Interest Rate Setting on the Swiss Franc Repo Market

Sébastien Kraenzlin*

JEL-Classification: C23, E43, E52, E58
Keywords: Repurchase Agreement, Repo, Monetary Policy, Panel Data Econometrics, Collateral, Switzerland

1. Introduction

Repurchase agreements (repos) are secured money market transactions. The cash taker provides collateral in the form of securities and in return receives money from the cash provider. To ensure the continuous covering of the cash amount, the definition of eligible collateral, its handling and valuation play an important role. This mainly as these securities nearly eliminate credit risk. In Switzerland almost all repo transactions, i.e. interbank repos as well as repos with the Swiss National Bank (SNB), are conducted via the highly standardized and automated trading, clearing and settlement system. One of the advantages of this system is, that cash takers (i.e. collateral providers) do not have to select individual securities, but rather have to choose between four different collateral baskets. The four different collateral baskets comprise different security categories. After a collateral basket has been chosen, SIS SegaInterSettle AG (SIS) is assigned with the task of transferring the securities at the beginning and the end of the transaction as well as with the daily valuation of these securities during the term. Furthermore SIS will trigger so-called margin calls if insufficient coverage is given.

* Money Market and Foreign Exchange, Swiss National Bank. Address: Sébastien Kraenzlin, Feierabendstrasse 12, 4051 Basel, Switzerland. E-Mail sebastien.kraenzlin@snb.ch.
The content of the publication is the sole responsibility of the author and does not necessarily reflect the views of the Swiss National Bank. The author would like to thank C. Ravara and U. Beeler for their support before and during the composition of the paper. Additionally I would like to thank P. Kugler from the University of Basel for giving me the opportunity to write my PhD Thesis at the department of monetary macroeconomics and for useful suggestions and ideas on this topic. I am also grateful to M. Arellano for his support concerning the econometric model specification, to K. Hug and M. Schlegel for useful comments. I am indebted to S. Ruckstuhl for providing me with the necessary data. Finally I would like to thank the anonymous referees at the Swiss Journal of Economics and Statistics.

On the Swiss franc repo market – in contrast to other repo systems – the range of collateral that the SNB accepts for its open market operations is also standard for the interbank market. This stands in contrast, for example, to the Eurosystem. The European Central Bank (ECB) accepts, among others, securities with a single 'A' rating and non-marketable assets in its open market operations. These assets are in general not eligible for transactions between banks.[1] The fact that the interbank market in the Eurosystem sets higher standards for the eligibility of collateral shows that risk perception of banks may differ from that of a central bank. In 2002 the SNB conducted a survey, which showed that not all four baskets were equally favored by the participants.[2] This of course raises the question if repo traders treat all collateral categories equivalently with respect to risk considerations – like the SNB – or not. If not, market participants could for example charge a higher interest rate or apply haircuts to the different collateral categories. As latter is not market standard on the Swiss franc repo market, a higher interest rate would be the consequence.[3] An interest rate differentiation is done very often on repo markets. In the U.S. repo market, for example, repo rates on transactions backed by U.S. Treasuries are lower than such against mortgage-backed securities (MBS).

The aim of the paper is to find out how interest rates are set on the Swiss franc repo market. In particular the paper will address the issue of collateral influence, i.e. if the selected collateral basket had an influence on the repo rate. To analyze the pricing behavior the 1 September 2003 is taken as break point. At that date the SNB combined three of the four individual baskets to one collective basket, namely the 'SNB GC Basket'. By introducing the collective basket, the SNB indicated explicitly that it would continue to treat the three different baskets – from a pricing and implied risk point of view – equivalently. The panel data set is thus split in two periods, namely in a pre and a post 'SNB GC' introduction period. Paradoxically, the results from the least squares dummy variable regression show that after – and not before – 1 September 2003, two interest rate curves were traded, when not the collective basket but a specific basket had been chosen. This of course suggests that some banks do not regard the three baskets as equivalent. A possible solution to this peculiarity – which will be discussed in

1 Eurepo – which is the benchmark rate of the large Euro repo market – is solely based on interbank transactions where government guaranteed bonds and bills are provided as collateral, see www.eurepo.org.

