## 2. AN ASSESSMENT OF LUXEMBOURG'S RESIDENTIAL REAL ESTATE MARKET

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ABSTRACT

This article analyses the residential property market in addition to mortgage market developments in Luxembourg. One of the main issues from a financial stability perspective is banks' vulnerability to a sudden and sharp correction in residential property prices. Altogether, the analysis attaches a low probability to this event. Indeed, the results show that residential property prices have evolved broadly in line with their fundamentals at the end of the period under consideration. Nevertheless, the analysis emphasizes the continued need for monitoring and surveillance of property price developments in the periods ahead given the potential for Luxembourg residential property prices to continue increasing against a background of elevated demand in combination with supply constraints. In addition, continued vigilance with respect to the evolution of households' mortgage debt burden, mortgage issuance by banks in an environment characterized by low interest rates and large increases in the interest rate seems warranted. The latter is important from a financial stability viewpoint in order to ensure that potential risks resulting from sudden increases in interest rates are contained, particularly given the importance of households' mortgage debt burden.

Chart 1
Residential property price indices of selected EU countries
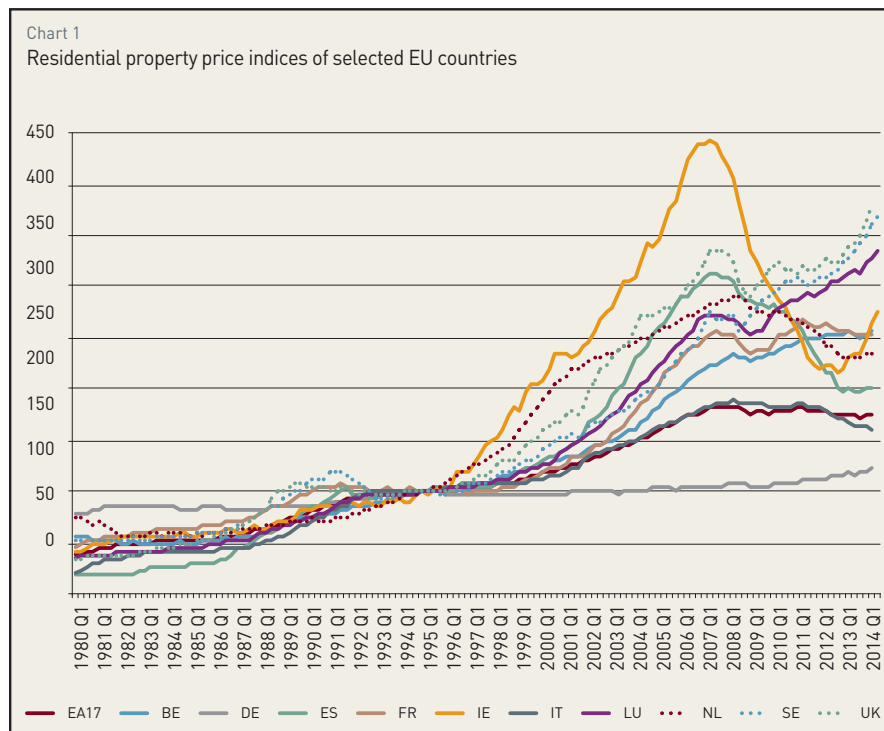
Sources: BCL, BIS, ECB-SDW, 1995=100

1. INTRODUCTION

Chart 1 presents the evolution of residential property price indices of selected EU member countries. In 2014, a first group of countries experiences moderate growth rates in prices (BE, DE, ES, FR, IT, NL) while relatively stronger growth rates in prices prevail in a second group of countries (IE, LU, SE, UK), including Luxembourg. The current level of residential property prices in Luxembourg is elevated in comparison to its historical average and its earlier peak in 2007. A question that arises naturally is whether such dynamics could have an impact on financial stability in Luxembourg.

One of the main financial stability issues for Luxembourg is the potential onset of a sharp and sudden correction in residential property prices. Such a correction

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might induce wealth losses for households. Debtors could potentially encounter difficulties repaying their mortgages or any other debt backed by their wealth depending on their debt servicing capacity. Therefore, banks face three major risks on the asset-side of their balance sheet: a fall in property value held as collateral, an increase in non-performing loans and capital losses on real estate investments. Given that in Luxembourg, three banks hold more than 70% of mortgages,[4] it suggests that authorities should continue to monitor concentration levels.

Against this background, this article analyses potential risk sources stemming from the residential property market and the mortgage market.[5] One of the main objectives is to investigate whether residential property price dynamics are justified by or disconnected from their fundamentals.[6]

To this aim, section 2 undertakes chart-based analyses of developments on the demand side (section 2.1) and on the supply side (section 2.2) of the residential property market, accompanied by ratio-based and model-based analyses (section 2.3). Risks related to mortgage market developments are investigated in section 3 on the borrowers' side (section 3.1) and on the lenders' side (section 3.2). Section 4 concludes.
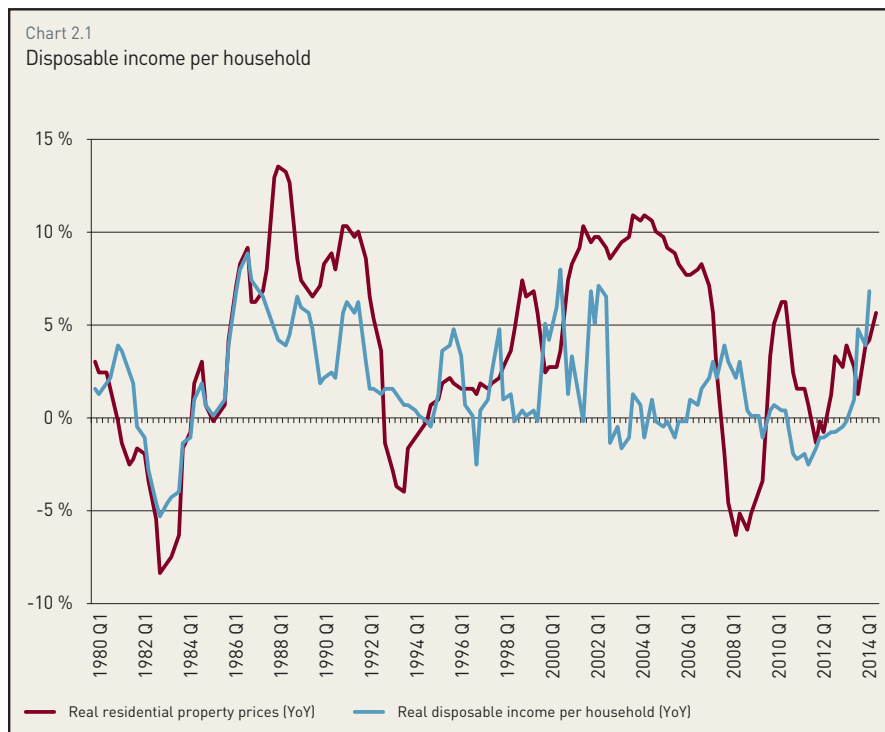
2. RISKS STEMMING FROM THE RESIDENTIAL PROPERTY MARKET

