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Bank Leverage, Credit and GDP in Switzerland: A VAR Analysis 1987-2015

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Abstract: A VAR analysis of Swiss data from 1987 to 2015 provides no evidence for significant long and short run influence of leverage on GDP, credit and the interest rate spread. Increasing capital requirements for banks should therefore have no strong negative macroeconomic effects.

Key words: GDP, credit, leverage interest spread, long and short run impact VAR.

JEL classification: G21, G28

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1. Introduction

A key regulatory objective of the ongoing reform of the financial system is to increase the soundness and resilience of banks. In line with this objective, regulators massively increased common equity capital requirements during the last eight years. The industry has been critical of stronger capital and liquidity requirements pointing out that this would ruin their business, discourage lending and endanger economic growth. The banks' argument is based on the observation that banks finance their lending using a combination of debt and equity funding. As the latter is more expensive banks' overall funding costs increase and are passed on into widening credit spreads and higher interest rates. This in turn reduces lending and ultimately triggers a reduction in the long run growth path of real GDP. It is well known that this argumentation neglects the Modigliani-Miller theorem which suggests that the increase in capital may not have a strong effect on total capital cost. Accordingly, more equity would reduce the riskiness of the equity returns and the required rates of return on equity and debt with no or only a partial effect on total cost of capital and on lending rates. Indeed, there are several studies pointing to the empirical relevance of the Modigliani-Miller (M-M) effects (Kashyap et al, 2010; Miles et al, 2012; Junge and Kugler, 2013; Junge and Kugler, 2017) and showing that the long run or steady state effect of increased capital requirement on GDP is relatively weak. However, it is of interest to consider also the short run cyclical interrelationship of GDP, credit, leverage and the lending spread. Even if there is no large long run effect there could be a strong short run impact of leverage on credit and GDP. To our knowledge, the cyclical interaction between GDP, credit, leverage and the lending spread has not been addressed so far.

We provide an empirical analysis using quarterly Swiss data from 1987 to 2015 using VectorAutoRegression (VAR) and conintegration methodology. The Swiss case is interesting for several reasons. Firstly, the size of Swiss banking system is large as banks' balance sheets reached a peak level of more than six times GDP before the recent financial crises. Secondly, there are two large banks which are classified as Global Systemically Important Banks which were subject to more stringent capital requirements in the framework of a Too Big To Fail legislation. Thirdly, Switzerland went through a severe banking crisis in the early 1990ies before the bursting of the IT bubble in 2001 and the subprime crisis of 2007-09.

The remaining content of the paper is organized as follows. Section 2 displays the data and compares the development of GDP and credit growth as well as the interest rate spread in the leveraging period before the big financial crisis of 2007 to 2009 and the development of these variables during the deleveraging process thereafter. In section 3 we address the main aim of the paper and test empirically to which extent the increases in bank capital levels fed into higher spreads and lower credit and GDP growth. To this end we use a VAR which is the standard tool in order to analyse dynamic interaction without strong a priori assumptions. In this exercise we take into account the integration and cointegration properties of the series. Section 4 provides our conclusions.

2. Higher capital requirements: the recent experience

The Institute of International Finance (IIF)[1] maintained in September 2011 that the economic impact of the new Basel III framework will be significant in terms of higher lending rates, lower credit volumes and lower GDP growth. For the USA, the Euro area, UK, Switzerland and Japan the IIF predicted an average increase of bank lending rates by 364 basis points (bps), a decline of credit volumes and an annual real GDP loss 0.7 % over the period 2011 to 2015.[2] The specific forecast for Switzerland was: an increase of lending rates by 93 bps and an annual GDP loss of 0.8%. None of this happened neither for Switzerland nor the other countries. As for Switzerland Table 1 shows that Credit Suisse and UBS raised their common equity[3] ratio from a low level of somewhere between 2% and 4% before the financial crisis to a 10% (Credit Suisse) and 14% (UBS) at the end of 2014. Yet credit spreads shrank and credit volumes expanded in general compared to the pre-crisis period. The average annual growth of credit volumes to companies was larger in the period 2010-14 than in the period 2003-2007. On the other hand, the growth rate of residential mortgages used to be somewhat larger in the pre-crises period than the period 2010-14. Similar observations were made for other countries as shown by Cecchetti (2014). Based on a detailed analysis including 15 countries, he concluded that "capital requirements have gone up dramatically, and bank capital levels have gone up" but "lending spreads have barely moved, bank interest rate margins are down and loan volumes are up." One may argue that many other influences were present in the years since the outbreak of the financial crisis, notably an exceptionally accommodative monetary policy. This is not denied, however the equating of higher capital requirements with an automatic negative macroeconomic impact as sometimes maintained by the banking industry is not supported by the evidence.