2 The survey conducted by the SNB was not published, but is made available by the SNB on request.

3 Papadia (2006), pp. 33 and 40.

this paper – would be to apply different haircuts, which depend on the characteristics of the collateral provided.

The first section of the paper provides a short introduction to the characteristics and development of the Swiss franc repo market as well as to the different collateral baskets. A more detailed overview on the Swiss franc repo market can be found in Veyrassat (2004) and Kraenzlin (2007). The second section will outline the different interest rate components of a secured interbank loan. This mainly to provide a better understanding on the composition of the repo rate. A description on the properties of the dataset as well as the chosen econometric methodology is given in the third section. Finally the regression results are presented in the fourth section. The last two sections discuss the results and provide concluding remarks.

2. The Swiss Franc Repo Market

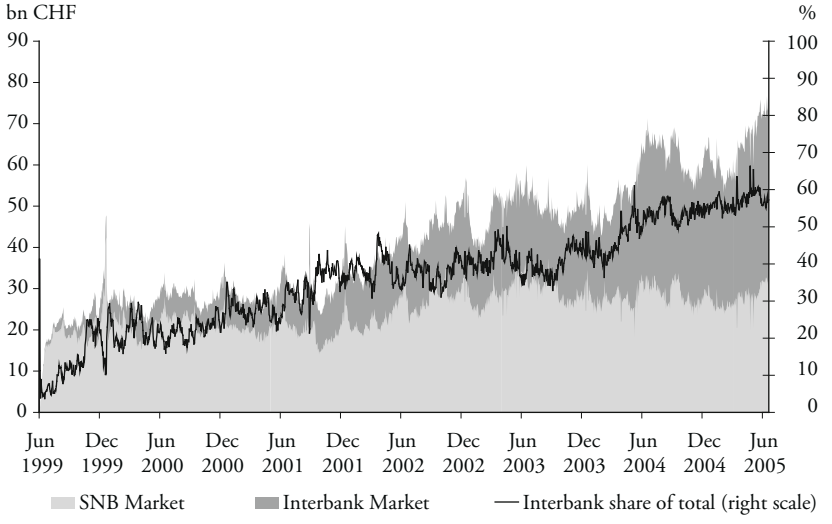
The Swiss franc repo market can notionally be split into two submarkets, namely into a so-called interbank market and a SNB market. All repo transactions that are concluded between banks belong to the interbank market, while repos involving the SNB are assigned to the SNB market. With the adoption of the new monetary policy framework at the end of 1999, the SNB almost exclusively implemented its monetary policy through repo transactions. Currency swaps, which had been the main policy instrument until then, were virtually superseded.[4] The SNB uses fixed rate tender auctions to provide the banking system with liquidity. Until June 2005 auctions were carried out in 97% of the occasions (i.e. 1 481 out of 1 525 business days). Since June 1999 the outstanding volume remained at values between CHF 20 and 30 billion (see Figure 1).

Repo transactions on the interbank market differ from those on the SNB market in three main aspects: Firstly, the allocation of liquidity resources and the price-setting behavior underlie the forces of money supply and demand in a competitive environment and are not predetermined as in the fixed rate tender auction (monopolistic setting). Secondly, not only general collateral (GC) repos, but also special repos can be undertaken. The two types of repo transactions are basically the same, except that the main purpose of a GC repo transaction is to raise short-term liquidity funds, while in a special repo transaction the securities delivered are of primary importance.[5] Thirdly, a wider range of collateral

4 See Jordan and Kugler (2004).

5 See Csoport (2000) for a more detailed description of GC and special repos.

Figure 1: Outstanding SNB and Interbank Market Volume (incl. Intraday)



Source: Eurex

can be used for interbank repos. In addition to the collective basket 'SNB GC Basket', which comprises three individual baskets, participants can also use the 'SMI GC Basket'.

Compared to the SNB market, the interbank repo market has developed rather slowly, surpassing the outstanding volume of the SNB market only in April 2004 (see Figure 1). Dividing the interbank volume over the last five years into the different maturities further shows that on average 50% of the outstanding volume had a maturity of two months and more, while the one week to one month transactions as well as the very short maturities (Overnight, Spot Next, Tom Next)[6] accounted for 27% and 12% respectively.

