The SNB survey on loan quality: a qualitative survey in a quantitative "suit"?

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1. Introduction

This paper describes the innovative design of the Swiss National Bank (SNB) survey on loan quality, which is based on a non-harmonised data source. Implementing a statistical survey using a non-harmonised data source raises several problems, in particular with respect to data comparability. The paper describes in greater detail how the survey deals with these problems and places special emphasis on the modified calculation of quartiles, which is one of the key elements of the survey in its final form.

The paper is structured as follows: Section 2 discusses the need for an assessment of loan quality and gives a brief overview of some possible data sources for this assessment. Section 3 looks more closely at probability of default and the associated concept of expected loss, which are the core indicators of the SNB's survey on loan quality. Finally, placing emphasis on the description of the modified quartile calculation, the current survey design and possible data usage is explained. Section 4 concludes.

2. Loan quality, loan quantity and data needs

2.1 Overview

The core business of commercial banks is to transform deposits into loans. This activity exposes banks to liquidity risk, interest rate risk and credit risk. Credit risk depends on the quality of loans. If commercial banks lend imprudently, they finance unprofitable firms and projects. If these firms fail, this creates costs to the bank and to the firms' own creditors. In a fragile environment, such costs can lead to contagion, whereby the failure of some firms triggers the failure of other firms and/or banks. As a worst case, the impairment of a single bank threatens the banking sector as a whole. Hence, regulators and central banks should be concerned about banks' credit risk, i.e. the quality of their banks' loan portfolios.

2.2 The ideal survey and the real world

The quality of a loan depends on the quality of both the borrower and the collateral. Ideally, in addition to information on the quality of the collateral, all possible socioeconomic characteristics of individual borrowers would be collected on a continual basis, in order to obtain a broader understanding of interdependences with respect to the development of microeconomic and macroeconomic factors. However, for obvious reasons, this is not possible. In the case of Switzerland, it should furthermore be noted that, while the SNB is mandated to contribute to financial stability, it does not have the legislative authority to regulate[1] how banks should deal with credit risks. Therefore the SNB has to base its

[1] In Switzerland the state regulatory body is the Swiss Financial Market Supervisory Authority (FINMA). FINMA is endowed with supreme authority over banks, insurance companies, stock exchanges, securities dealers and collective investment schemes.

assessment of loan quality on existing data. In this regard, four different data sources can be considered:

- market data
- balance sheet data
- non-public data collected by the supervisory authority
- existing data from the banks' risk management systems.

Market data-based indicators, such as spreads on corporate bonds or prices for credit default swaps, have the advantage that they reflect all the information in the market and that they are readily available. Unfortunately, market indicators are not available for households or small and medium-sized companies – groups that make up the largest part of banks' loan portfolios in Switzerland. Furthermore, even if data were available for most of the relevant entities, information is still lacking on whether individual banks have exposures to these entities. Thus, market data is not well suited for the assessment of loan quality.

All kinds of borrower type are represented in banks' balance sheet data. Balance sheet-related items like write-downs or new loan loss provisions point to a materialisation of credit risk. Probably the most common indicator for describing loan portfolio quality is calculated as the ratio of non-performing loans to total lending volume. This indicator is a backward-looking indicator, i.e. it is an indicator that provides a description of the path of defaulted loans in the past, but offers limited forecasting possibilities. Furthermore, this indicator has the disadvantage that it does not provide any information on the coverage of non-performing loans (e.g. the existence of collateral).

Indicators that take into account the existence of collateral can be obtained from the data of supervisory authorities. Swiss legislation prescribes minimum capital requirements based on the Basel capital adequacy framework (Basel II) of the Basel Committee on Banking Supervision. An overall measure for credit risk is the capital required as backing for credit risk – a higher level of risk leads to an increase in required capital. However, it should be borne in mind that banks can choose between three different approaches[2] for determining their credit risk exposure for capital requirements. The most commonly used approaches classify the economic entities into relatively broad risk weight categories, so that they do not make differentiated distinctions with respect to credit risk distribution. Moreover, the risk weights are not regularly adapted, i.e. the defined risk weights are constant over a longer period. Finally, this data source does not provide a breakdown by industry, which is a key element in determining a risk profile.

