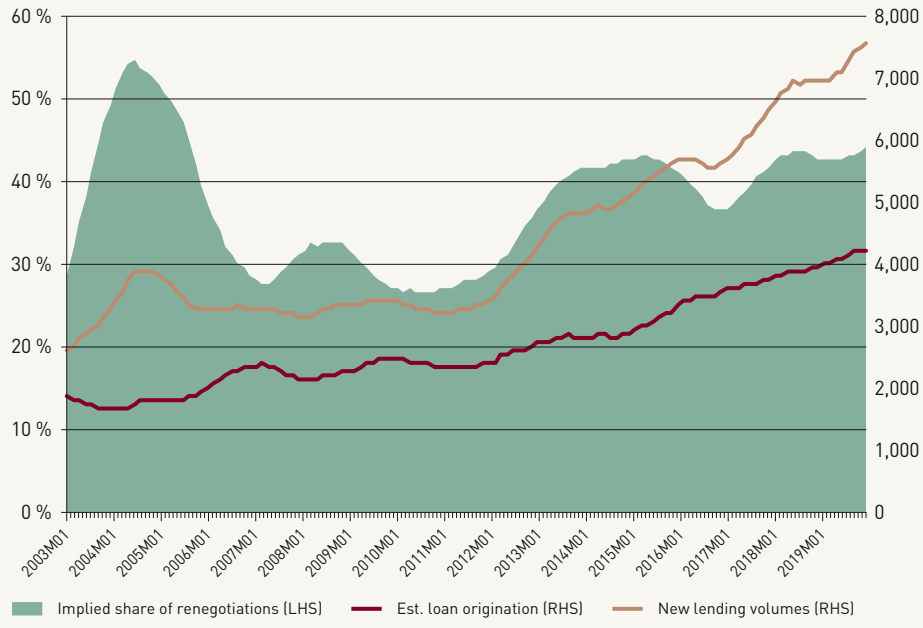
This is confirmed by Figure 3a, which reports the implied share of loan renegotiations as computed from the difference between new lending volumes and loan origination estimates.[78] Developments in implied loan renegotiations appear to reflect important events such as the financial crisis, the sovereign debt crisis in 2012 and the beginning of the Eurosystem asset purchase programme (APP) in 2015. Loan renegotiations peaked at the beginning of 2010, accounting for more than 50% of new mortgage lending. After a decline in 2011, loan renegotiations increased again in 2012, as mortgage interest rates in Luxembourg declined during the sovereign debt crisis. At the beginning of the APP in 2015, loan renegotiations increased once more and have remained at a high level since then. This suggests an ongoing switch from variable-rate to fixed-rate mortgages, which is also consistent with the high share of fixed-rate loans in new mortgage lending[79]. The enduring low interest rate environment is the most likely cause of this switch.

Comparing Luxembourg to the euro area as a whole, before the financial crisis loan origination was slightly lower in the euro area (Figure 3b). During the crisis, the slowdown was more pronounced and more persistent for the euro area as a whole. Growth in mortgage loan origination did not start recovering in the euro area until 2015 and still remains below levels in Luxembourg. Figure 3b also

