
Modeling non-maturing savings volumes

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ABSTRACT

In Basel II the regulators stress the importance of finding realistic volumes models for non-maturing accounts (NMAs), given their cash-flow uncertainty due to optionality. Focusing on Swiss savings accounts, we identify their seasonal pattern and we derive their sensitivity to market rates and to relevant macroeconomic factors. We derive a realistic volumes model, that allows for cash-flow forecasting, which is essential for liquidity management in banks.

Keywords: *non-maturing savings accounts, savings volumes, market rates macroeconomic, factors regression analysis VAR*

JEL classification: C13 – Estimation, E4 - Money and Interest Rates, G2 - Financial Institutions and Services

1. INTRODUCTION

Non-maturing accounts (NMAs) are characterized by two options: first, the bank is allowed to adjust the client rate at any time as a matter of policy and second, clients are allowed to withdraw their investments or to repay variable mortgages at any point in time without penalty. Therefore, the future cash flows from the client rate payments and the volume changes of these positions due to the demand for retail products are uncertain. In this context, Basel II stresses the importance of finding realistic client rate and volumes models for NMA, given the uncertainty of cash-flows due to optionality.

The evolution of product volumes on the level of individual banks has received less attention among researchers. This may also be attributed to the fact that data are not publicly available. In the context of NMA valuation and risk management, some authors model the product volume as a deterministic function of market and/or client rates, see [1], [3], [4], [5] or [6], which implies the simplistic assumption that the volume dynamics can be fully explained by interest rates. In contrast to this, [7] note that correlations between market rates and deposit volumes on the German market are not particularly high. Macroeconomic variables are often mentioned as important measures of systematic market effects, but rarely applied. It is far more common to include a deterministic time trend, as a proxy for macroeconomic influences, probably also due to the fact that forecasting such variables is far from trivial (see [2]).

The objective of this paper is to offer a comprehensive analysis of the Swiss NMA savings volumes dynamics, given their sensitivities to the client rate¹, to market rates and to relevant macroeconomic variables. We also identify seasonal patterns, which helps us to get important insights about the behavior of Swiss depositors.

2. MODEL

We use in our analysis NMA savings data at an aggregate level over all Swiss banks, as published by the Swiss National Bank (SNB). We derive a forecasting model for volumes based on the investigation of the goodness with respect to all single liquid swap rates (source: Datastream). Short-term as well as long-term maturities are considered in the analysis. We also investigate volumes sensitivities to relevant macroeconomic variables: monetary aggregate (M1), Consumer Prices Index (CPI), Swiss Performance Stock Index (SPI) as well as the Swiss Bonds Index (SBI) (source: SNB). We apply regression analysis to test for the constant impact in time of the explanatory variables on the volumes dynamics. The dynamic impact in time will be investigated in an VAR framework by impulse-response analysis (see [8]).

¹ the rates paid by banks to depositors

We adopt the backward approach by including in the regression analysis rates of all maturities, as well as their spreads to the client rate paid by the bank to depositors. We eliminate stepwise those which are not significant. Individual market rates factors for the SNB aggregate savings volumes are derived. We also account for monthly seasonality, to describe typical situations like: tax payments in certain month of the year (Switzerland), or Christmas payments (13th salary), etc. We test for omitted variables to see if adding one of the macroeconomic factors listed above would significantly improve the model performance. We choose as final factors the variables which provide the highest R² statistic to the model. In order to correct for serial correlation, we derive a model in autoregressive form. To avoid spurious results caused by the non-stationarity of market rates and volumes series, we model absolute changes in the volumes.

The representation of our forecasting volumes model is derived below:

$$\Delta V_t = \beta_0 + \beta_1 F_{1t} + \beta_2 F_{2t} + \alpha_t + \varepsilon_t$$

$$\varepsilon_t = c + AR(1)\varepsilon_{t-1} + AR(2)\varepsilon_{t-2} + u_t \quad (1)$$

where F_{1t} and F_{2t} are individual factors derived and α_t represents dummy variables for each month of the year.

3. RESULTS

The OLS estimation results of equation 1 are presented in Table 1. Our results show that for the aggregate Swiss savings accounts the Swap 5 year rate is the market rate which offers the best explanatory power. For each 100 bp increase in the Swap 5 year rate, a decrease of -869.042 mil. CHF occurs. Thus, our model reflects the negative correlation between the savings accounts and market rates. Including more than one market rate in our volumes model we deal with the problem of multicollinearity, since the market rates are strongly correlated. Performing a test for omitted variables (see [9], pp. 137), we found that the Monetary Aggregate (M1) is the only macroeconomic variable which, added to our list of explanatory variables, would bring a significant additional explanatory power to the volumes. Concerning the seasonality pattern, we observe that the winter as well as the summer months are significant. Furthermore, we observe that significant withdrawals occur in June and July. This can be explained by the fact that in many cantons in Switzerland taxes are paid in June or July. On the other hand, the drop can be due to vacation costs. We also observe that in December a significant increase in the savings volumes occurs. This can be explained by the fact that in December the 13th salary is paid (Christmas payments).