To summarise: these data sources have specific advantages and disadvantages, although none of them are well suited to the requirements of the SNB. What all indicators have in common, though, is that they focus more or less on the probability of default. This is an indicator that attempts to measure the probability that a loan is becoming non-performing. It is often used in the banks' internal risk management systems. One main advantage is that it is, by definition, a "forward-looking" indicator, i.e. it estimates the probability that a borrower will default within a given period in the future. The possibility of using this indicator in a forward-looking manner explains the increasing interest[3] in using it for financial stability purposes. Since banks' internal risk assessment is based on this indicator, we assume that – in this context – this data source offers the best available data. Furthermore it is worth

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[2] There are two standardised approaches and an internal ratings-based (IRB) approach. The two standardised approaches work with predetermined risk weights for counterparties, whereas only the IRB approach allows an individual assessment of the particular risk weights.

[3] For instance, probability of default is the core of the IRB approach that was introduced as part of Basel II.

mentioning that by collecting information on both the probability of default and the related expected loss indicator, it is possible to derive information on the coverage of loans (e.g. existence of collateral). This is especially important with respect to household loans, which are often mortgages.

The SNB's approach is therefore to collect data from the banks' internal risk management systems. Consequently, the probability of default and the expected loss are the core indicators of the SNB survey on loan quality. We will look more closely at the underlying concepts in the following section.

3. The SNB survey on loan quality

3.1 The core of the survey: probability of default and expected loss

The core indicators used in banks' internal risk management systems are the probability of default (PD) and the expected loss (EL). The PD is the probability that a particular counterparty will default on its obligation within a certain time period (see, for instance, Boemle et al., 2002). Usually the time horizon to which the PD refers is one year. The PD is typically, but not mandatorily, estimated through the use of models which draw on macroeconomic and socioeconomic variables. Generally two different approaches are applied in the models: "point in time" and "through-the-cycle" (Balás, 2009). The former estimates the PD on the basis of the current economic situation, whereas the latter takes into account the long-term trend, i.e. it provides an average value over the economic cycle.

The concept of the PD has gained in importance as a result of the increasing popularity of risk-adjusted pricing (RAP), which is considered best practice in lending (Spreeman and Gantenbein, 2007). RAP means that the price of a credit contains a "premium", or to be more precise, an additional charge, which should correspond with – and therefore pay off – an expected loss ("standard risk cost"). Therefore the result of RAP is that banks can grant loans with an individual risk premium for every single client, instead of pricing loans via a standard price, including an interest margin. The key variable in the RAP approach is the expected value of the loss for the bank, generally referred to as expected loss. The expected loss can be expressed as a ratio (EL_R) or a monetary amount (EL_M). When estimating the EL_R, the first element that needs to be known is the likelihood that a borrower will default within a given time horizon, i.e. the PD. Second, the EL_R depends on the fraction of the credit exposure that is lost if the borrower defaults (typically expressed as a proportion of nominal). This ratio, usually referred to as loss given default (LGD), is equal to one minus recovery rate (RR). The RR is an estimation of the collectability of the loan and indicates that in a given default only a part of the exposure is lost. Finally the EL_M is calculated by multiplying the EL_R by the exposure at default (EAD), which describes the amount of the exposure at the moment of default. The above-mentioned relations can be expressed in terms of the following equations:

(1) $EL_R = PD * LGD$

(2) $LGD = 1 – RR$

(3) $EL_M = EL_R * EAD$

The variable EL_M reflects the figure which must be compensated by means of a risk premium that has been calculated actuarially. The definition of a default – crucial when calculating EL –

is provided by Basel II.[4] Basel II also introduces an internal ratings-based (IRB) approach, whose core is the estimation of the PD.[5] Opting for this approach requires the application of sophisticated rating models by the banks. Taking the longer-term view, RAP and capital adequacy regulations create in turn a kind of "lemons problem" because banks with more primitive rating approaches fear that poor quality borrowers rejected by banks with sophisticated risk management systems will end up with them. Thus, this development creates market pressure for banks to develop and use sophisticated internal rating systems.