78 The graph begins in 2009 because new lending volumes before that date included only variable rate loans.

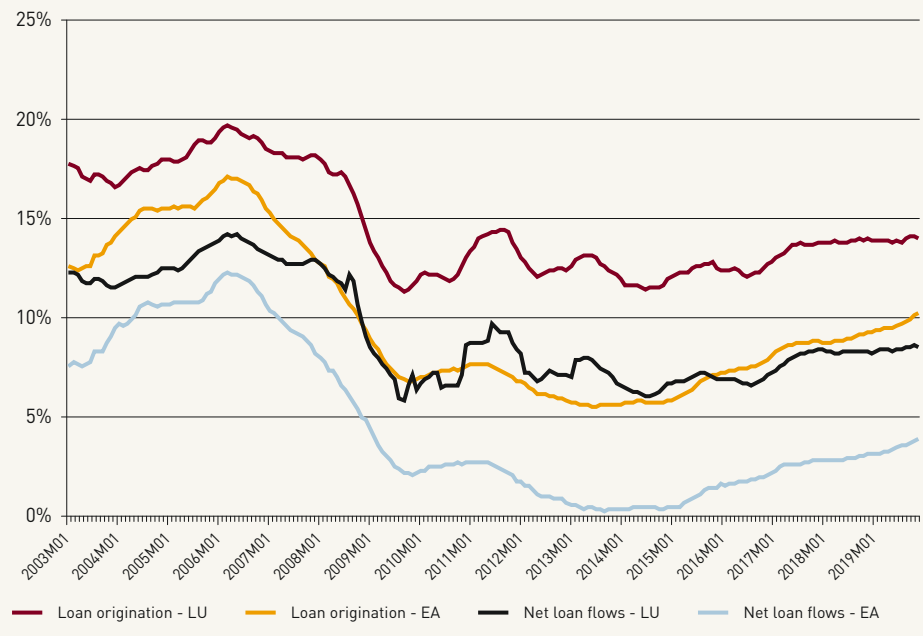
79 According to MIR data, since the beginning of 2015, more than 50% of new mortgage loans are at fixed rates.

Figure 3a
Implied loan renegotiations in new lending volumes and mortgage loan flows
(LHS: share of new lending volumes; RHS: loan flows in EUR million)



Source: BCL, own calculation. Note: The implied share of loan renegotiations is the difference between loan origination and new lending volumes expressed as a share of the latter.

Figure 3b
Mortgage loan origination in Luxembourg and in the euro area
(contributions to annual loan growth)



Source: BCL, ECB, own calculations. Note: loan origination is expressed as 12-month cumulated flows divided by the loan stock in t-12.

shows that the gap between loan origination and net loan flows is slightly larger for the euro area in the years following the crisis (i.e. repayments contributed more negatively in the euro area). This suggests that the stock of mortgages in the euro area grew more slowly in the years following the financial crisis. In Luxembourg, the stock of mortgages grew more steadily, indicating a relatively smaller effect of repayments (Figure 2a).

4. Conclusions

This analysis decomposed the flows of mortgage loans to Luxembourg households into loan origination and loan repayments to provide better insight into credit market developments.

Results suggest that net flows calculated from bank balance sheets are less informative than loan origination estimates. The financial crisis had a smaller impact on loan origination than suggested by calculating net flows from balance sheet data, which also displayed a more timid recovery. Moreover, loan origination in Luxembourg has increased steadily over the years. This is consistent with banks' replies to the Luxembourg Bank Lending Survey, in which they regularly reported increases in mortgage loan demand along with easing lending standards. Furthermore, the growth in loan origination is comparable to that of house prices, which also increased since 2017. The resulting increase in mortgage indebtedness led the ESRB to issue a warning to Luxembourg in 2016 and a number of other recommendations in 2019.[80] This analysis confirms that loan origination stands at record high levels, supporting the need to introduce appropriate macro prudential tools to moderate mortgage growth in Luxembourg.

Finally, this study revealed a high and persistent share of loan renegotiations in new mortgage lending, suggesting an ongoing switch from variable-rate to fixed-rate mortgage loans likely driven by the enduring low interest rate environment.

Appendix A – Methodology

For an aggregate bank loan portfolio, net mortgage loan flows (F_t) can be decomposed into two components: loan origination (LO_t) and loan repayments (R_t):

$$F_t = LO_t - R_t \tag{1}$$

Neither LO_t nor R_t can be observed in loan statistics collected by central banks, but they can be estimated using assumptions on their repayment scheme. Over the past years, the most common mortgage contract in Luxembourg has been a fixed rate mortgage with constant instalments and an ex-ante known repayment scheme.[81] This can be expressed as:

$$R_{t,\tau} = LO_t(1+i)^{\tau-M}\left[\frac{1-(1+i)^{-1}}{1-(1+i)^{-M}}\right] for\ t+1\ \leq \tau \leq t+M \tag{2}$$