[1] The IIF is the global association of the financial industry.
[2] IIF (September 2011), The Cumulative Impact on the Global Economy of Changes in the Financial Regulatory Framework, Table I.1, p 10.
[3] The exact ratio of Common Equity or of CET1 to RWA is not known from the period before the introduction of Basel III. However, based on comparisons between today's Basel III capital definitions and the capital definitions under Basel II one can roughly calculate the size of capital ratio in terms of common equity. See Annex 4 for further details related to the conversion of capital definitions between Basel III and Basel II.

Table 1: Switzerland: capital levels, interest rate spreads and credit volumes

Periods	Common Equity in % of RWA	Interest Rate Spreads		Annual % change in Credit Volume to Companies		Annual % change in Residential Mortgages
		Mortgages minus Saving Deposits	Net Interest Margin	Utilisation: Other loans than mortages	Mortgage loans	
2003 - 2007	about 2%-4%	2.60%	0.82%	-1.67%	0.71%	5.70%
2010 - 2014	in Q4 2014: CS:10.3%* UBS:	2.44%	0.76%	-0.52%	5.90%	4.45%

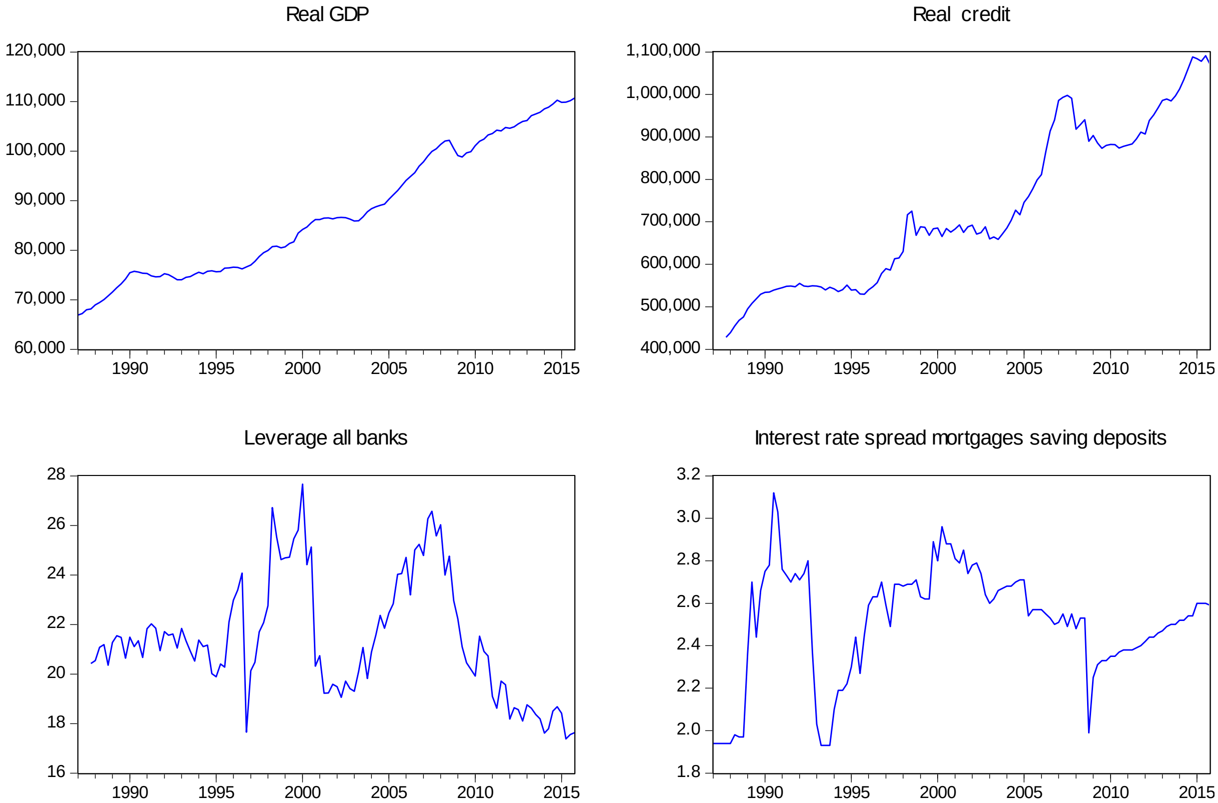
* Measured as CET1
Sources:
CS and UBS: Annual Report 2014;
Mortgages with variable interest rates and Saving Deposit Rate: SNB Historical Statistics, Monthly Bulletin of Banking Statistics;
Net Interest Margin: Net income as a % of Balance Sheet Assets, SNB Statistics, Banks in Switzerland, Tables 1.2 (Assets) and 3 (Income Statement);
Credit Volumes to Companies and Residential Mortgages: SNB Historical Statistics, Monthly Bulletin of Banking Statistics.

