3 THE LEVERAGE CYCLE IN LUXEMBOURG'S BANKING SECTOR [1]
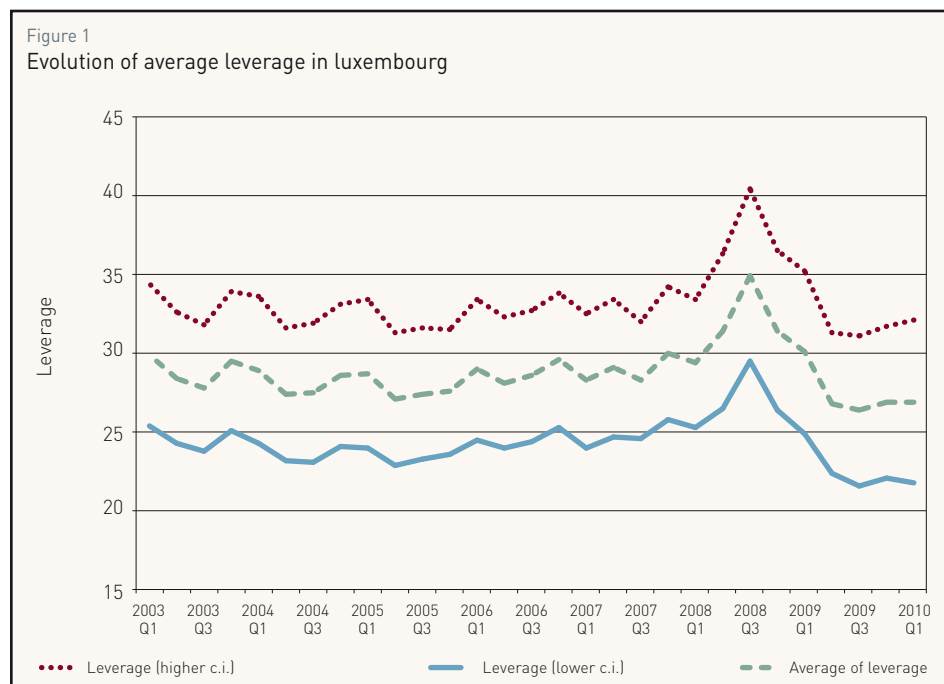
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1 INTRODUCTION

A variable that received quite some attention in the aftermath of the crisis was the leverage ratio. The leverage ratio is indicative for a bank's level of indebtedness and measures how much of a bank's own funds cover its assets. Banks tend to increase their profits by attracting more outside funding as outside funding is generally cheaper and easier to obtain than raising equity. However, relying on outside funding makes banks more susceptible to bank runs and sudden shifts in liabilities or risky assets. Therefore, one can associate a higher level of indebtedness, as measured by the leverage ratio (assets divided by own funds), with a higher probability of bank default and an increase in the impact of withdrawals of short-term liability.

It is, thus, useful to analyze why and when banks actually want to accept the higher risks that are associated with a higher indebtedness. To do this, we build a panel dataset with individual banks' balance sheet data covering the whole population of banks in Luxembourg and ranging from 2003 Q1 – 2010 Q1. We use macroeconomic indicators to study which factors drive the leverage cycle. Our real variables are the rate of unemployment and European GDP growth, the financial variables are the EuroStoxx 50 index and Euribor-OIS spread, while the expectation variables are the Luxembourgish consumer confidence indicator and a variable that we construct ourselves, which is new to the literature, and which we dub the herd effect. With this variable we want to capture at least a part of the herd behavior in the leverage process.

## 2 THE MECHANICS BEHIND THE LEVERAGE CYCLE

As Figure 1 shows, leverage in Luxembourg was procyclical during the boom of 2003 Q1 to 2008 Q1, increased sharply at the beginning of the financial turbulences in 2007 Q4, and then quickly decreased to its all time low with the materialization of the financial crisis in 2008 Q3. If banks expand their balance sheets by raising own funds, then leverage should decrease. As Figure 2 shows for individual bank data spanning the Luxembourgish banking sector from 2003 Q1 to 2010 Q1, this is clearly not the case in Luxembourg. Instead, increasing asset values are highly correlated with increasing leverage.