The analysis of risks stemming from the residential property market boils down to investigating whether price dynamics are justified by their fundamentals. On the demand side of the residential property market, several fundamentals drive residential property price dynamics: wealth (disposable income, employment), demographics (population growth, net migration, household size), housing finance indicators (mortgage loans, mortgage rates), return indicators (price-to-rent ratio, imputed rent-to-actual rent ratio, risk-adjusted returns of various asset classes, taxation) and sentiment indicators (household confidence index, household financial condition, household sentiment about housing purchase/investment). On the supply side, dwellings investment, building permits, construction cost, employment in the construction sector, business sentiment in the construction sector, and taxation are the most forward-looking indicators driving the evolution of residential property prices.
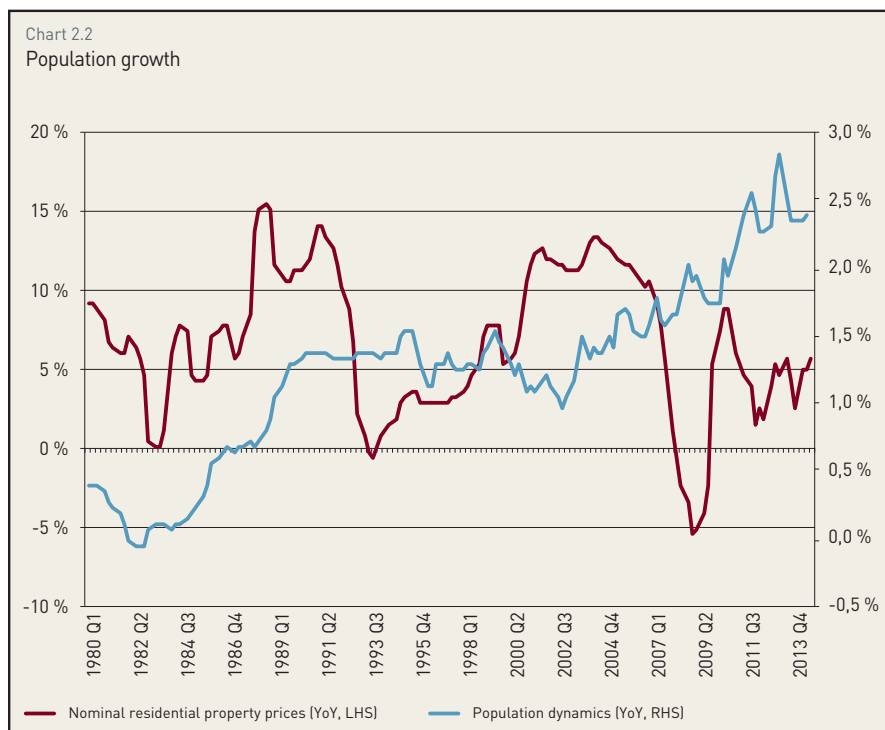
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4   *In Luxembourg, five banks hold 90% of total mortgages.*
5   *Investigating potential risks originating from the real estate market also necessitates the analysis of risks stemming from the mortgage market. Indeed, according to the latest figures provided by the Household Finance and Consumption (HFCN) survey, in 2008, about half of Luxembourg households resort to mortgages to afford buying a residential property. Therefore, mortgage market developments could play an important role in residential property market developments.*
6   *Fundamentals are defined as macroeconomic and financial variables that play a significant role in the determination of demand and supply of residential properties, and hence in the determination of residential property prices.*

Chart 2.1
Disposable income per household

Legend: Real residential property prices (YoY) — Real disposable income per household (YoY)

Sources: BCL, STATEC

Chart 2.2
Population growth

Legend: Nominal residential property prices (YoY, LHS) — Population dynamics (YoY, RHS)

Sources: BCL, STATEC

2.1 Demand side

Chart 2.1 presents the evolution of residential property prices and disposable income per household in real terms. Real disposable income per household grew slower than real residential property prices in 2000Q1-2007Q4 and in 2010Q1-2013Q4. The disconnection is more acute in the former period than in the latter one. This led to a decline in the disposable income level of households willing to buy a residential property during these periods. Indeed, households must, *ceteris paribus*, increase their share of income allocated to the purchase of a residential property. Since 2014Q1, real residential property prices and real disposable income per household have been growing approximately at the same rate.
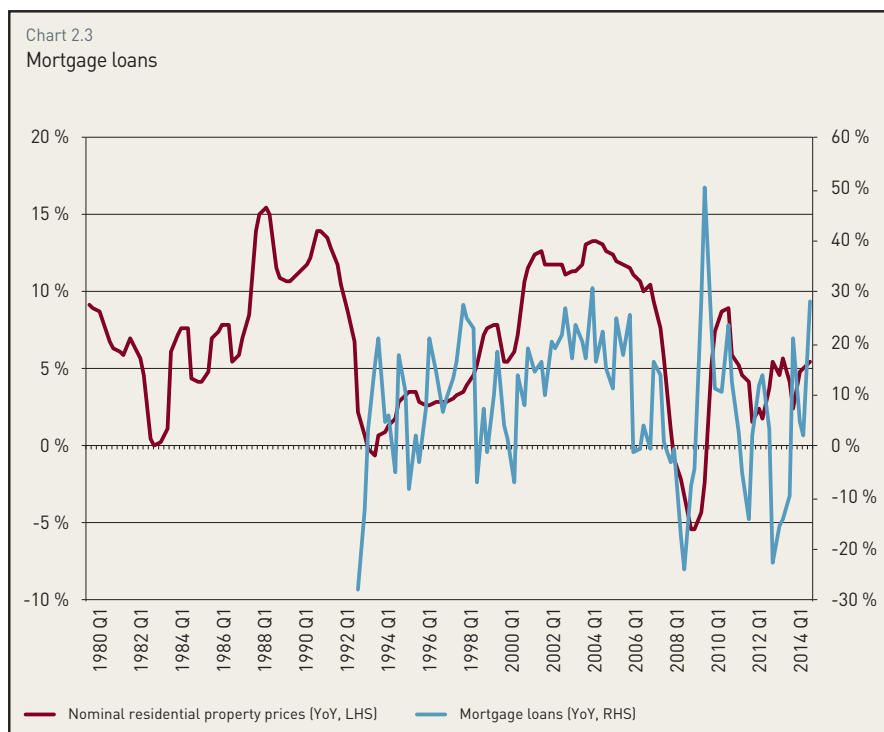
The population growth rate has maintained a positive trend since 2003Q1, reaching an average rate of 1.8% a year (Chart 2.2). The population increase is driven by strong net migration,[7] which can potentially be explained by relatively better labor market conditions in Luxembourg compared to other European countries. Demographics in Luxembourg are also characterized by a decrease in the average size of households (from 2.51 in 2000 to 2.41 in 2010, according to STATEC's population

7   *Net migration is defined as the difference between the number of persons entering and leaving Luxembourg during a year.*
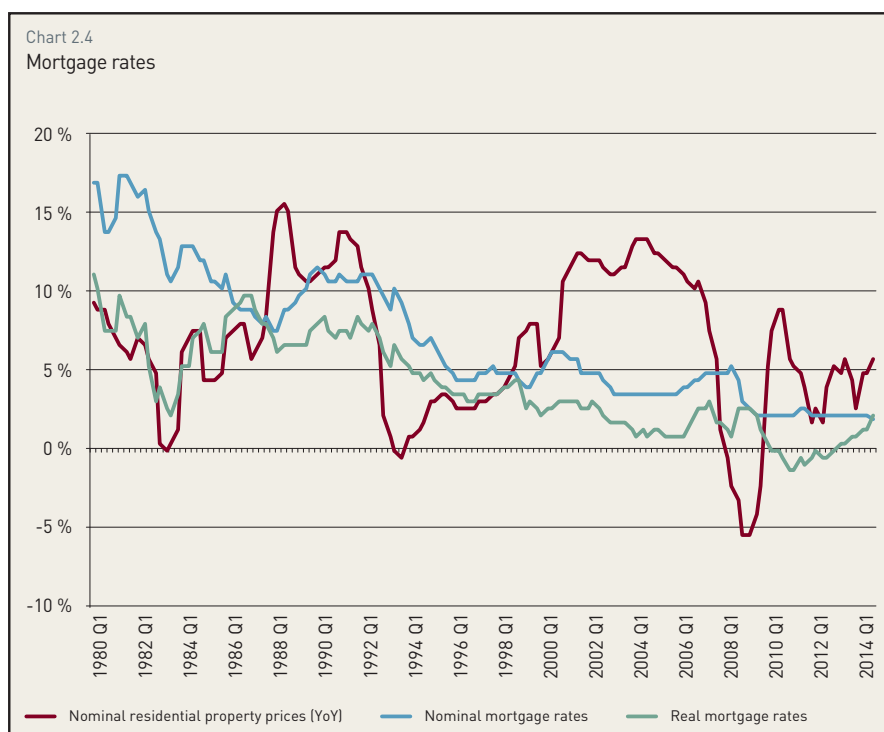
census).[8] Hence more households are living separately. This can be explained by socio-cultural factors putting some upward pressure on residential property prices.