Table 1: <i>Volumes model with M1</i>		
dependent variable ΔV_t		
out of sample with split in Dec 2000		
	Coefficient	t-stat
Constant	0	
$\Delta \text{Swap5year}_{\text{lag1}}$	-869.042*	-2.884
M1	0.136*	6.759
JAN	981.612*	2.770
FEB	594.498	1.717
MAR	-168.883	-0.481
APR	139.889	0.401
MAY	39.139	0.112
JUNI	-1556.515*	-4.489
JULY	-707.0705*	-2.030
AUG	275.614	0.795
SEPT	-423.869	-1.216
OKT	-162.759	-0.464
NOV	-99.559	-0.273
DEC	2529.429*	6.978
AR(1)	0.454*	7.119
AR(2)	0.254*	3.987
R ²	0.737	
DW	2.097	

In the context of linear regression analysis we found that the SBI, SPI and CPI do not have a significant constant impact in time on the savings dynamics. We employ the impulse-response analysis in a VAR framework to see if there is a dynamic impact of shocks in one of these variables on the savings volumes (see [8]). The vector of variables includes the discussed macroeconomic factors, as well as one short-term and one long-term market rate. Results are available in figure 1.

The Swiss savings volumes respond to changes in the market rates. Thus, an increase in the Libor 3 month rate and in Swap 5 year rate will have as effect a decrease of the savings volumes after 2-3 months.

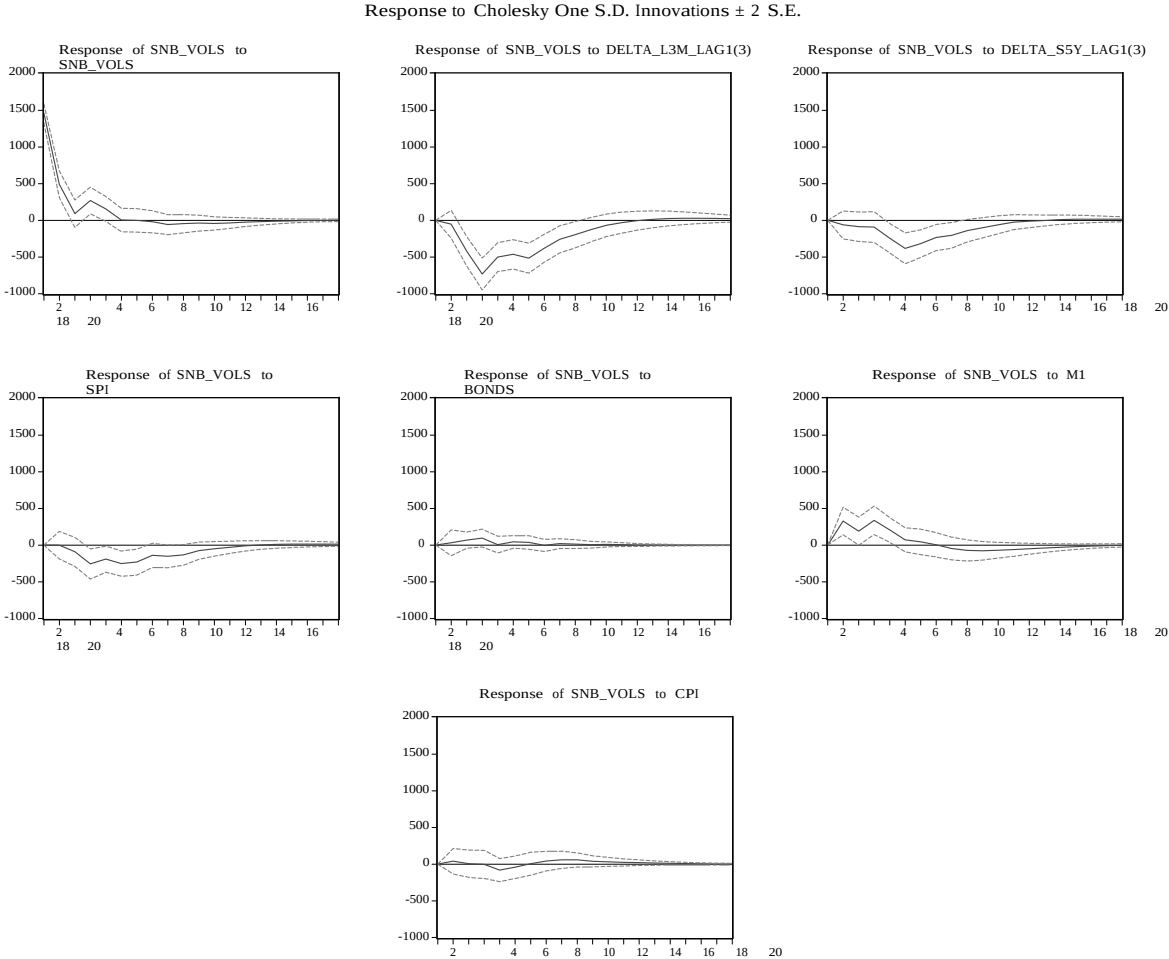
We observe that any shock in the SPI Index will affect the savings volumes after 3 months. Swiss investors shift from their savings deposits to stock investments, if they expect increasing stock markets. From the analysis we cannot conclude a response of the volumes dynamics to shocks in the bond index.