Figure 1
Evolution of average leverage in luxembourg

Legend: •••• Leverage (higher c.i.)   —— Leverage (lower c.i.)   – – Average of leverage

Source : BCL

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1   This contribution is a non-technical summary of a forthcoming BCL working paper.

Figure 2
Leverage growth versus asset growth, 2003 Q2–2010 Q1
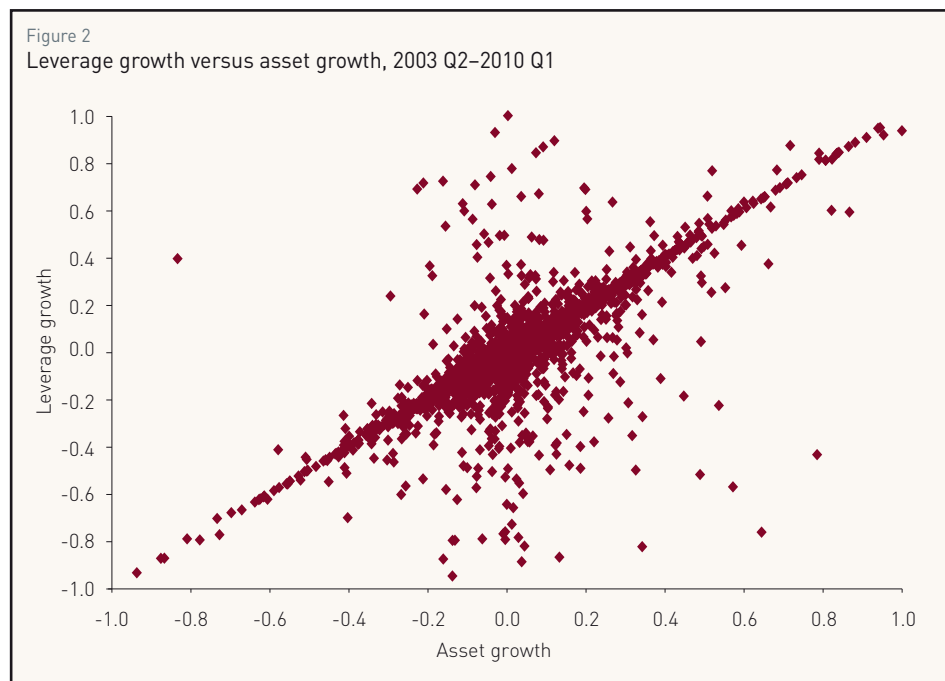
Thus, banks increase their assets mainly through increasing their liabilities (less own funds). Figure 3 demonstrates that the evolution of leverage is mainly due to assets. While own funds continued to grow at approximately the same rate as before the crisis, assets reduced significantly after the Lehman bankruptcy.

Taking a closer look at the main components of assets, Figure 4 shows that the major driver of the collapse in the stock of total assets was total credits. A somewhat more disaggregated look at credits allows us to conclude that credits to `monetary financial institutions' were the main source underlying the decline in total credits. The fact that mainly credits drive assets is supported through the observation that banks' portfolios in Luxembourg are, on average, composed to 75% of credits and to 15% of securities.