Housing finance indicators can help to explain residential property price dynamics. Indeed, the evolution of mortgages appears to be correlated with residential property price dynamics (Chart 2.3). Mortgage demand should typically increase when mortgage rates decline since this decreases households' borrowing costs. On the other hand, banks may issue more mortgages when risks become subdued and economic outlook improves. Since 2009Q2, mortgage rates decreased in nominal terms (Chart 2.4), due to an accommodative monetary policy in the euro area, and also in real terms, due to weak inflation rates in Luxembourg. However, over the same period, the growth rate of mortgage loans became more volatile (Chart 2.3). A possible explanation is that banks may not have had a clear view on borrowers' risks due to the large uncertainty prevailing in the economic environment during this period. Nevertheless, recent figures highlight a relative increase in mortgage issuance in 2014 compared to 2013 (Chart 2.3). The Bank Lending Survey confirms this trend, projecting a reduction
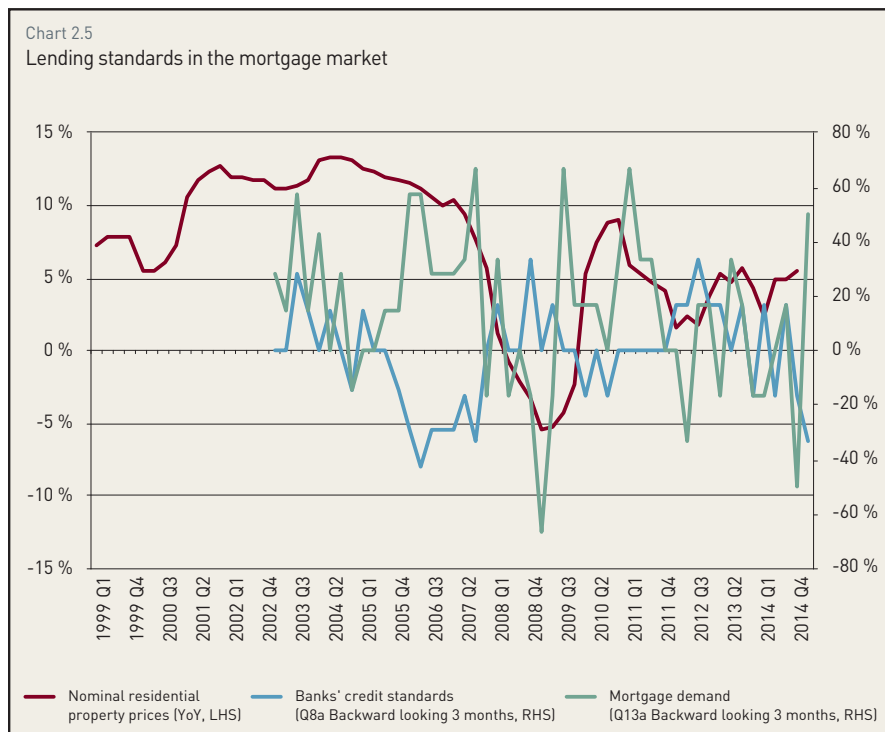
8   See STATEC, "Résultats du Recensement de la Population 2011", available at: http://www.statistiques.public.lu/fr/population-emploi/rp2011/menages/index.html. See also: http://www.statistiques.public.lu/stat/TableViewer/tableView.aspx?ReportId=423&IF_Language=fra&MainTheme=2&-FldrName=1&RFPath=72.

Chart 2.3
Mortgage loans

Nominal residential property prices (YoY, LHS)   Mortgage loans (YoY, RHS)

Sources: BCL, STATEC

Chart 2.4
Mortgage rates

Nominal residential property prices (YoY)   Nominal mortgage rates   Real mortgage rates

Sources : BCL, ECB-SDW (MIR survey)

Chart 2.5
Lending standards in the mortgage market

— Nominal residential property prices (YoY, LHS)	— Banks' credit standards (Q8a Backward looking 3 months, RHS)
	— Mortgage demand (Q13a Backward looking 3 months, RHS)

Source: Bank Lending Survey (BLS); the survey is carried out for seven Luxembourgish banks

Chart 2.6
Risk-adjusted returns of various asset classes

— Residential property prices (rents included)   — Stock prices   — Bonds   — Gold
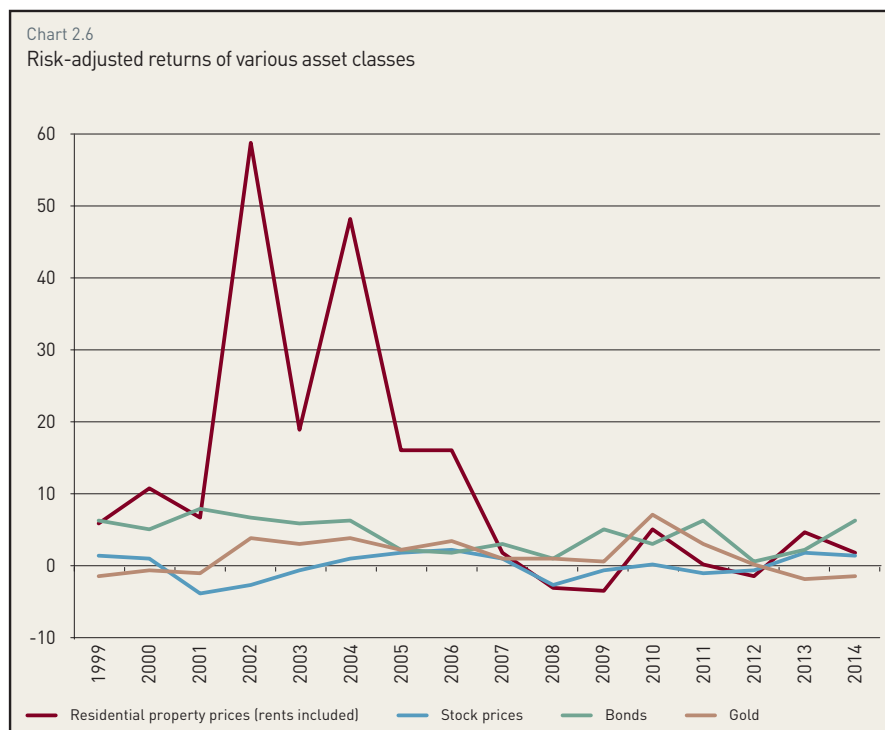
Sources: ECB-SDW, STATEC, BCL

in banks' credit standards and an increase in mortgage demand in 2015Q1 (Chart 2.5). This could contribute to sustained growth in residential property prices.

Chart 2.6 reports risk-adjusted returns[9] of various asset classes. Any abnormal risk-adjusted returns could suggest overheating in the market. Concomitant to the positive growth cycle in Luxembourg residential property prices, risk-adjusted returns in residential property investments were substantially higher than in other asset classes between 2002 and 2006. However, since 2007, investments in residential properties produced broadly the same yield as other asset classes.
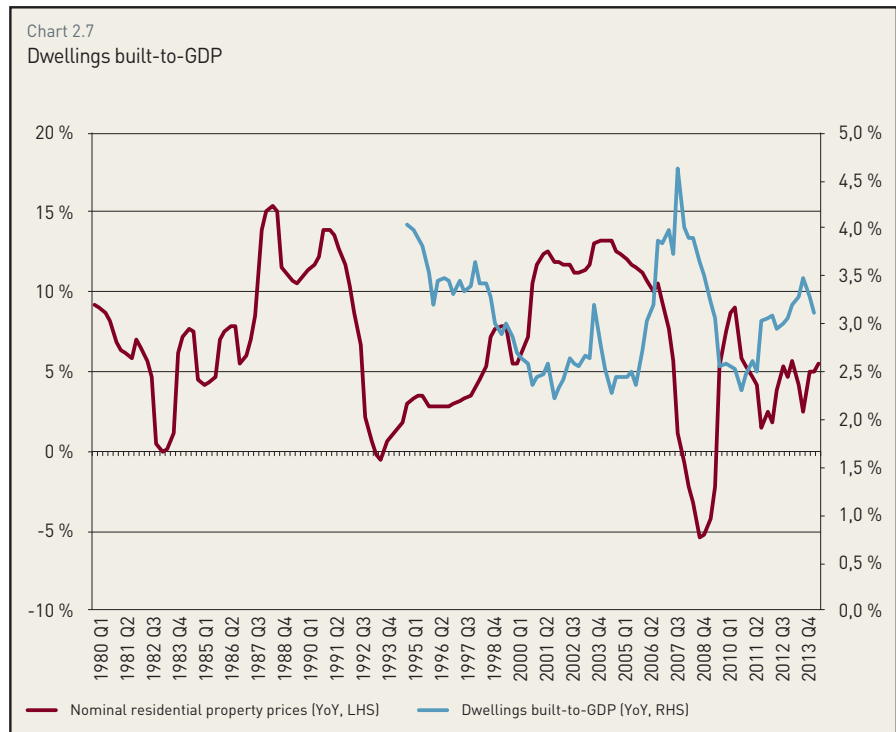
2.2   Supply side