3. The dynamic interrelationship capital levels, Spreads and GDP growth

In this section we analyse the dynamic interrelationship between bank leverage and real GDP, real domestic credit and the interest rate spread for Switzerland. We use quarterly data from 1987 to 2016. Bank leverage is defined by the ratio of total balance sheet assets to total equity (book values) of all banks. Correspondingly total (domestic and foreign) credit refers to the amount supplied by all banks. Real values of seasonally adjusted GDP and the credit volume are expressed in 1985 Swiss Francs. The interest rate spread is between the rate on new mortgages and that on saving deposits.

Figure 1 shows the four series from the fourth quarter of 1987 to the fourth quarter of 2015. Real GDP and real credit volume display a growth trend over the nearly 30 years and exhibit sometimes rather strong business cycle variation, most pronounced for the recent financial crisis. The interest rate spread shows a trendless development although with strong variations whereas for the leverage we see a strong leveraging and deleveraging pattern in the IT bubble and its bursting as well as particularly strong around the big financial crisis of 2007-09.

Figure 1: Real GDP, Real Credit, the interest rate spread and the leverage of large banks, CH, 1987/4-2015/4



Data source: Real GDP: https://data.snb.ch/de/topics/uvo#!/cube/gdprpq, seasonally adjusted quarterly growth rate, cumulated in 1985Q1 prices. Domestic credit: https://data.snb.ch/de/topics/banken#!/cube/bakredsekbm), monthly data, last month of quarter, seasonally adjusted. Leverage: https://data.snb.ch/de/topics/banken#!/cube/bab, balance sheet/equity (Eigene Mittel), monthly data, last month of quarter. Interest rates: https://data.snb.ch/de/topics/ziredev#!/cube/zikrepro, monthly data, averaged to quarterly values.

In a first step we analyse the trend properties of the series at hand. Real GDP and real credit could be trend or difference stationary whereas the interest rate spread and leverage may be driven by drift-less random walks. Table 1 contains the results of the Phillips-Perron unit root test (PP) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity test without and with deterministic trend for leverage/interest rate spread and GDP/Credit, respectively.[4]

[4] The PP unit root test considers the null hypothesis of a difference stationary or I(1) series whereas the KPSS test is based on the null hypothesis of a (trend) stationary series.

Table 2: Unit Root and Stationarity Tests for Log GDP, Log Credit, Interest Rate Spread and Leverage Large Banks, 1987/4-2015/4

Series	PP	PP with trend	KPSS	KPSS with trend
Log GDP	-	-2.129	-	0.159**
Log credit	-	-2.903	-	0.0536
Interest rate spread	-3.138**	-	0.1582	-
Leverage	-2.426	-	0.2167	-

Notes: Lag length for the nonparametric autocorrelation correction is equal to 3 (selected automatically according to Newey-West and Bartlett kernel). *, **, *** indicates significance at the 10, 5 and 1% level, respectively.

Table 2 indicates that GDP is a difference stationary or I(1) series. In this case the unit root hypothesis cannot be rejected at the 10% level and the stationarity hypothesis is rejected at least at the 5% level. For domestic credit and leverage the test result are inconclusive as both hypotheses cannot be rejected. Finally the interest rate spread appears to be stationary: the unit root hypothesis is rejected at the 5% level whereas the KPPS statistics for the null of stationarity is clearly below the 10% critical value of 0.3447.