As Figure 3 shows, the increase in equity in the pre-crisis period cannot solely account for the growth in assets. Thus, the increase in assets must have come through attracting other liabilities. Similarly, since banks in Luxembourg reduced their assets from 2008 Q3 onwards while they continued to increase their equity, then this implies that they adjusted their balance sheets by changing other liabilities. Banks in Luxembourg did this especially through shedding deposits, which make up around 85% of liabilities on average. As Figure 5 shows, we observe a highly significant and positive correlation (82%) between asset growth and deposit growth. Thus, deposits are the main means of adjustment to match the asset and liability sides of banks' balance sheets in Luxembourg.
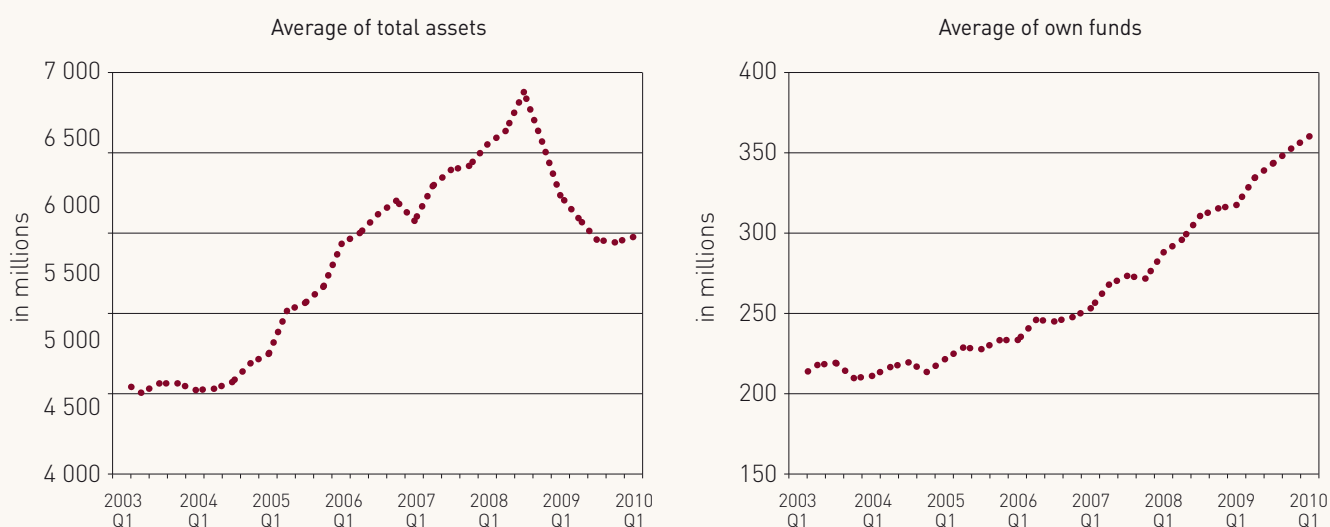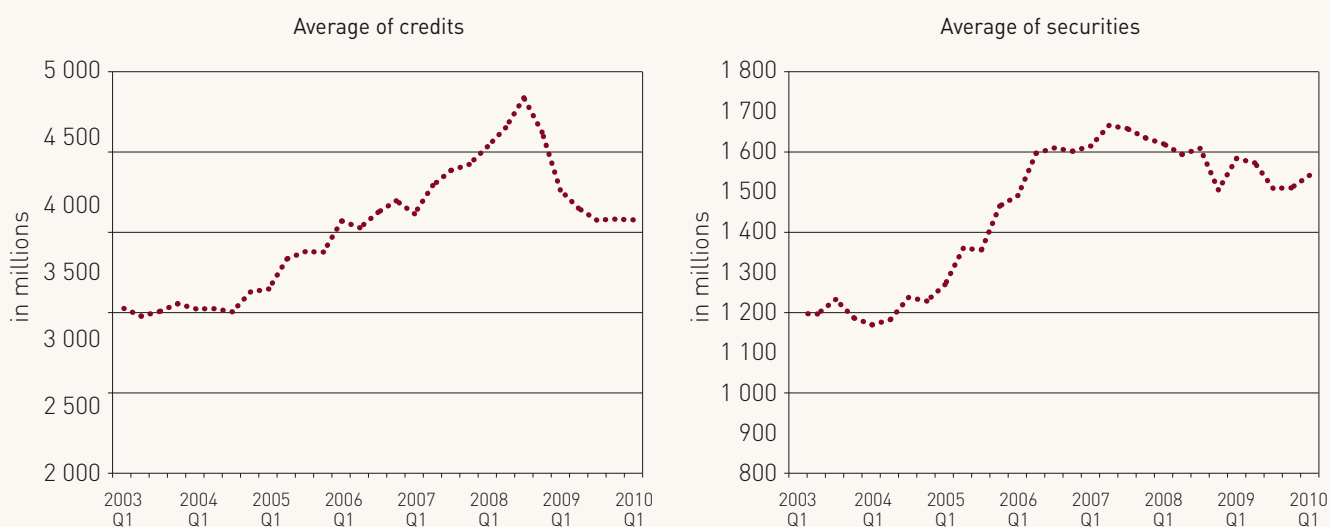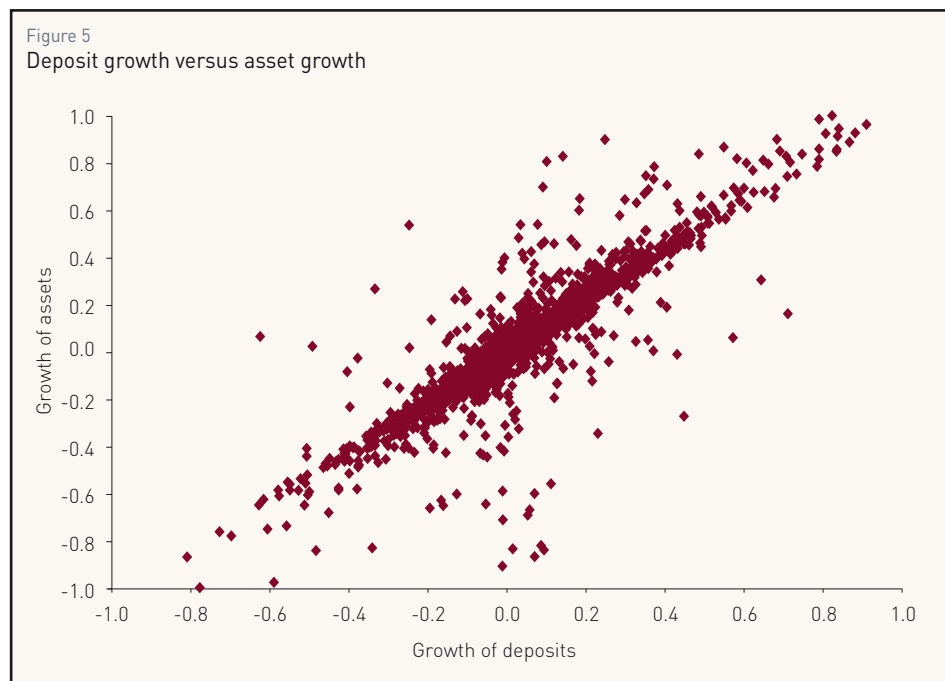
Figure 3
Evolution of assets and own funds