The third graph from the second row of figure 1 shows that the Swiss deposits respond to shocks in the Monetary Aggregate (M1) after 2 months. Because of inflation, the nominal volume is expected to increase.

Overall, our results show no response of the volumes to shocks in the CPI. Therefore, we conclude that the Monetary Aggregate (M1) is a better proxy for the inflation in our investigation.

Figure 1: *Response in $-\Delta V_{all}$*

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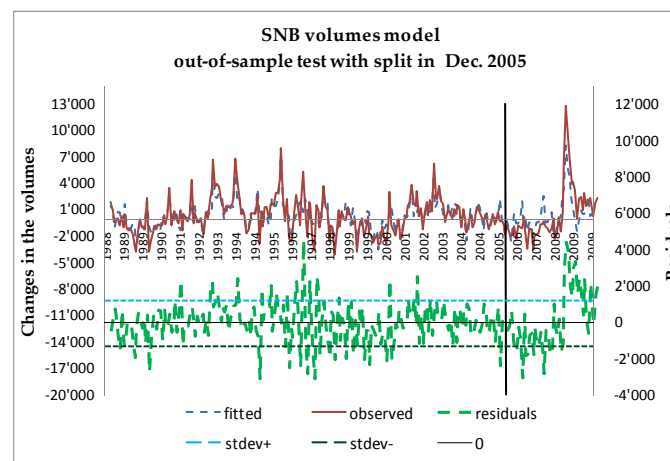
4. MODEL ASSESSMENT – out-of-sample test

In order to test for stability in our estimated coefficients, we test our model out-of-sample. Thus, we re-estimate equation (1) using a shorter data sample (up to December 2005). We use the re-estimated parameters to calculate the model fit out-of-sample and to test, in this way, the forecasting power of the model. The results of the out-of-sample test are presented in Table 2. We observe that also out-of-sample we have a summer/winter seasonality pattern. Significant withdrawals occur in June/July, while in December the volumes of the aggregate Swiss savings accounts increase significantly. The identified model coefficients are stable over time. Figure 2 concludes a good forecasting power of the volumes model. However, during the financial crisis period, in 2008, we observe that the model underestimates the increase in deposit volumes.

Table 2: SNB aggregate savings - out-of-sample test split in 2005

pendent variable ΔV_t out-of-sample with split in Dec 2005		
	Coefficient	t-stat
Constant	0	
$\Delta \text{Swap 5 year}_{\text{lag1}}$	-886.507*	-3.043
M1	0.125*	6.208
JAN	660.342	1.22
FEB	550.743	1.15
MAR	-153.551	-1.14
APR	190.745	0.22
MAY	-124.748	-0.51
JUNI	-1614.674*	-3.75
JULY	-703.1908*	-2.60
AUG	389.020	0.65
SEPT	-210.513	0.26
OKT	-102.601	0.08
NOV	-27.724	0.81
DEC	2716.715*	5.81
AR(1)	5.324557	5.32
AR(2)	2.261132	2.26
R^2	0.73	
DW	2.1	

Figure 2: Volumes model - out-of-sample test split in 2005



5. CONCLUSION

As a general conclusion of our volumes modeling efforts, we found that the market rates are important explanatory factors and have a good forecasting power for savings volumes dynamics. The monthly seasonality factor is important to be considered in modeling volumes of non-maturing savings accounts. Because of inflation, the nominal savings volumes is expected to increase. Swiss investors shift from their savings deposits to stocks investments with increasing stock markets. All these findings help banks to understand depositors' behavior. This is essential for cash-flow forecasting, which helps banks to plan a sufficient cushion of liquid assets, as hedge against a range of liquidity stress events.

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