For a loan issued at time t, repayments at time τ ($R_{t,\tau}$) are a function of the initial amount of the loan at origination (LO_t), the initial loan maturity (M) and the interest rate at origination (i). This repayment scheme can easily be extended to accommodate for variable rate loans. The most straightforward

80 See European Systemic Risk Board (ESRB) Warning of 22 September 2016 on medium-term vulnerabilities in the residential sector of Luxembourg (ESRB/2016/09) (https://www.esrb.europa.eu/pub/pdf/warnings/161128_ESRB_LU_warning.en.pdf) and ESRB Recommendation of 27 June 2019 on medium-term vulnerabilities in the residential sector in Luxembourg (CERS/2019/6) (https://www.esrb.europa.eu/pub/pdf/recommendations/esrb.recommendation190923_lu_recommandation~6577fe0f0d.en.pdf)

81 See European Mortgage Federation, Hypostat – A review of Europe's mortgage and housing markets, September 2019.

example is an adjustable rate loan where initial instalments are set under the assumption that the market interest rate will remain constant over the life of the loan. Changes to lending rates lead to an adjustment in the monthly instalments (interest component), while repayments and loan maturity remain unchanged. This adjustment is shown in Adalid and Falagiarda (2019), Figure 7 and 8.

Using equation 2, a portfolio of loans can be simulated by assuming that all loans originated at time *t* (LO_t) are repaid from *t+1* until *t+M*. The portfolio repayments in each period (R_t) thus equal the sum of repayments for all loans active in that period. The following table illustrates the flows associated with a simulated loan portfolio that starts at time *t* for the first 5 periods. Bank payments to borrowers are shaded red and repayments to the bank in green.

Table:

Loan origination and repayments for a loan portfolio with M = 3

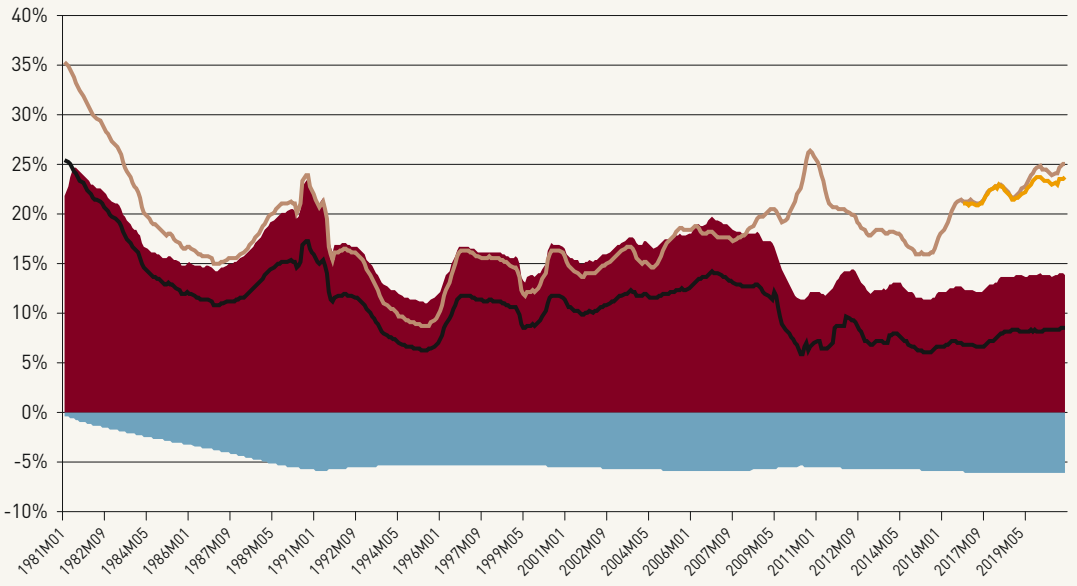
(flows in each period)