According to Schneider (2013), a housing construction sector that accounts for a disproportionately high percentage of GDP could imply a state of overheating in the residential property market. The ratio of dwellings built-to-GDP (Chart 2.7) represents the share of housing construction in the wealth produced by the country. The ratio increased from 2006Q1 and peaked in 2008Q1 at more than 4.5% of GDP. This peak could suggest overheating in the residential property market over this period. After falling in 2008-2010, the ratio increased in 2011 and stabilized at around 3% in 2014Q3.
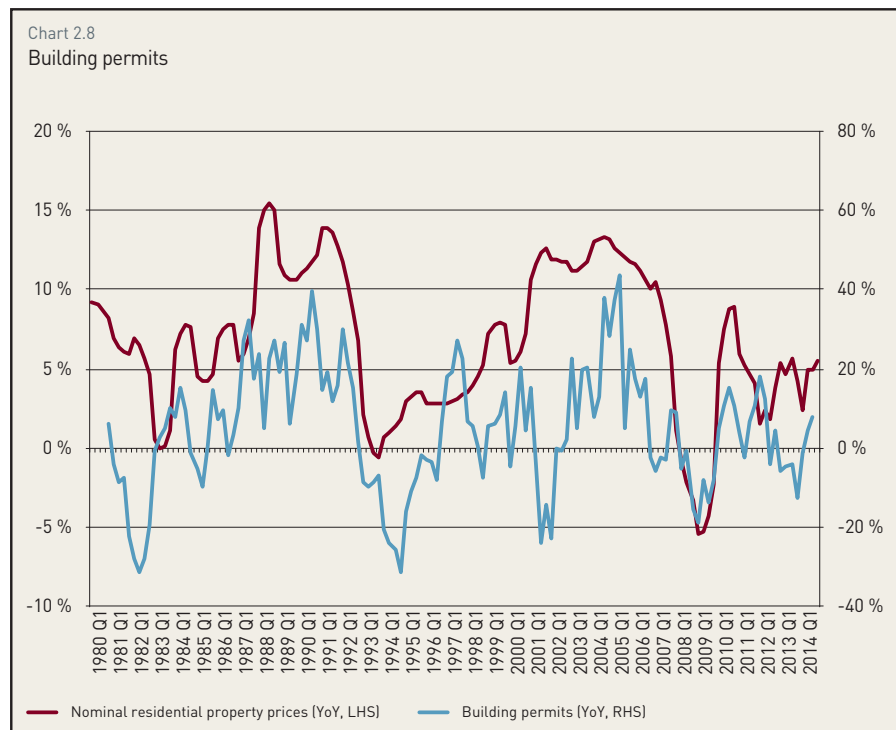
9   *Risk-adjusted returns are defined as the average returns over one year, divided by the standard deviation of returns in the considered asset over one year. All returns are expressed in euro and in real terms (deflated by CPI inflation in Luxembourg).*

Chart 2.8 presents the evolution of building permits, which are a determinant of construction activity in the residential property market and an indicator of demand overrhang in the residential property market. Over the period, building permits appear correlated with residential property prices. They increased significantly during the positive growth cycle in 1999-2007 suggesting a demand surplus in the market. This pattern also justifies the increase in the share of dwellings built-to-GDP over this period (Chart 2.7), as rising property prices stimulated construction. Recent figures show that since 2010, the growth rate in building permits has stabilized.
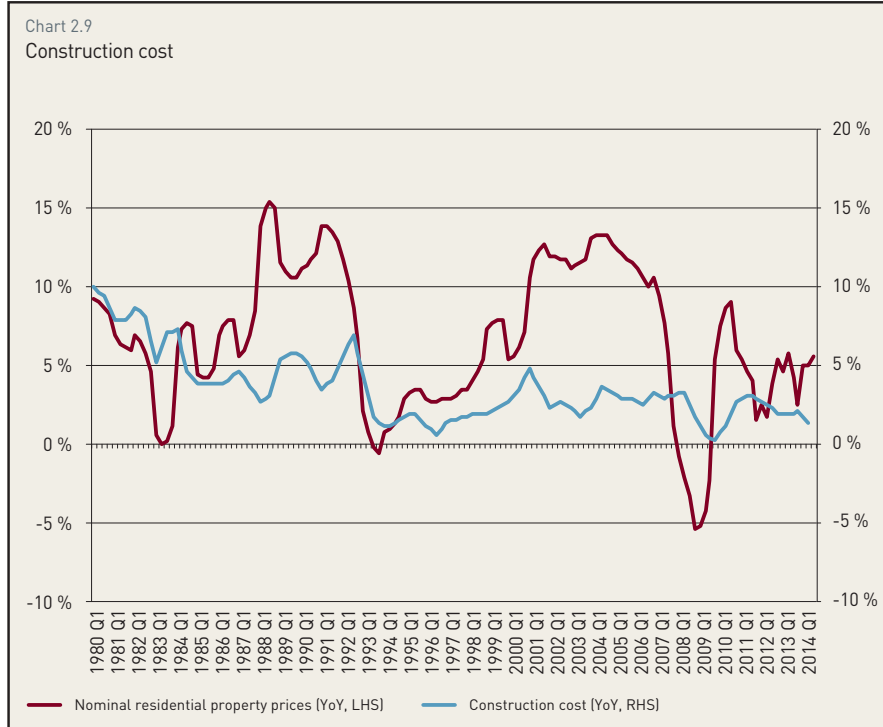
Construction costs help explain residential property price dynamics in the long run. If residential property prices evolve close to their fundamentals, property prices should share the same evolution as construction costs. During the positive growth cycle in 1999-2007, residential property prices drifted away from construction costs (Chart 2.9). Since 2012, residential property prices have evolved closer to construction costs.

Chart 2.7
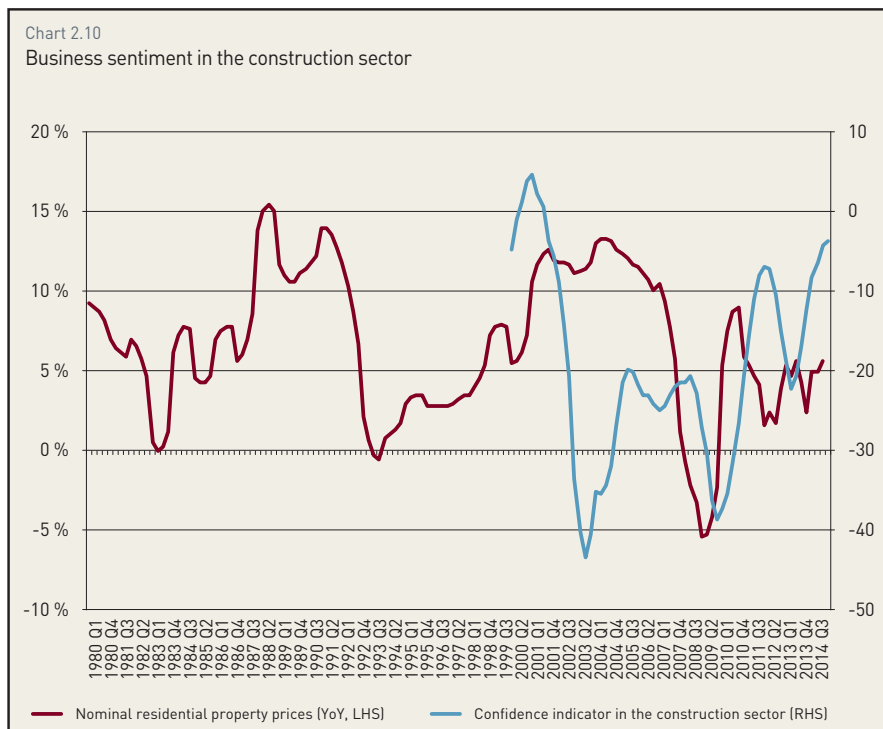Dwellings built-to-GDP

— Nominal residential property prices (YoY, LHS) — Dwellings built-to-GDP (YoY, RHS)

Source: STATEC

Chart 2.8
Building permits

— Nominal residential property prices (YoY, LHS) — Building permits (YoY, RHS)

Source: STATEC

Chart 2.9
Construction cost

Legend:
— Nominal residential property prices (YoY, LHS)
— Construction cost (YoY, RHS)

Source: STATEC

Chart 2.10
Business sentiment in the construction sector

Legend:
— Nominal residential property prices (YoY, LHS)
— Confidence indicator in the construction sector (RHS)

Source: STATEC

Recent figures on business sentiment in the construction sector point to better prospects in the residential property market (Chart 2.10). This could herald an increase in construction activity that could mitigate any rise in residential property prices stemming from strong supply constraints.

2.3 Disconnection of prices from their fundamentals

We now use both univariate ratios and multivariate model analysis to complete the examination of the potential disconnection of residential property prices from their fundamentals.

2.3.1 Ratio-based analysis

The ratio-based analysis considers two ratios that provide insight into price pressure in the residential property market.

The price-to-income ratio (*i.e.* the affordability ratio) represents a gauge of whether housing is within the reach of an average buyer. An increase in this ratio indicates deterioration in the affordability of residential property. Households will normally reduce their demand for dwellings, thereby driving house prices down.