In combination, these two factors – RAP and capital adequacy regulations – will contribute to a continued increase in the use of PD estimates in bank risk controlling systems, and this should, ultimately, result in a steadily improving data base.

At this point it might be worth mentioning that even though RAP and the IRB approach are based on the estimation of the PD, the two concepts target different areas of loss distribution. The aim of RAP is to give a best possible estimation for the provision designed to cover the expected loss, while the intention of the capital adequacy regulation is to estimate the unexpected loss (UL). The reason for this is based on the logic that the expected loss should be covered by the loan loss provisions. Thus, the supervisory capital requirements for credit risk should cover unexpected losses. The difference between expected and unexpected loss is illustrated in Figure 1, which shows a credit loss distribution. The losses that will not be exceeded, with a probability of 99.9%,[6] are called the value at risk. The difference between the value at risk and the expected loss is the unexpected loss.

Figure 1 – Probability Distribution of Potential Losses

Source: Federal Reserve Board (2006)

[4] A default is considered to have occurred with regard to a particular obligor when either or both of the two following events have taken place. 1) The bank considers that the obligor is unlikely to pay its credit obligations to the banking group in full, without recourse by the bank to actions such as realising security (if held). 2) The obligor is past due more than 90 days on any material credit obligation to the banking group. Overdrafts will be considered as being past due once the customer has breached an advised limit or been advised of a limit smaller than current outstandings (cf. Basel Committee on Banking Supervision, 2006).

[5] More precisely: The framework distinguishes two alternatives of the IRB approaches: Foundation IRB (F IRB) and Advanced IRB (A IRB). In the former, the banks only estimate the PD; in the latter, banks are allowed to estimate more risk parameters in addition to the PD, namely LGD and EAD. However, both alternatives are usually only referred to as IRB approach.

[6] Parameters other than 99.9% can be chosen for the estimation of the value at risk.

3.2 Implementation: practical and technical obstacles

The SNB started work on a loan quality survey in 2002. Yet banks will not begin to report data until the third quarter of 2010. It therefore took nearly eight years to implement this survey. Why did implementation take so long? The answer can be split into two parts – a more or less political (or cost-related) reason and a technical (or statistical) reason. At the beginning of the discussions, banks feared that the intention of this survey was to implement an IRB approach for all banks through the back door. This fear was alleviated by clearly stating that the SNB would use the existing data and would not make any prescriptions.[7] The lack of any binding principles with regard to the design of banks' internal risk management systems has led to a non-harmonised data source. The heterogeneity of the different risk management systems, in turn, creates problems of data comparability. These problems, together with technical issues, turned implementation of the survey into a challenge.

In order to obtain a solution to the technical (statistical) hurdles, three main building blocks were necessary:

1) Collection of the location parameters of the PD distribution.

2) Collection of the average values for the PD and EL for every single PD quartile and for the whole population.

3) Modification to the quartile calculation.

Adequate results have mainly been achieved through the third building block, i.e. by modifying the quartile calculation. Collecting location parameters and their related means has provided comprehensive information on PD distribution and loan coverage, and made it possible to handle the heterogeneous data without harmonising it.

The next section will present the survey, placing the emphasis on the modified quartile calculation.

3.3 The final form of the survey

Since separate reporting of data on every single loan is not feasible, aggregated data is reported in the survey. Loan quality is, as mentioned above, gauged by the PD and the EL.[8] By collecting the means of both the PD and the EL,[9] we can accordingly derive average LGD and average RR by applying equations (1) and (2). At this point the question might be raised as to why information on the LGD is estimated and not collected by the SNB. The answer is that many banks do not keep this information in their systems, because the LGD is often only an intermediate result in assessing the EL.

Due to the fact that a statistical average can be biased by extreme values the survey collects the PD quartiles and the maximum PD. This facilitates the handling of heterogeneous data.