The pattern of results of Table 2 suggests that three variables are potentially I(1) series and qualify therefore for a cointegration analysis. A priori we conjecture a long run equilibrium relation between domestic credit (KR), GDP and bank leverage (LAB) which can be interpreted as a long run credit supply function. Table 3 provides the estimation and test results of the Fully Modified OLS method.

Table 3: Cointegration Estimates and Tests for Log GDP, Log Credit, and Leverage, 1987/4-2015/4

$$\log(KR_t) = b_0 + b_1 \log(GDP_t) + b_2 LAB_t + u_t$$

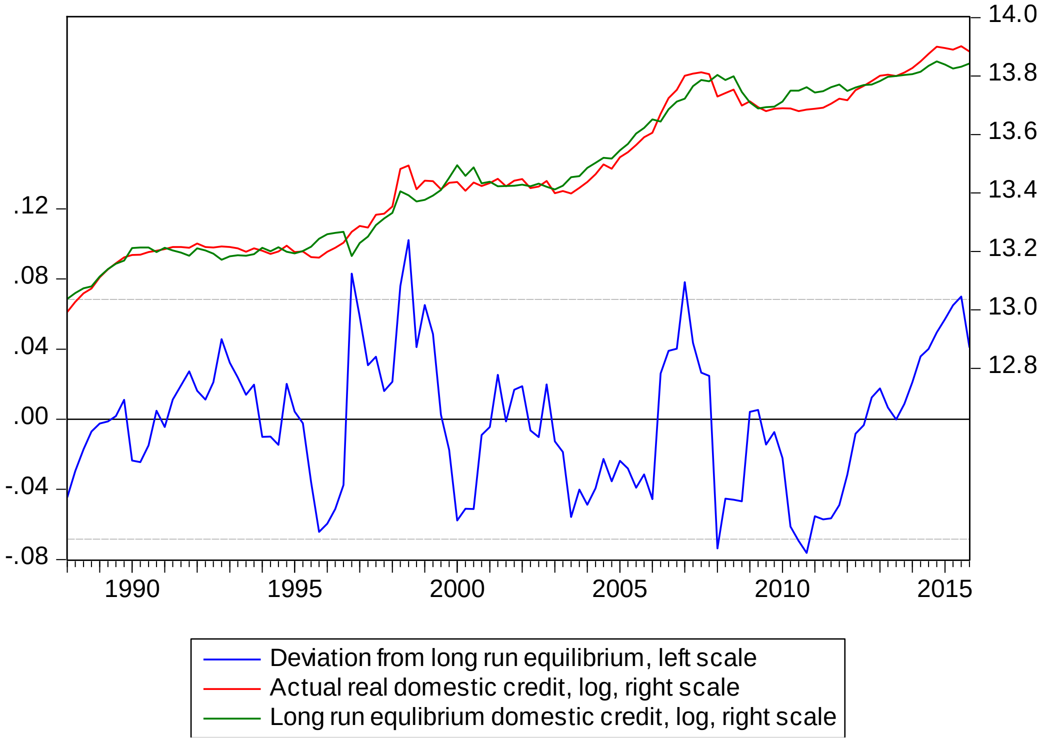
b_1	b_2	R^2	DW	Philipps Ouliaris τ-Test	Hansen Test
1.778*** (0.04584)	0.0142*** (0.001257)	0.977	0.448	-3.938**	0.666**
1.722*** (0.0616)	0	0.964	0.233	-3.197*	0.193

Notes: Newey-West standard errors in parentheses. *, **, *** indicates significance at the 10, 5 and 1% level, respectively.

Table 3 provides no clear evidence for the cointegration of the three variables. The coefficient of leverage is relatively small and the null hypothesis of no cointegration can be rejected by the Philipps-

Ouliaris test at the 5% level, but the null hypothesis of cointegration is also rejected by the Hansen test. We get more evidence about the cointegration when we consider only the long run relationship between credit and GDP. The null hypothesis of no cointegration is marginally rejected whereas the null hypothesis of stationarity could not be rejected. Figure 2 shows the fit of the regression including only GDP as well as its residuals. We clearly see two periods of strong excess credit with a deviation of 8 to 10% from equilibrium, namely 1997-2000 and 2006-2007. Moreover, the recent real estate boom in Switzerland is also visible with a peak deviation of around 7% in 2015.