The price-to-rent ratio assesses the attractiveness of renting a home relative to the attractiveness of purchasing a home. If property prices increase relative to rents, more households should choose to rent rather than to buy, driving rents up and property prices down. This ratio is also an

indicator of the potential return on housing investment,[10] where an increase in this ratio indicates a lower return on investment.

In a perfect economy without frictions, residential property prices should cointegrate with income and rents. In other words, residential property prices could wander away from the dynamics of the aforementioned variables in the short run, but revert back to their respective dynamics in the long run.

Both ratios evolve above their historical average since 2005 (Charts 2.11 and 2.12). This suggests that, on average, residential property prices grow faster than disposable income per household and rents. This in turn places downward pressure in prices in the medium run, although nominal prices are still growing at an average annual rate of 4.5% in 2014.

One of the major drawbacks of the ratio-based analysis is the reliance on a single fundamental, while residential property prices dynamics are affected by a larger number of fundamentals stemming from the demand-side and the supply-side of the market. The model-based analysis circumvents this shortcoming.

2.3.2 Model-based analysis

The model-based analysis relies on three models, each of which

10   *In this case, the measure is akin to the price-to-dividend ratio in the stock market, assuming rental income is analogous to dividend payments.*

Chart 2.11
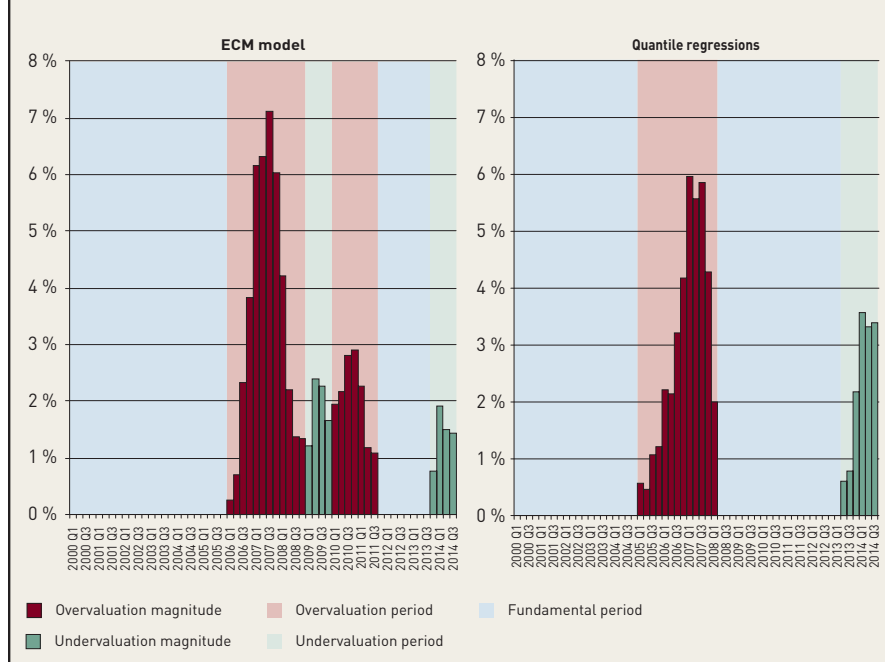Gap of affordability ratio relative to its historical average (2000Q1-2014Q3)
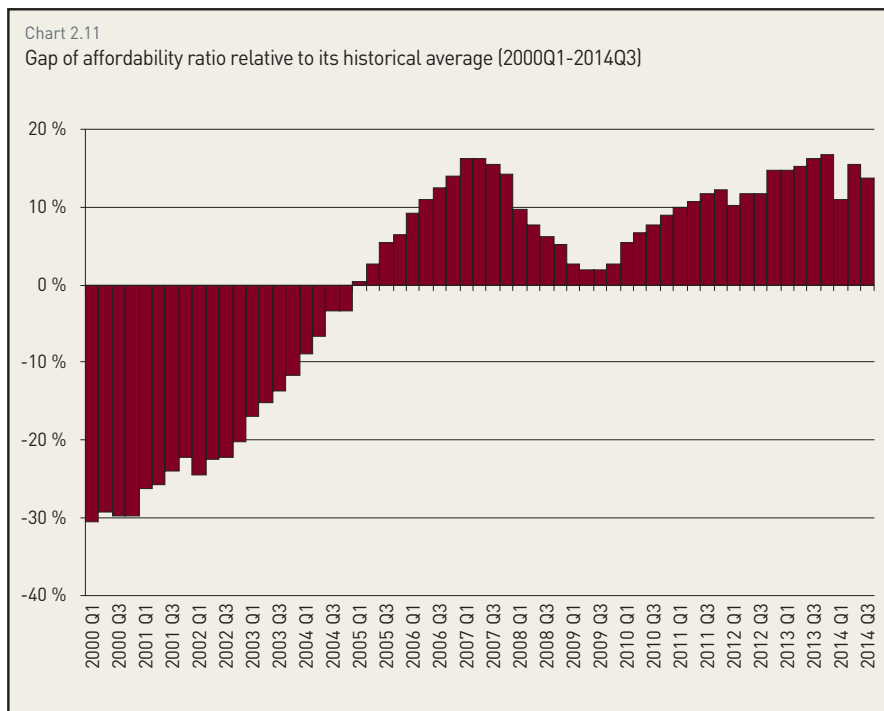
Source : BCL calculations. The affordability ratio is defined as the ratio of residential property prices over disposable income per household.

Chart 2.12
Gap of price-to-rent ratio relative to its historical average (2000Q1-2014Q4)
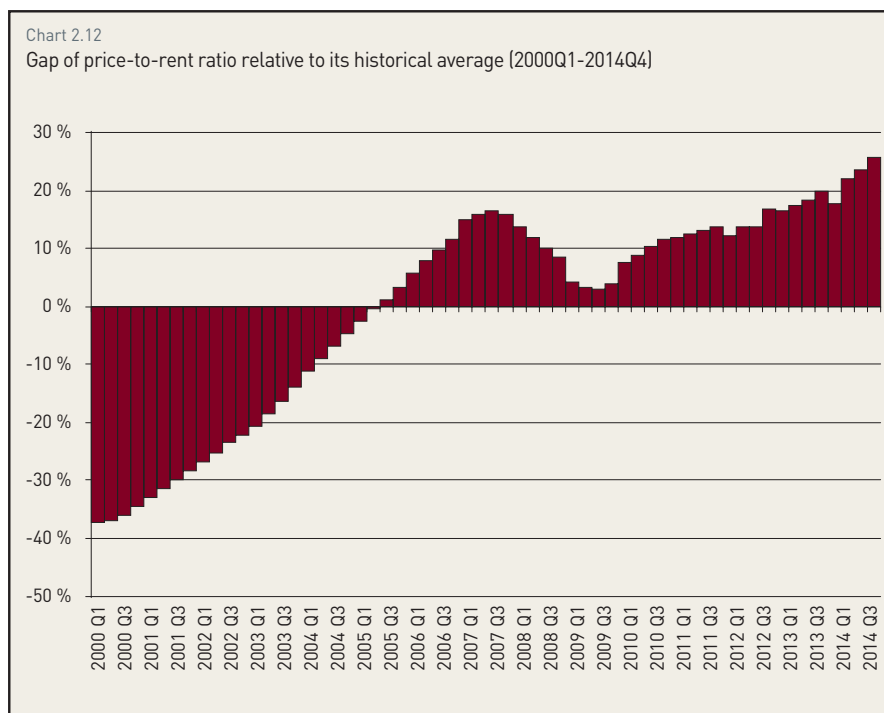
Source : BCL calculations.

Chart 2.13

Disconnection between actual and fundamental levels of residential property prices

ECM model

Quantile regressions

■ Overvaluation magnitude   ■ Overvaluation period   ■ Fundamental period

■ Undervaluation magnitude   ■ Undervaluation period

Source : BCL calculations. Estimation period: 1980Q1-2014Q3.

includes the following set of demand-side and supply-side fundamentals: disposable income per household, the user cost of owning a dwelling,[11] the number of households and the stock of dwellings.

To identify any disconnection of prices from their fundamental value, we build two indicators. The first indicator relies on an error correction model (Stock and Watson (1993)). The indicator predicts overvaluation (undervaluation) periods when prices evolve above the upper (lower) fundamental bound. It supposes that prices are in line with their fundamentals when prices evolve within the interval defined by the aforementioned bounds. The second indicator is based on quantile regressions (Gerdesmeier *et al.* (2012)). When prices evolve above (below) their fundamental value as estimated

by the 80th (20th) quantile, the indicator highlights overvaluation (undervaluation) phases in the market. When prices evolve within the interval defined by the latter fundamental values, prices are assumed to evolve in accordance with their fundamentals.