2.1 The Basket Structure

The definition of eligible collateral, its handling and pricing play an important role in secured interbank transactions. This mainly as these securities nearly eliminate counterparty risk. To meet the high requirements and to provide the participants with a highly standardized system, the SNB defined different security baskets, which can be selected for repo transactions conducted via this system.

Additionally, the system automatically revalues the collateral at market prices (mark-to-market) and thus makes sure that sufficient coverage is provided at all times.[7]

To define the range of eligible collateral present until June 2005 it is again best to notionally split the Swiss franc repo market into two submarkets (SNB and interbank market). Eligible for repo transactions with the SNB are all assets that belong to the 'CHF GC Basket', the 'Euro GC Basket' and the 'German Jumbo Pfandbriefe GC Basket' (hereinafter 'Jumbo Basket').[8] To facilitate the collateral management these three baskets were combined to a collective basket, namely the 'SNB GC Basket', on 1 September 2003 (see Figure 2 for an overview on the revisions of the basket structure). However, the individual baskets still continue to exist. For interbank repo transactions, banks can additionally use the 'SMI GC Basket', which encompasses all components of the Swiss Market Index (SMI). In contrast to the other baskets, where the securities can be used for all maturities, the 'SMI GC Basket' can only be used for Overnight, Tom Next, Spot Next, one week, two week and non-standard repurchase transactions.

In Switzerland repo transactions are almost exclusively conducted via the Swiss repo platform, where the handling and pricing of collateral is predefined. All transactions, with the exception of intraday and special-rate repos, are not subject to a haircut.[9] This mainly as the net exposure a party holds vis-à-vis each participant is calculated twice daily and credit and market risks are therefore offset to a great extent. The high liquidity standards on the other hand reduce liquidity risks. However, the application of no haircut, raises the question if traders treat all collateral categories equivalently with respect to risk considerations or if the

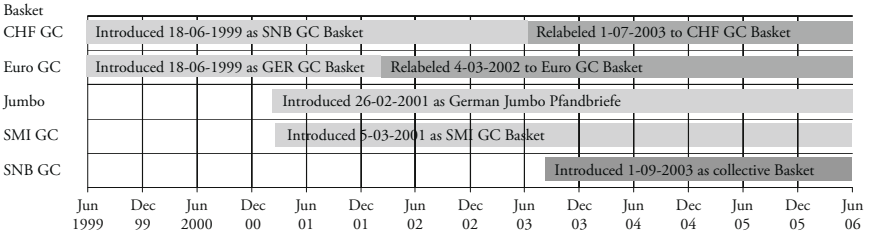
6 Spot Next and Tom Next stand for transactions with a maturity of one working day. In contrast to Overnight transactions, the value date for Spot Next (Tom Next) transactions is one (two) working day(s) after conclusion of the transaction.

7 For a more detailed overview on the so-called Triparty Repo Service, which is carried out by SIS, as well as on how margin calls were met, see Jordan (2007) and Kraenzlin (2007).

8 Until 1 July 2003, the basket known today as 'CHF GC Basket' was called 'SNB GC Basket'. On 1 June 2006 the 'Euro GC Basket' and 'Jumbo Basket' were renamed 'Government GC Basket' and 'International GC Basket' respectively. As this paper focuses on repos that were concluded until June 2005, the old terminology will be kept. See SNB (2006) for further details on the revision of the baskets and extension of the list of eligible collateral.

9 In correct terms intraday and special-rate repos underlie an initial margin, and not a haircut. The initial margin defines the degree of over-collateralization with the cash position as basis (100%). An initial margin of 10% implies that collateral worth CHF 110 million has to be delivered to obtain CHF 100 million in cash. A haircut of 10%, in contrast, implies that CHF 100 million has to be delivered to obtain CHF 90 million in cash. In the haircut example the cash taker would thus have to deliver CHF 111 million to obtain CHF 100 million in cash.