PERIOD	PORTFOLIO		INDIVIDUAL LOAN ISSUED IN				
	Loan origination (LO_t)	Repayments (R_t)	*t*	*t+1*	*t+2*	*t+3*	*t+4*
t	LO_t	0	LO_t				
t+1	LO_{t+1}	$R_{t,1}$	$R_{t,1}$	LO_{t+1}			
t+2	LO_{t+2}	$R_{t,2} + R_{t+1,1}$	$R_{t,2}$	$R_{t+1,1}$	LO_{t+2}		
t+3	LO_{t+3}	$R_{t,3} + R_{t+1,2} + R_{t+2,1}$	$R_{t,3}$	$R_{t+1,2}$	$R_{t+2,1}$	LO_{t+3}	
t+4	LO_{t+4}	$R_{t+1,3} + R_{t+2,2} + R_{t+3,1}$		$R_{t+1,3}$	$R_{t+2,2}$	$R_{t+3,1}$	LO_{t+4}

The simulation algorithm estimates loan originations to ensure that equation 1 holds: each period loan origination minus all repayments must match the observed net loan flows.

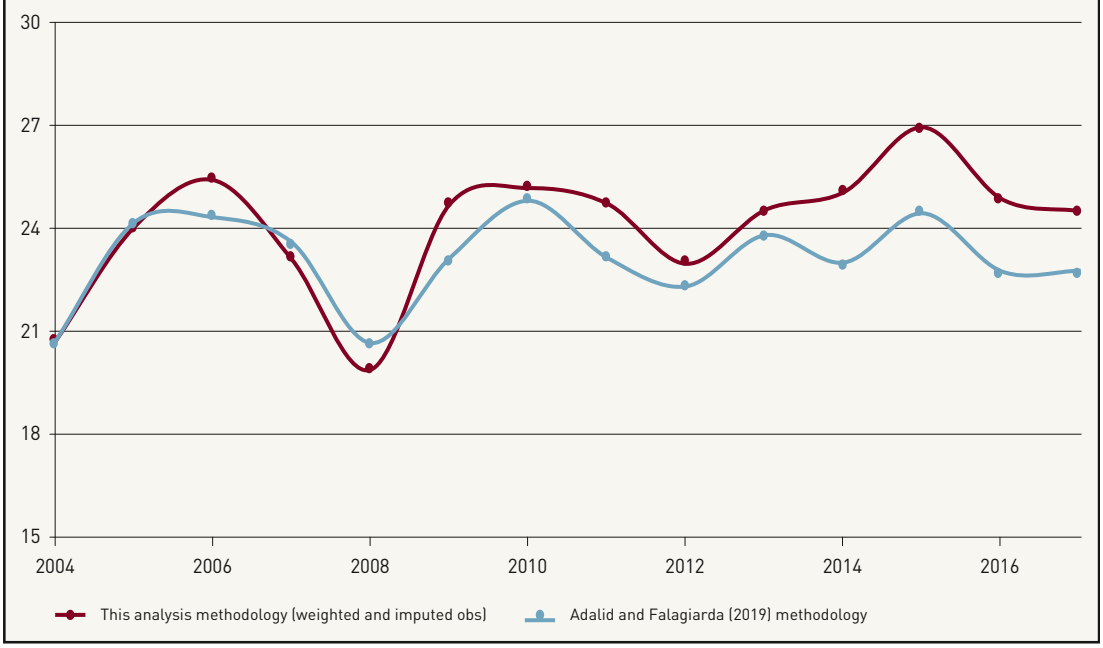
Appendix B – Additional figures

Figure A1
Luxembourg net mortgage loan flow decomposition
(annual growth rate and contributions)



Source: BCL, own calculation. Note: Loan origination, repayments and new lending volumes are expressed as 12-month cumulated flows divided by the loan stock in t-12. Pure new lending excludes loan renegotiations (as reported by banks).

Figure A2
Average mortgage maturity in Luxembourg by year of origination, 2017/18 HFCS
(years)



Source: HFCS, own calculation.