Estimation results show an overvaluation period in 2006Q1-2008Q4 (ECM model, Chart 2.13) and in 2005Q1-2008Q1 (quantile regressions, Chart 2.13). While quantile regressions suggest prices evolve in line with their fundamentals after this overvaluation period, the ECM model points to an undervaluation period (2009Q1-2009Q4) followed by an overvaluation phase (2010Q1-2011Q3). Both approaches identify price undervaluation at the end of the period.

A third indicator characterizes the growth regime of residential property prices by relying on a two-state Markov switching framework (Corradin and Fontana (2013)). The model assumes that prices switch between a high-growth regime and a moderate-growth regime. Regimes are identified with smoothed probabilities estimated for each regime over time.

Estimation results (Chart 2.14) show that prices experienced a high-growth regime in 2000Q3-2007Q1 followed by a moderate-growth phase (2007Q2-2009Q4) and then a high-growth period (2010Q1). The indicator suggests that residential property prices currently evolve within a moderate-growth regime.

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11 *The user cost of owning a dwelling is defined as the costs inherent to holding a residential property by the occupying owner. The user cost is computed following the method of Poterba (1984). It notably takes into account the mortgage rate, the residential property tax rate applied to the property occupied by the owner and the other costs associated to the holding of a residential property (e.g. the depreciation and the maintenance of the dwelling, etc.).*

Overall, the model-based indicators suggest that in 2014Q3, the current level of actual residential property prices evolve below their equilibrium value as predicted by fundamentals. Moreover, a moderate-growth regime characterizes residential property price dynamics. Hence, after a high-growth period in 2000-2007, residential property prices experienced relatively lower growth rates since the spark of the global financial crisis in 2008.

3. RISKS STEMMING FROM THE MORTGAGE MARKET

Mortgage market risks are analysed for both borrowers (households) and lenders (banks). On the borrowers' side, the risk of excessive build-up in mortgage loans and the burden of households' mortgage debt are analysed. Risks pertaining to households'

Chart 2.14
Growth regime of residential property prices

| Regime 1 (high growth period) | Regime 2 (moderate-growth period) | ···· P(St=1/I_t) |

Source: BCL calculations. Estimation period: 1980Q1-2014Q3.

deteriorating ability to repay mortgage debt are also investigated. On the lenders' side, credit risk (*i.e.* the risk of a deterioration in asset quality induced by borrowers' default on mortgage debt repayment) and banks' capacity to absorb risks in case of an unexpected adverse shock stemming from the residential property market are considered.

3.1   Borrowers' risks

When the housing market is booming, households become more optimistic about future economic prospects and mortgage demand to purchase a home tends to increase. As the growth in residential property prices inflates the value of borrowers' collateral, banks may issue more mortgages by relaxing lending standards. However, if the build-up in mortgages is excessive, risks can arise. To highlight any excessive build-up in mortgage loans, we analyse the gap[12] of the ratio of mortgage loans-to-disposable income per household (Chart 3.1). The larger the gap, the higher the risk of excessive build-up in mortgages. During the positive growth cycle in prices (1999-2007), the ratio evolves far above its trend (the gap is highly positive). In 2014Q3, the ratio evolves below its trend (the gap is negative) suggesting a containment of risks pertaining to excessive build-up in mortgages.

The ratio of mortgage debt relative to households' disposable income (Chart 3.2) is used to assess households' mortgage debt burden. A high ratio (potentially higher than 100%) could make it more
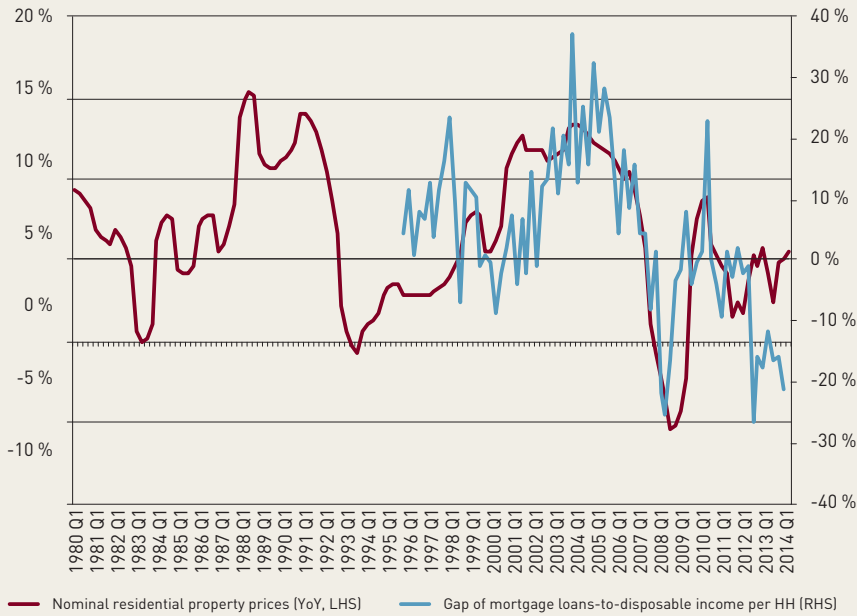
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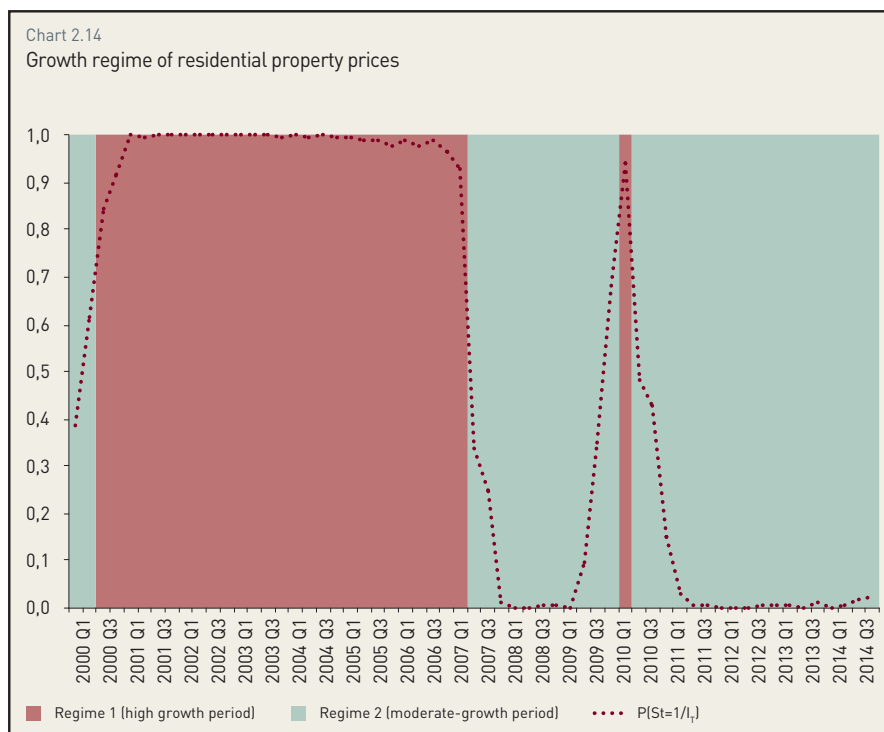
12   *To compute the trend, we use a recursive one-sided (or "real-time") Hodrick-Prescott filter (Alessi and Detken (2011)) with a smoothing parameter of 400.000 (Andersen et al. (2014)).*
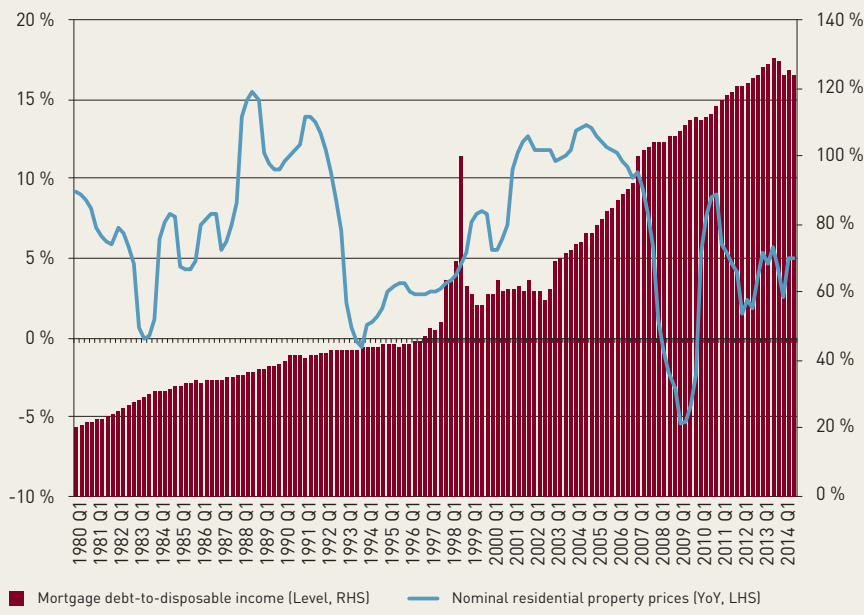
Chart 3.1