Figure 2: Overview on the Revisions of the Basket Structure



implied risks are offset by higher interest rates. This question is of special interest because of following aspects. A survey conducted by the SNB in 2002 showed that not all baskets were equally favored. All cash providers were willing to accept securities from the 'CHF GC Basket', while only 39% and 30% accepted collateral from the 'Euro GC Basket' and 'Jumbo Basket' respectively. Finally only 13% of the respondents accepted collateral from the 'SMI GC Basket'. The relatively low rate of acceptance indicates that cash providers disliked the latter three baskets to a certain extent either because of risk considerations or low market penetration and may have charged a mark-up in case these securities were used. The SNB, on her part, always treated the three individual baskets equivalently. On 1 September 2003 the SNB introduced a collective basket, namely the 'SNB GC Basket'. This measure was mainly intended to facilitate the collateral management of banks. By introducing the collective basket, the SNB indicated explicitly that it would continue to treat the three different baskets – from a pricing and implied risk point of view – equivalently. This of course raises following two questions that will be analyzed empirically in subsequent sections:

1. Was there an interest rate differentiation on the interbank market with respect to the collateral basket provided before the introduction of the 'SNB GC Basket'?
2. Did the introduction of the collective basket lead to equal treatment of the different baskets on the interbank market?

Before dealing with the question on the existence of interest rate differentiation with respect to the collateral provided, the components of the repo rate – from a theoretical perspective – will be outlined in the next section.

3. Components of the Repo Rate

The price on a repurchase agreement transaction is called repo rate and can be divided into following components:[10]

1. Interest rate environment: The interest rate environment determines the repo rate level and represents the main component of the repo rate. For the period of observation it can be assumed that the corresponding Libor rate, i.e. the unsecured interbank rate based on the same maturity as the repo transaction, serves as benchmark for the repo rate.
2. Quality of collateral and cash taker characteristics: It can be ascertained that the quality of the securities as well as counterparty characteristics have a decisive influence on the interest rate level. Csoport (2000) shows that the delivery of securities featuring high market and liquidity risks in combination with a bank having a low rating, leads to a higher cumulative probability of default and will most probably imply higher repo rates (or higher haircuts).[11] The higher repo rates primarily compensate the cash provider for possible losses that may arise when either the cash taker defaults and the collateral would have to be liquidated or when the cash taker as well as the collateral issuer defaults.
3. Maturity structure: A further component of the interest rate is the maturity structure. A transaction, where a longer maturity had been agreed upon, is usually priced at a higher repo rate than a shorter-term loan.[12]
4. Banking relationships: Eventually banking relationships may also affect the pricing of repo transactions. Borrowing institutions could, for example, build up relationships with a particular institution to establish that they are a good credit risk and thereby get a more attractive interest rate.[13]
5. Specialness fee: In the case of a special collateral repo, where the main purpose of the transaction is the borrowing of the securities, a so-called specialness fee

10 See Csoport (2000), pp. 62. A further component, that will not be outlined, is the right to substitute securities, which are delivered at the opening transaction. This option normally implies a higher repo rate, as the cash taker has the possibility to substitute the so-called purchase securities at any time. The cash provider on the other hand will not be able to re-use these securities boundlessly. However, up to June 2005 only one repo transaction has been undertaken with an explicit substitution right in Switzerland.

11 Csoport (2000), pp. 144.

12 This applies during a normal interest rate phase. However, during a period of an inverse yield curve, longer-term transactions would be traded at lower interest rates than shorter-term ones.

13 Furfine (1999), p. 8.

will apply to the repo rate. This fee depends on the demand for the specific asset and measures the specialness of the security. Generally the fee is less than the repo rate, which is why the cash provider will still receive a positive accrued interest rate. For GC repos no specialness fee applies.

4. Data and Econometric Methodology

4.1 Data and Stylized Facts

The data used in this study consists of interest rates that were charged for secured money market loans denominated in Swiss francs. In particular, each data point provides information on the two banks involved, the collateral basket and maturity chosen as well as the cash amount provided.[14] [15] The sample covers all repo transactions that were concluded on the Swiss repo platform from 18 June 1999 to 30 June 2005. During this period a total of 132 banks (incl. SNB) acted either as cash taker or provider. However, the number of active banks per day in the panel is not always the same as some banks did not participate regularly on the repo market. This of course implies that the dataset is unbalanced.