Figure 2: Cointegration Estimates Log GDP and Log Credit, 1987/4-2015/4



Our cointegration analysis provides evidence that GDP and credit are cointegated, but there is no clear evidence for a long run influence of leverage on GDP, credit and interest rate spread. This observation is consistent with the prima facie evidence presented in Junge and Kugler (2013) that there is no discernible long run relationship between leverage on the one hand and the size of interest spreads and economic growth on the other hand.

In the next step, we consider the dynamic short run interrelationship of all four variables. As we have no clear cut results on the nature of the trend and non-stationarity of our data we estimate a level VAR including a deterministic trend as well as two crisis dummy variables which are zero before the first quarter of 1991 (2007) and one thereafter, respectively. This allows us to take into account the reduction of the Swiss GDP trend path caused by the two serious banking crises (Junge and Kugler, 2013). We adopt a lag length of four which is optimal according to the Akaike-criterion as well as a sequential likelihood ratio test[5].

The contemporaneous correlation between the residuals of our four VAR equations are low except those between GDP and credit on the one hand and credit and leverage on the other hand which are statistically significant and 0.253 and 0.295, respectively.

Figure 3 shows the generalized Impulse Response (IR) of the VAR model. This approach, introduced by Pesaran and Shin (1998), treats both variables symmetrically and not asymmetrically as the standard Choleski decomposition with its recursive representation of residual correlation. In general the IR shows the dynamic reaction of all four variables to an exogenous ceteris paribus shock to each of these variables. The shock is one standard deviation of the residual of the corresponding VAR equation. In addition, the point estimates of two standard error bounds are given. We observe a strong positive and statistically significant feedback relationship between GDP and credit with adjustment in both variables to both shocks extending over 12 quarters. Leverage has a similar impact pattern on GDP and credit although it is only marginally statistically significant. There is, however, a statistically significant hump-shaped positive response of leverage to GDP and credit shocks. Therefore, our results suggest a dynamic interaction between leverage, GDP and credit, where the dynamic effect of GDP and credit on leverage is more discernible than the effect of leverage on the former variables. Note however that the interest spread shock has no statistically significant effect on the three other series and the spread is itself not significantly influenced by the other three shocks, in particular not by changes in leverage as it is often maintained by the banking industry.[6] In sum our evidence supports the view that changes in leverage have no major impact on GDP and credit, neither directly and definitely not via the interest rate spread. This pattern is clearly not consistent with the argument that less leverage (more equity) raises banks' aggregated cost of funds and reduces strongly via widening interest spreads credit and GDP. However, as we observe some feed-back from leverage to credit and GDP we interpret this as evidence that the M-M offset is less than perfect.

[5] The Schwarz criterion and the Hannan-Quinn-criterion points to a lag length of one which, however, seems to be too restrictive in order to capture the dynamics of quarterly data.

[6] In a recent study supported by UBS, Bernardi, S. et al (2015) claim that substantially higher capital leads to material increases in lending spread in Swiss loan markets.

Figure 3: Generalized Impulse Response, VAR(4), GDP (LGDP), Credit (LKR), Bank Leverage (LAB) and Interest Rate Spread (INTSPREAD), 1987/4-2015/4