Gap of mortgage loans-to- disposable income per household ratio

Legend:
— Nominal residential property prices (YoY, LHS)   — Gap of mortgage loans-to-disposable income per HH (RHS)

Sources: BCL, STATEC

Chart 3.2

Ratio of mortgage debt-to-disposable income

Legend:
■ Mortgage debt-to-disposable income (Level, RHS)   — Nominal residential property prices (YoY, LHS)

Sources: BCL, STATEC, ECB-SDW

difficult for households to repay their debt, notably in the event of unexpected and sudden negative shocks affecting households' wealth (e.g. fall in GDP, increase in interest rates, etc.). The ratio experiences a positive trend between 1999Q1 and 2013Q3. Between 2013Q4 and 2014Q3, the ratio stabilises and reaches 124% in 2014Q3.
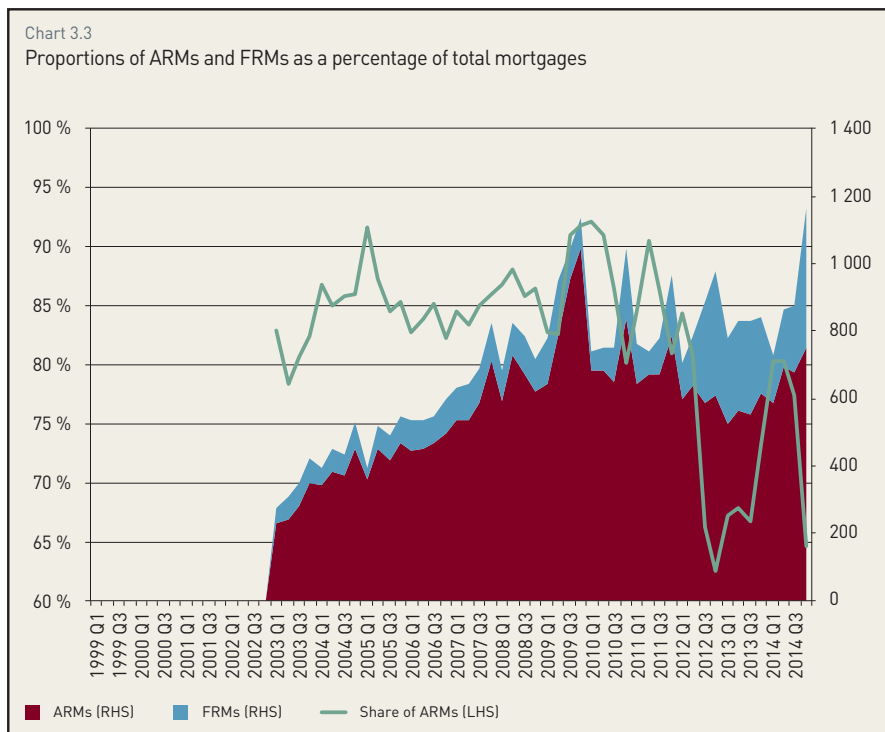
This elevated ratio raises some concerns regarding households' mortgage debt sustainability. As a result, the evolution of households' mortgage debt must be monitored in order to avoid any dramatic deterioration in their repayment capacity.

Given the long period of low interest rates prevailing in the euro area since 2009, one of the main risks that borrowers may face is an unexpected increase in mortgage rates. Indeed, the majority of Luxembourgish households with mortgages are indebted with adjustable-rate mortgages (ARMs; see Chart 3.3). Since 2003Q1, ARMs represent on average 82% of mortgages issued by banks. In 2014, 76% of mortgages granted by banks were ARMs.[13]
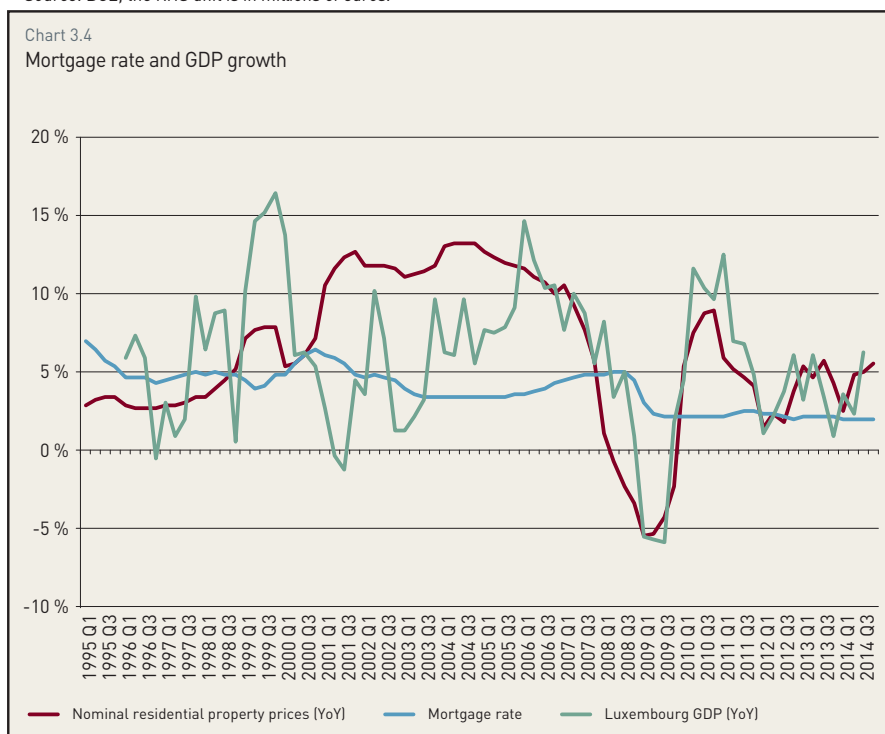
Some of the possible risks related to the low interest rate environment are now considered. Chart 3.4 presents the evolution of mortgage rates and economic activity

13   *Since 2012, the proportion of ARMs slightly decreased to the benefit of FRMs (Chart 3.3). A possible explanation is that the protracted period of low interest rates had led borrowers to favor FRMs since borrowers expect a likely increase in interest rates in the future, during their debt repayment period.*
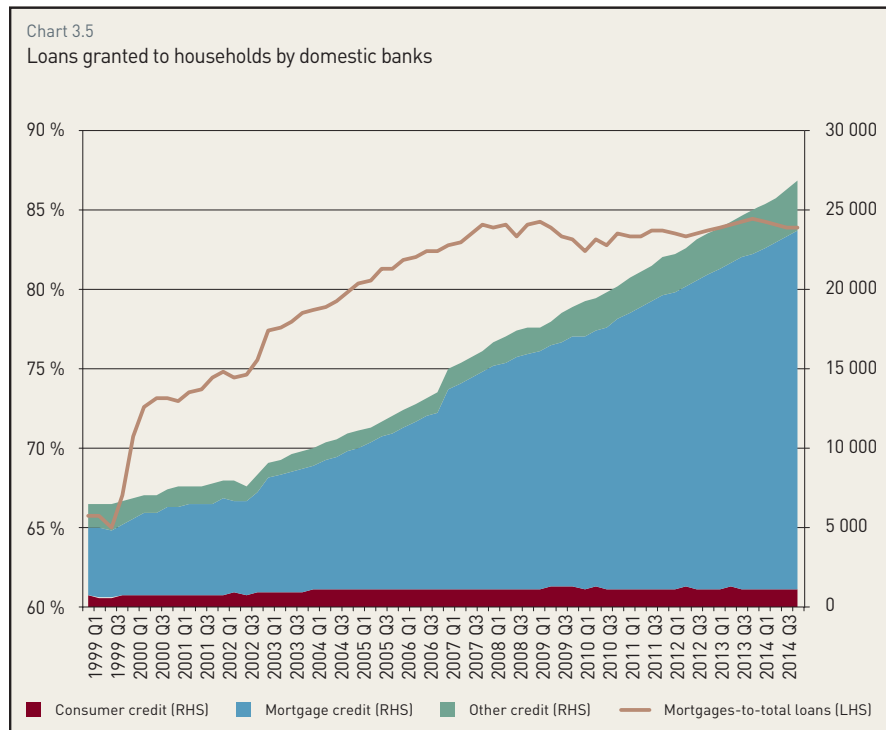
(proxied by GDP) in Luxembourg. When the gap between the economic growth rate and the interest rate becomes large for a long period of time, the actual economic growth rate could drift away from its structural rate, overheating the economy. During the positive growth cycle in residential property prices (1999-2007), nominal interest rates were actually lower than economic growth which could have nurtured the boom in the residential property market. Since 2012, mortgage rates have evolved closer to the growth rate of economic activity in Luxembourg, therefore resulting in a low probability of materialization of an adverse scenario.