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7 These would otherwise have generated considerable costs for the reporting agents.

8 Banks report the one-year PD and the one-year EL.

9 In practice, not all loans are rated by the banks. Some banks estimate only the PD or the EL for some loans. Thus, if we were to mix information for the different loan types in one reporting form (loans with PD and EL together with loans featuring only one of these two parameters), the PD and EL could no longer be mutually allocated (i.e. we would not know if PD and EL are based on an identical population). The estimation of an LGD on the basis of two different independent loans should be classified as a misleading result. To obtain a picture for all loans, and not just for those loans for which we have PD and EL data, information is collected on all loan types separately (loans with PD and EL, loans with only one of either PD or EL and non-rated loans). In the event that only PD or EL is available, banks provide the mean, the quartiles and the mean of the quartiles in each case for the parameter in question.

To ensure that the LGD can be calculated PD quartile by PD quartile the average values of the PD and the EL are also collected for every single PD quartile.

When developing the survey, the question arose as to how the quartiles need to be calculated if we are to obtain useful additional information. Quartiles are usually calculated one-dimensionally. What this means is that the population is sorted by one variable and the resulting output is a value that depends on the number of units of the population. For financial stability purposes, however, the number of loans is much less important than the volume of loans. Thus quartiles based on the number of loans do not provide an adequate result. To illustrate this point, let us take the simplified example of a portfolio of four loans A, B, C, D (see Table 1). In this example we assume a constant LGD of 50%. We also assume that the loan volume is equivalent to the exposure at default.

Table 1

Simplified example

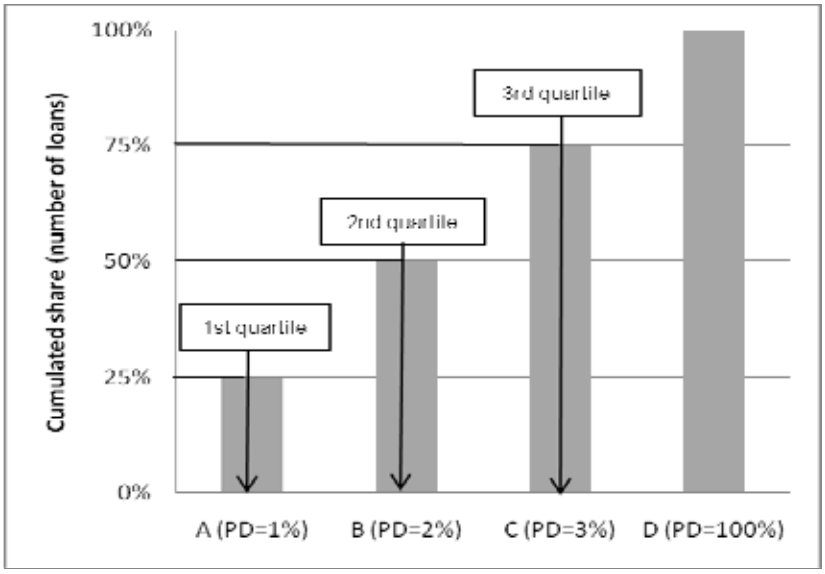
	Loan A	Loan B	Loan C	Loan D
PD	1%	2%	3%	100%
EL	0.5%	1%	1.5%	50%
Loan volume	$2	$3	$20	$75

It is evident that loan D, which has a PD of 100% and a loan volume accounting for 75% of the total loan volume of the given portfolio, is the most important with regard to financial stability.

However, an “ordinary” quartile calculation would undervalue the risk. In our example, with a portfolio of four loans, one loan corresponds to 25% of the population. Thus the result of an “ordinary” quartile calculation would be that the first quartile consists of loan A, the second quartile of loan A and B and so on. Our interpretation would be that 25% of the loans have a PD not exceeding 1%, 50% of the loans a PD not exceeding 2% and 75% of the loans a PD not exceeding 3%. At this point it should be borne in mind that these 75% of the loans only account for a 25% share of total loan volume. The result of an “ordinary” quartile calculation is shown in Figure 2.