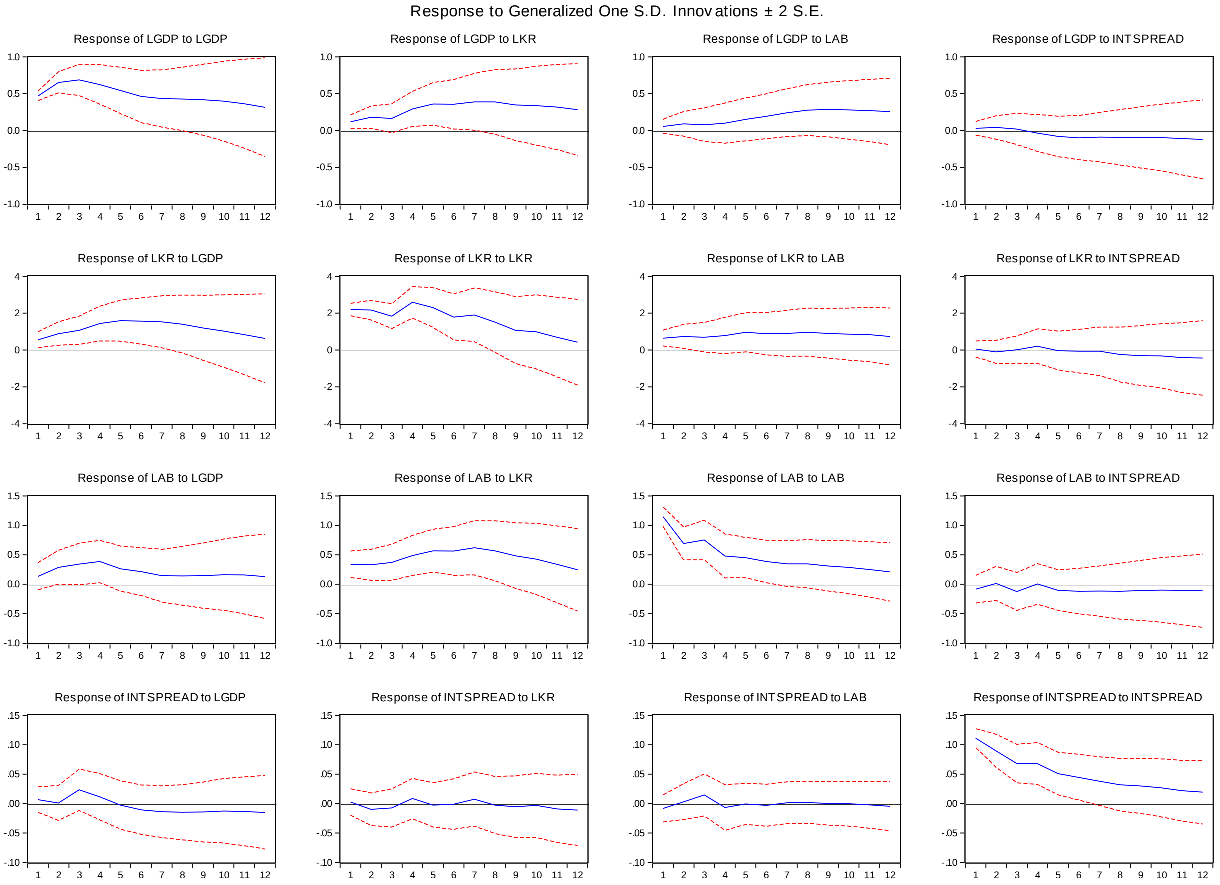
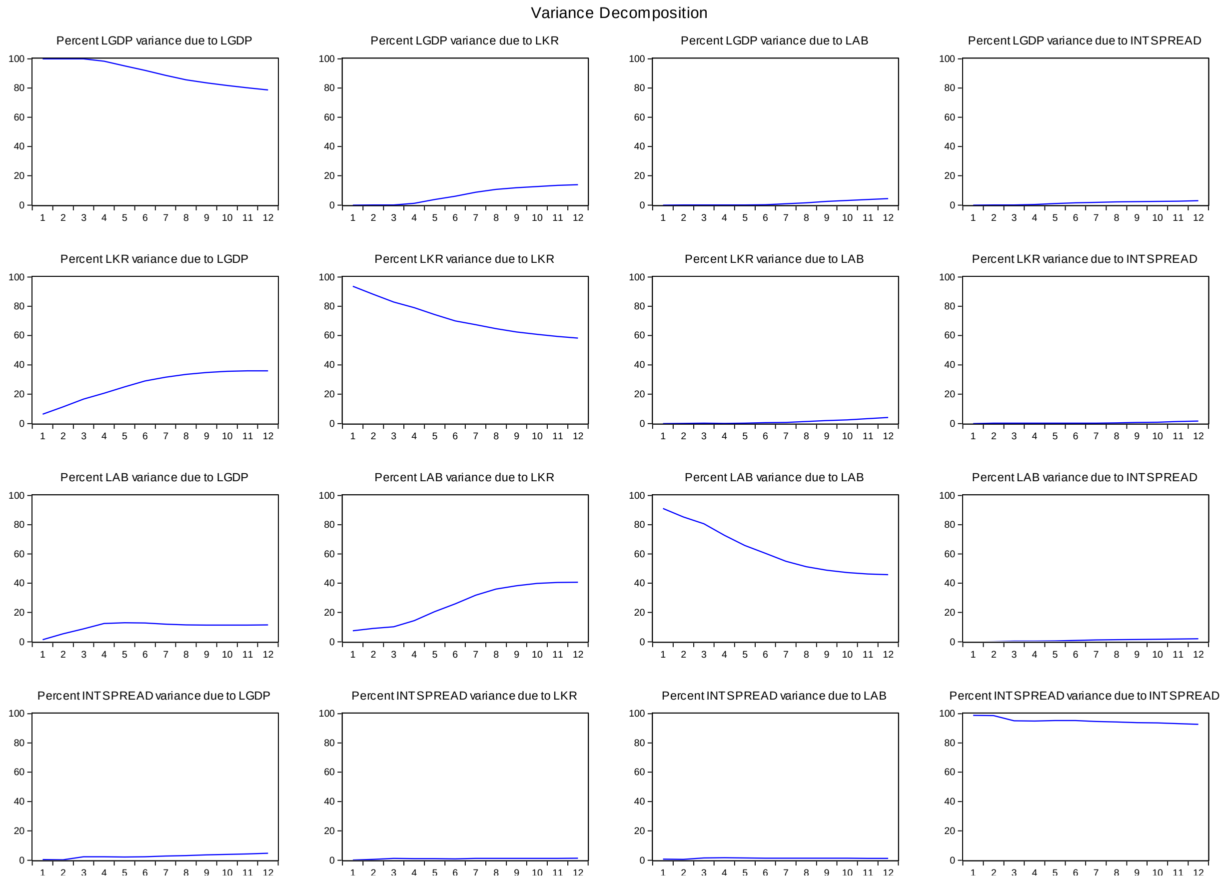