Chart 3.3
Proportions of ARMs and FRMs as a percentage of total mortgages

Source: BCL; the RHS unit is in millions of euros.

Chart 3.4
Mortgage rate and GDP growth

Sources: ECB-SDW, BCL

Chart 3.5

Loans granted to households by domestic banks

Consumer credit (RHS)   Mortgage credit (RHS)   Other credit (RHS)   Mortgages-to-total loans (LHS)

Source: BCL; the LHS unit is in millions of euros.

Chart 3.6

Non-performing loans to total gross loans

Nominal residential property prices (YoY, LHS)   Non-performing loans to total gross loans (RHS)

Source: BCL

3.2 Lenders' risks

Mortgage loans account for a large share of banks' loans granted to households (Chart 3.5). Financial intermediaries are therefore exposed to risks stemming from the residential property market. However, banks in Luxembourg appear to be able to monitor and screen credit risks since non-performing loans represent a low share of total gross loans (below 1%, see Chart 3.6).

Moreover, banks' capital levels appear rather comfortable in Luxembourg when measured relative to risk-weighted assets (Chart 3.7). Indeed, the regulatory Tier 1 capital-to-risk-weighted assets ratio and the regulatory capital-to-risk-weighted assets[14] ratio evolve above the minimum thresholds required by the regulator (respectively, 6% and 10% under Basel III) and are among the highest capital requirement ratios in the euro area. This increases the banks' capacity to absorb risks stemming from the residential property market.

The index of the relative change in the loan-to-value (LTV) ratio on new mortgages granted to households (HHs) (Chart 3.8) represents a measure of risk-taking by banks. When the ratio increases, banks magnify their risk exposure in the mortgage market (and *vice versa*). The LTV ratio increased dramatically from 2005 to 2009, suggesting that banks took higher risks over this period. Then, between 2010 and 2012, banks' risk exposure

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14 *Risk-weighted (i.e. risk-adjusted) assets are the total of all assets held by the bank weighted by credit risk.*
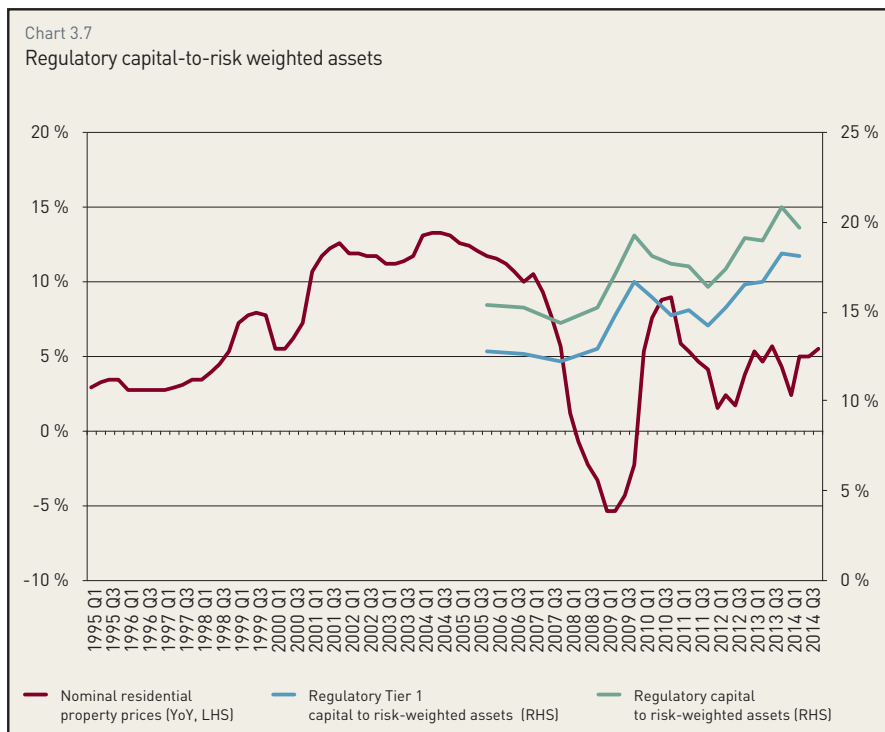
stabilized. From 2013 onwards, the LTV ratio decreases suggesting lower risk exposure by banks in the mortgage market.
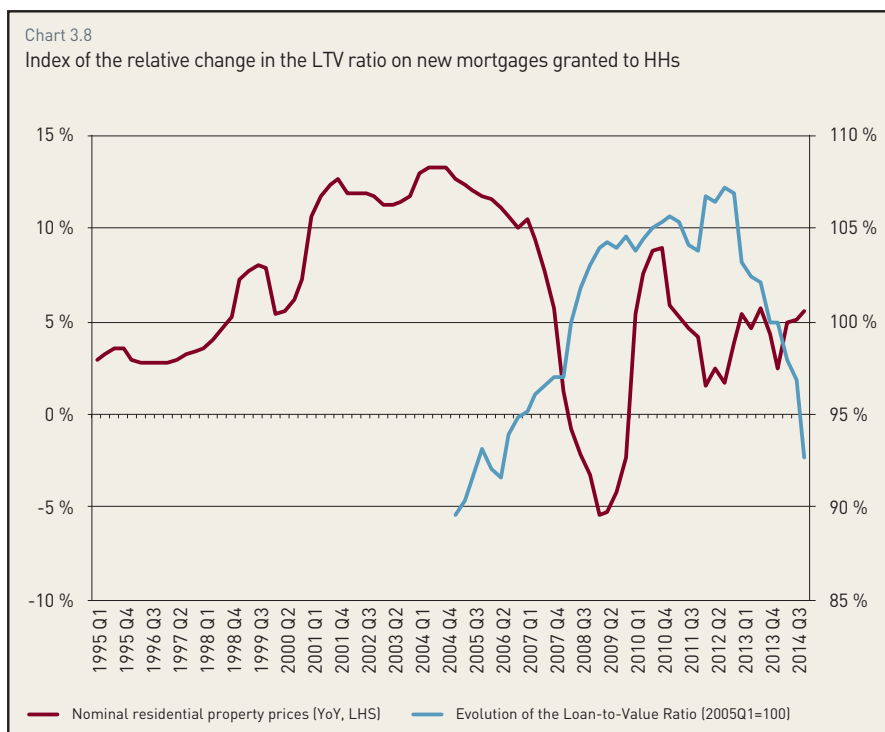
4. Concluding remarks and ways forward

The article analyses financial stability issues related to the residential property market and mortgage lending in Luxembourg. One of the main issues that warrant ongoing monitoring is the banks' vulnerability to a sudden and sharp correction in residential property prices. However, the analysis attaches a low probability to this event. Indeed, results show that residential property prices evolved broadly in line with their fundamentals at the end of the period under consideration.

Additional areas of the residential real estate sector that should continue to be closely monitored by authorities include the risk of a disconnection of residential property price dynamics from the path predicted by fundamentals, the evolution of households' mortgage debt burden (including the amount of mortgage issuance by banks in a low interest rate environment) and interest rate risk (*i.e.* ensure that risks coming from sudden increases in interest rates are manageable, given the importance of households' mortgage debt burden).

In view of these potential risk sources, authorities should remain vigilant and be prepared to adopt any necessary measures that would help to attenuate adverse developments in the real estate sector.

Chart 3.7
Regulatory capital-to-risk weighted assets

Legend:
— Nominal residential property prices (YoY, LHS)
— Regulatory Tier 1 capital to risk-weighted assets (RHS)
— Regulatory capital to risk-weighted assets (RHS)

Source: BCL

Chart 3.8
Index of the relative change in the LTV ratio on new mortgages granted to HHs

Legend:
— Nominal residential property prices (YoY, LHS)
— Evolution of the Loan-to-Value Ratio (2005Q1=100)

Source: BCL

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