Average of total assets

Average of own funds

Figure 4
Evolution of credits and securities

Average of credits

Average of securities

Figure 5
Deposit growth versus asset growth

3   DESCRIPTION OF ECONOMETRIC APPROACH

The dataset that we construct to complement the descriptive analysis above is an unbalanced panel dataset consisting of 153 banks for the period 2003 Q1 – 2010 Q1. We define leverage as total assets divided by own funds. Own funds include basic capital, assimilated capital and reserves.

We account for the crisis period by defining a dummy called crisis, which is equal to one for the period 2007 Q4 - 2010 Q1. The date 2007 Q4 coincides with the beginning of the turbulences, where confidence, industrial production, GDP and the stock index started to decline.

Table 1 presents the summary statistics. Since most of the macroeconomic expectation variables are highly correlated, we decided not to use these simultaneously in the regressions but study their respective impacts individually.

Table 1:
Summary statistics

Variable	Mean	Stand. Dev.	Min.	Max.	Source
Growth in leverage	0.005	0.194	-0.878	0.992	BCL statistical tables
Consumer confidence	-0.525	6.188	-17	8	BCL, seasonally adjusted
Euribor-OIS spread	0.335	0.305	-0.18	1.04	ECB SDW
Herd effect	-0.001	0.016	-0.046	0.045	Authors' calculations
Growth in EU GDP	1.024	2.304	-5.18	3.56	ECB SDW, seasonally adjusted
EuroStoxx 50 index	299.7	73.2	177.4	440.8	ECB SDW, seasonally adjusted
Unemployment (%)	4.405	0.701	3.276	6.035	BCL, annual % change, seasonally adjusted
Crisis	0.334	0.471	0	1	Authors' calculations

Our econometric model is

$$growth(L_{it}) = \alpha \times growth(L_{it-1}) + X_{it-1}\boldsymbol{\beta} + v_i + d_t + \varepsilon_{it}, \qquad (1)$$

where we explain the growth in leverage by its lagged value (to account for dynamic effects), by a vector of variables X_{it} that we use to explain the macroeconomic environment (confidence, Euribor-OIS spread, EU GDP growth, EuroStoxx 50 index, unemployment and herd effect), by unobserved fixed effects v_i, seasonal dummies d_t and an error term ε_{it}.