Due to ticket restrictions per transaction (≤ CHF 100 million)[16] by the Swiss repo system, a trade on CHF 600 million, for example, has to be split into six transactions with a value of CHF 100 million each. This thus leads to repeated observations, without providing any additional information. To remove these redundant observations, all transactions conducted between the same banks, on the same day, at the same rate and with the same collateral basket category are combined to one trade. The cash amount is aggregated accordingly. The aggregation of the cash amount is unproblematic as – in contrast to mortgages or consumer loans – the interest rate set on a money market transaction is independent of the transaction size. All 138 transactions that were undertaken between 23 and 31 December 1999 are excluded. This mainly as repo rates jumped from

14 To guarantee anonymity of the banks involved, the information was provided in a coded form.

15 As the SNB revised the basket terminology on several occasions, the collateral basket names had to be adjusted. For more information on the name adjustments, see Figure 2.

16 In fact only repo transactions concluded with the SNB underlie an explicit CHF 100 million rule. Technically it would thus be possible to conduct an interbank repo transaction based on more than CHF 100 million. However, splitting a transaction into small volume tranches facilitates the transfer of securities, which is why almost all interbank transactions are based on volumes less than CHF 100 million as well.

one level to another due to Y2K uncertainties and would distort the analysis.[17] Furthermore all all non-standard (4,158) and special repo transactions (343) are excluded. Eventually all ON trades which had been concluded on the last day of the maintenance period are excluded. This mainly as ON interest rates are very sensitive with respect to liquidity on the last day of the maintenance period and thus tend to be particularly volatile on that day.[18] Altogether, the original sample with 144,443 transactions is reduced to 92,377 observations.

Considering the various repo rates within a trading day, indicates that the interest rates charged on different repo transactions are very much alike and move in the same direction after a liquidity supply shock or monetary policy decision, for example. Calculating the correlation of repo rates within a trading day for the SNB and interbank market shows that these possess a so-called intra-class correlation of 0.998 and 0.990 respectively. Running a regression with a variable that possesses such a high intra-class correlation will imply correlation in disturbances, which will in turn lead to underestimation of the standard errors and make hypothesis testing and interval estimates invalid. Hence, the empirical model will have to account for the high intra-class correlation to ensure that valid estimation results are obtained.[19]

Looking at the interest rate level of different maturities reveals that an inverse yield curve had been present in Switzerland from December 2000 to December 2001. Throughout this period short-term interest rates were higher than longer-term ones. In the empirical analysis maturity dummies will be added to the regression to reproduce the yield curve. Consequently, the existence of an inverse yield curve requires two separate maturity dummy categories, namely one for a normal and one for the inverse interest rate curve period.

The question on stationarity is not dealt with in this analysis. The repo rate is a nominal interest rate, which in turn is the sum of the real interest rate and inflation. On the basis of the neoclassical growth theory literature, one would expect the real interest rate to be stationary or at least regime-wise stationary.[20]

17 Repos undertaken on 11 September 2001 and on following days are not excluded, as rates did not show any unusual pattern.

18 See Benito et al. (2006) for an empirical analysis on the volatility of the Euro ON interest rate (EONIA).

19 Additionally the intra-class correlation of the interest rates by individual (cash taker ID) was calculated. This led to correlation values of 0.206 for the SNB and 0.145 for the interbank market. The motivation of focusing on the division 'by trading day' rather than 'by cash taker ID' is given in the next section.

20 A series is considered to be regime-wise stationarity, if a unit root hypothesis can be rejected when one or more breaks in the mean are allowed.

The fact that the time dimension (five years) is relatively short, further supports the assumption of a stationary real interest rate. The inflation rate in Switzerland, on the other hand, has stationary properties too, as the SNB has set an upper bound of 2%. The lower bound (0%) is implicitly given, as the SNB will want to avoid deflation. Considering that in the period of observation the inflation rate had almost exclusively been in the range of 0% and 2%, the assumption of stationarity is sensible. Hence, the repo rate, as sum of these two stationary variables, is stationary itself.

4.2 Econometric Methodology

To empirically investigate the impact of the different components on the repo rate (y_{it}) the sample is split in three. The first part represents the period before the introduction of the 'Jumbo Basket'. The second part contains all transactions that were undertaken after the 'Jumbo Basket' had been introduced up until the launch of the 'SNB GC Basket'. Finally, the third part represents the period after the introduction of the collective basket (see Figure 2). All transactions where the SNB had been involved are excluded from the sample. This mainly as liquidity is provided via the fixed rate tender auction, where interest rates are predefined and thus no mark-up with respect to the collateral category is charged. As it is therefore known in advance that basket dummies in a regression with SNB transactions should not contribute in explaining the repo rate, one has the possibility to verify and corroborate the model with these observations (see appendix for these regression results).