Figure 2

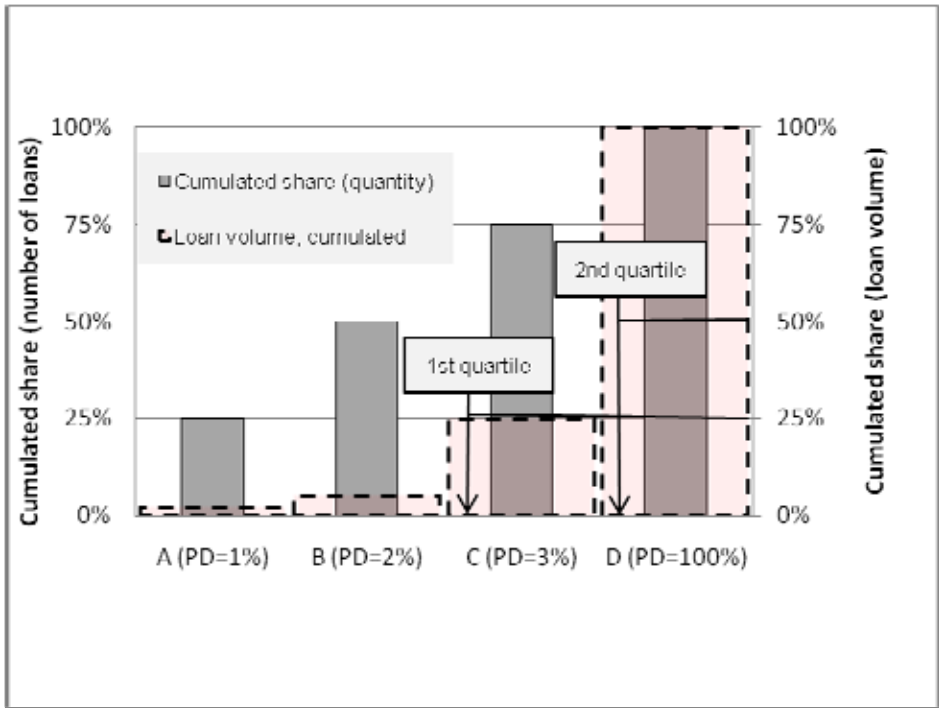
“Ordinary” quartile calculation



As mentioned above, for financial stability purposes the loan volume is the relevant criterion. By adding the relevant loan volume, we obtain the following result: 25% of loan volume has a PD not exceeding 3%.

Figure 3

Modified quartile calculation



The approach adopted for the SNB survey on loan quality is as follows. The information it collects for each individual quartile depends on the quantity of individual loans and has a PD value as its outcome. To obtain this result, the loans are sorted in ascending order according to their PD values, as is done in the "ordinary" quartile calculation. But the criterion whereby the population is divided into four subsets is the loan volume, or more precisely, the cumulated shares of the loan volume. The resulting quartiles are the PD values that divide the volume of the loans into four equal subsets.[10]

Taking up the above-mentioned example, banks would report for the first quartile for which:

- 25% of the loan volume with the lowest PDs has a PD not exceeding 3%
- 25% of the loan volume with the lowest PDs has an average PD of 2.72%
- 25% of the loan volume with the lowest PDs has an average EL of 1.36%
- 25% of the loan volume with the lowest PDs is composed of three loans

We can then estimate that the average LGD of these 25% of the loan volume with the lowest PDs amounts to 50%. For the second quartile they would report the quartile value of 100% and an average PD of 75.6%, and so on. The values of the third quartile would then be equal to those of the second quartile. This result better reflects the risk in the given loan portfolio.

[10] It lies in the nature of this calculation that a single loan will not always exactly match the quartile limits (25%, 50%, 75%). Therefore the quartile PD value is defined as the PD of the loan which lies at least partly below the limit in question.