The Arellano-Bond estimator is our preferred estimator here as we expect significant fixed effects which should give rise to the Nickell bias.

We now discuss our results variable by variable and present the coefficients of the estimates in brackets with stars denoting the significance levels (*** implies p-value <0.01; ** implies p-value <0.05; * implies p-value p<0.1).

4   OVERVIEW OF THE RESULTS

4.1   Unemployment

Cross-boarder commuters make up a large share of employment in Luxembourg. Since, furthermore, Luxembourg's banks are rather internationally-oriented, it would be surprising to find an impact from unemployment on leverage as a whole. Instead, what is interesting to study is whether the unemployment rate predicts the evolution of credits and deposits to households in Luxembourg. We find that credits to households in Luxembourg are unaffected by unemployment, most likely because banks expect the increase in unemployment to be short-run and they expect little changes to the local collateral values.

In contrast, unemployment affects deposits from households in Luxembourg negatively, albeit only in the crisis (-0.0846***). We believe that the increase in unemployment during the crisis seems to have reduced overall wealth sufficiently in order to be reflected in the amount of deposits held at the banks.

4.2   European GDP growth

Luxembourg is a strongly Europe-oriented banking sector with, on average, 42% of all deposits coming from monetary financial institutions (MFIs), and credits to MFIs averaging 72% of total credits. Thus, we expect European GDP growth to be a proxy for deposit supply and credit demand in Luxembourg.

We cannot find a significant effect from EU GDP growth to leverage growth in the pre-crisis period (-0.00841), but confirm a positive and significant effect during the crisis (0.0205*). This effect during the crisis comes through a positive impact of EU GDP growth on credits (0.0126**) and on deposits (0.0107**). These findings would suggest that the financial sector in Luxembourg, in the build-up to the crisis, might not have been driven by economic fundamentals. In general, one would be inclined to call this evidence for a bubble, with the financial sector getting detached from the real sector.

4.3   EuroStoxx 50 Index

The Dow Jones EuroStoxx 50 Index represents the 50 strongest Blue-chip companies in Europe. Higher collateral values or assets prices should impact leverage positively through an effect on the market-book value and an expectation effect. Our econometric results show that the EuroStoxx 50 Index affected the growth of leverage during both the pre-crisis (0.000169***) and crisis period (0.000347***), with a statistically significantly higher impact during the crisis.

We can show that changes in the EuroStoxx 50 Index impact leverage nearly exclusively through credits and deposits. Thus, we find that banks in Luxembourg do not react to changing asset prices *per se*, but *inter alia*, to the news that comes with changes in asset values. In this sense, changes in portfolios in Luxembourg are not necessarily related to marking-to-market but instead to changes in expectations and collateral values.

4.4   Euribor-OIS spread

The Euribor-OIS spread is the difference between the 3-month Euro interbank offered rate and the Overnight Index Average rate. The 3-month Euro interbank offered rate is the rate at which selected banks can lend three-month unsecured funds in the EU interbank market, and the Overnight Index Average rate is an average interest rate at which those banks can borrow unsecured overnight funding. In general, default risk and liquidity risk induce a positive difference between those two rates. As the financial crisis of 2007 was mainly driven by liquidity risk then the Euribor-OIS spread should reflect the market's view of liquidity problems. Since Luxembourg's banks are liquidity providers, we expect a positive impact from the Euribor-OIS spread on leverage.