Figure 4 shows the variance decomposition for our VAR model. It decomposes the forecasting variance of all variables with horizons of 1, 2, 3, …..12 quarters into the contribution of all four shocks and it is necessarily based on a Choleski decomposition. This exercise shows that variation of GDP is even with a horizon of 12 quarters to nearly 80 percent caused by own shocks. Domestic credit shocks account for 15 percent with a 12 quarter forecasting horizon. Leverage and spread shocks appear completely unimportant over a three years horizon for GDP forecasting variance. The same applies for credit with a variance share attributed to GDP shocks rising to 40 percent over the 12 quarters horizon. The combined forecasting variance share of leverage attributed to GDP and (in particular) credit shocks increase to 50 percent over the three years' horizon. The variance decomposition supports our conclusion from the IR-analysis: Leverage shocks are not important for the variation of GDP, credit and the interest rate spread, but GDP and in particular credit shocks are important determinants of leverage variation over a three years forecasting horizon.

Figure 4: Variance Decomposition, VAR(2), GDP (LGDP), Credit (LKR), Bank Leverage (LAB) and Interest Rate Spread (INTSPREAD), 1987/4-2015/4



4. Conclusion

The empirical analysis of the long and short run relationship between GDP, bank credit, bank leverage and the interest rate spreads using Swiss data from 1987 to 2015 leads to the following conclusion. Firstly, there is evidence that GDP and credit are cointegated, but there is no clear evidence for a long run influence of leverage on GDP, credit and interest rate spread. Secondly, there is a positive short run feedback interactions between GDP, bank credit and leverage over a time span of up to 12 quarters in a VAR model. However, leverage has only some marginally significant positive dynamic impact on GDP and credit but is itself strongly and highly significantly affected by these variables. The spread has neither a significant dynamic influence on the other three variables and appears itself not to be influenced by them. A forecasting variance decomposition up to a horizon of 12 quarters reinforce the observed impulse responses. It shows that only a small part of GDP variation can be attributed to bank credit whereas the contribution of leverage and spread is practically inexistent. Similar observations apply to credit. Leverage variance in turn can be attributed to a sizeable extent to credit shocks.

Obviously, the time series analysis presented in this paper remains very general. It does not take into account differences between banks (size, capital composition) or changes in asset and capital composition. Nevertheless, the presented evidence provides little support that higher capital requirements for banks imply widening credit spreads, shrinking real credit volumes and lower real GDP growth as often assumed by the banking industry. It rather appears that strengthening bank capital has no sizeable negative impact on long and short run Swiss GDP development as predicted by the M-M theorem.

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