To assess both the distribution within a quartile and the significance of quartile values, the number of loans is collected. As regards lending volume, the survey is based on the EAD.[11] If the EAD is not available, the amount is approximated by the higher of either the value of any facilities approved by the relevant authority without further credit decision (credit lines), or any facilities actually drawn down.[12] Data on loans collected in this survey are broken down by industry, whereas households figure as a separate category in this breakdown.[13]

To complete the description of the survey, the basic framework is defined as follows: the questionnaire asks for all loans recorded in the balance sheet to be listed under "mortgage claims" and "claims against customers". This ensures that the data can subsequently be compared with other SNB statistics. Data is reported on a quarterly basis at consolidated level, i.e. the reporting entity is the corporate group. Data collection will start as of the third quarter of 2010. 12 banks with a share of more than 85% of domestic lending volume will participate in the survey.

The next section describes how the data can be used for financial stability analyses.

3.4 Use of the data

Usually, financial vulnerabilities are not built up in a single period. Thus time series analysis is crucial for monitoring loan quality. The survey on loan quality provides data that are well suited for this purpose and allow the SNB to keep track of movements in the portfolios of individual banks. In addition to the intra-bank view, an inter-bank view can be obtained by monitoring changes in "spreads" between the different types of means[14] of different banks. This involves comparing movements in the differences in bank means.

One of the main merits of rating systems is in estimating the capital level, be it regulatory capital or economic capital (in terms of the loss provision), that banks have to maintain over the given risk horizon. By, for example, using the UL function defined in the Basel Capital Accord, it becomes possible to establish a certain connection to capital requirements. For instance, it is possible to determine a certain capital level by using the UL formula of the F IRB[15] approach, which defines the required regulatory capital on the basis of the PD estimation of a given bank. This relationship can then be used for macro-stress testing by comparing the capital levels for the bank's estimate of PD X_i and the capital level for a "stressed" PD ($Xi + \Delta X_{st}$). A result of such an exercise would, for instance, be that a 10% deterioration in the PD would result in a 12% increase in required capital. This could then be related to the bank's eligible capital. However, due to the heterogeneity of the data, the results should be interpreted qualitatively rather than quantitatively. In other words, the above-mentioned 12% should not be interpreted literally as 12%, but rather as a risk indicator which should not exceed a certain threshold.

Once the first data are reported, further options are tested.

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[11] Banks are asked to report the EAD without consideration of any collateral, specific provisions or partial write-offs (i.e. gross EAD).

[12] We assume that a borrower will exhaust his credit line on the eve of a default.

[13] Banks with a substantial volume of loans abroad also provide this breakdown for foreign loans. All other banks report only the total amount of foreign lending.

[14] Four types of means are provided in this survey – the mean for the population and those for three quartiles.

[15] See footnote 5.

4. Conclusion

Due to both the heterogeneity of the banks' internal risk systems and the heterogeneity of the models upon which the latter are based, the comparability of the data is restricted to a certain extent. With the way the survey is set up, however, we are convinced that it is well suited for monitoring changes in portfolio quality and for forming a reliable data basis for macro-stress testing.

The innovative design of the survey and especially the modified quartile calculation makes it possible to use an existing data source. Given the fact that, usually, financial vulnerabilities and financial imbalances are not built up in a single period the data basis is sufficient to monitor trends in banks' loan portfolios. Furthermore, we should bear in mind the fact that using an existing data source minimises the reporting burden.

As regards future prospects, this positive assessment is supported by the fact that many banks are currently in the process of improving and enhancing their internal rating systems. Furthermore, some banks emphasised that they do not have adequate PD and EL numbers due to a lack of defaults and the fact that their time series do not consist of a whole business cycle and are therefore too short. For this reason, some banks are currently developing data pooling models.[16] This will further improve the quality of the data.

Despite this positive assessment, the fact remains that the data base is not harmonised. Thus, individual figures reported by one bank cannot be directly compared to those reported by another. To return to the initial question, we might therefore describe this survey – based on quantitative values – as a qualitative survey in a quantitative "suit".

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[16] The resulting concession is that the SNB is granting banks a transition period until 2015 to report the data. All banks have to report the volume and the number of loans from the inauguration of the survey. But data on PD and EL is not to be reported until data are available in the reporting systems.