We find that in the build-up to the crisis the Euribor-OIS spread is positively associated with leverage growth in Luxembourg (0.0445**) through its impact on credits (0.0679***) and deposits (0.0637***). However, we find no significant impact during the crisis. Thus, an increasing spread indicates that Luxembourg's banks are in a relatively good position to provide inter-group funds more cheaply than if they come from other sources, but we find that this relationship breaks down during the crisis.

4.5   Consumer confidence

The variable consumer confidence is derived from a monthly questionnaire answered by a representative sample of Luxembourg's citizens and is calculated as the average of four questions. These questions are related to the expected financial situation of households over the next year, the expected economic situation over the next year, the expected evolution of unemployment and the expected ability to save over the next twelve months. This variable should reflect the anticipated evolution of the economic situation in Luxembourg. We suggest that consumer confidence also reflects bankers' confidence, with increasing confidence inducing lower risk aversion and an increasing leverage (see also Kiyotaki and Moore, 1997).

Our results suggest that consumer confidence (or expectations) drive leverage during the crisis (0.00596***), but not during the pre-crisis period. Thus, we find that there is indeed a role for the deleveraging process with banks reducing debt (mostly deposits) and shedding assets with decreasing confidence. We, however, do not find that consumer confidence can explain the build-up in leverage. It seems that the build-up is mainly driven by the increasing asset values, suggesting that stock market values and potentially the Euribor-OIS spread are the best indicators for the build-up of leverage.

4.6   Herd effect in deleveraging

Bankers invest according to their expectations, and these should at least partly be driven by the macroeconomic environment and the expectations of others. When one bank sees that other banks sell assets or reduce leverage, then that bank might do the same for several reasons. One reason, taken from Kiyotaki and Moore (1997), is the effect of expectations on collateral. A banker who becomes less confident in the markets attaches a lower expected value to his loan portfolio, and will subsequently be inclined to reduce his lending to those agents whose loans he presumes are too risky. This, for example, arises through a worsening of the collateral values or payback rates. If sufficiently many bankers face this decline in confidence, this will impact collateral values across the markets and potentially generate fire sales of

assets leading to further pressure on asset and collateral values and finally inducing a vicious circle of forced deleveraging even on those banks that otherwise had a sufficiently riskless portfolio.

The argument above can be complemented with the approaches in the literature on herd behavior (see e.g. Chari and Kehoe, 2004; Devenow and Welch, 1996; Calvo and Mendoza, 1996). Herding arises when sufficiently many investors follow a specific behavior, which might induce other investors to disregard their own private information and follow the herd.

We define a bank i's herd effect as the growth rate of the mean of leverage across all banks in Luxembourg at each period, excluding bank i's leverage. This measures a bank's incentive for changing its leverage, given that it observes the average changes in leverage of all other banks in Luxembourg. If all banks deleverage at the same time, then this might induce other banks to deleverage as reductions in asset or collateral values require re-assessments of risks and subsequent portfolio restructurings. In addition to this, the herd effect variable will also take into account that banks might target a similar leverage ratio.

Our main findings are that the herd effect is active only during the crisis period, and it affects leverage growth positively (0.446***). Thus, leverage is strongly impacted by the fact that banks react to the actions of the other banks. However, whether this is due to fire sales or changing expectations is difficult to assess with this variable.

5   CONCLUSION

In this short contribution we studied the impact of several macroeconomic variables on the evolution of leverage in the banking sector in Luxembourg. We found that the only variables that can predict the build-up in leverage before the crisis are the EuroStoxx 50 index and the Euribor-OIS spread. We expect that the EuroStoxx 50 index is mainly indicative for changing collateral values and therefore explains the increase in credits and deposits. In addition, the positive impact of the Euribor-OIS spread on leverage reflects the fact that Luxembourg's banks are liquidity providers. During the crisis period, most macroeconomic variables have a statistically significant impact on leverage, which of course is also driven by the fact that they are all highly correlated. We would need a structural model that explains the relationship behind those macroeconomic variables in order to understand which of these truly forces changes in leverage.

We also find a significant role for the herd effect during the crisis, indicating that banks may react to the deleveraging process that is happening in other banks. This gives some evidence for the fire sales argument and a vicious circle in deleveraging.

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