For all sample periods the following static panel data model is estimated for the interbank transactions where i denotes the cross-sectional (N banks) and t denotes the time-series (T days) dimension:

$$y_{it} = \alpha + \beta Libor_t + \sum_{h=2}^{H} \phi_h M_{ht} + \sum_{c=2}^{C} \varphi_c Basket_{ct} + \sum_{j=2}^{J} \gamma_j d_{ijt} + \varepsilon_{it}$$
$$i = 1,2,\ldots,N;\ t = 1,2,\ldots,T$$

$Libor_t$ daily one week Libor rate;

M_{ht} dummy variables equal to 1 if maturity h was used for trade y, else 0, $h = 2$ to 24 in the first and second sample period, representing ON, TN, SN, 1W, 2W, 3W, 1M, 2M, 3M, 6M, 9M and 12M maturities under a normal as well as an inverse yield curve. For the third sample period no inverse maturity dummies have to be added, wherefore h = 2 to 12. In

the first (second and third) sample period the 6M (9M) maturity dummy under a normal yield curve is taken as reference maturity and thus not included as dummy variable in the regression;

$Basket_{ct}$ dummy variables equal to 1 if basket c was used for transaction y, else 0, $c = C = 2$ for the first sample period, representing the Euro GC basket, $c = 2$ to 4 and $c = 2$ to 5 respectively, representing the baskets Euro GC, Jumbo and SMI as well as CHF GC for the third period;

d_{ijt} dummy variables equal to 1 if individual i is of type j, else 0, $j = 2$ to 50, $j = 2$ to 69 and $j = 2$ to 68 representing all banks that figured as cash taker in the first, second and third sample period respectively;

ε_{it} regression residuals;

t number of days in the sample period. $t = 1,2,\ldots,422$ for the first, $t = 1,2,\ldots,628$ for the second and $t = 1,2,\ldots,467$ for the third sample period.

$Libor_t$ is the tth observation on the one week Libor and serves as reference level for the interest rate. The one week Libor is preferred to the three month Libor, as most repo transactions were traded at short-term maturities (88% of the transactions had a maturity of one week or less) and as daily and weekly fluctuations are better reflected by that rate. To account for the yield curve, maturity dummies are added as explanatory variables for GC repos.[21] For the first and second part of the sample – where an inverse yield curve had been present – two types of maturity dummies are used, namely one for the inverse and one for the normal yield curve phase. In the first (second and third) sample period the six (nine) month maturity dummy (under the normal interest rate curve) is dropped to avoid perfect multicollinearity.

To quantify the mark-up in case the various collateral categories had been treated differently, a dummy variable for each individual basket is added to the regression. Again, to avoid perfect multicollinearity a reference basket has to be defined. For the first and second sample period the 'CHF GC Basket' is chosen, while in the third sample period the 'SNB GC Basket' dummy is suppressed.

To account for unobserved individual specific effects on the cash taker side, which cannot be explained by the observed independent explanatory variables,

21 When conducting a GC repo via the Swiss repo platform the maturities are predefined, i.e. a trader cannot conclude a trade with a maturity of 9 days but will have to choose between a one and a two week GC repo. If a trader wanted to conclude a 9 days transaction, non-standard repos – which were excluded from the analysis – could be used. Non-standard repos do not possess such standardized maturities.

a dummy variable (d_{ijt}) for $N-1$ cash takers is added to the regression. In the following analysis cross-sectional heterogeneity could for example arise due to counterparty characteristics, such as bank risk or liquidity endowment. In other words, if a bank figures constantly on the cash taker side, the counterparty could for instance take advantage of such a setting and ask for a higher interest rate. Instead of using the fixed effects (FE) or random effects (RE) approach, the so-called least squares dummy variable (LSDV) regression is run.[22] A LSDV regression is basically a pooled ordinary least squares (OLS) with dummy variables and produces identical coefficients for the independent variables (excl. those on d_{ijt}) as the FE approach. The LSDV approach is preferred to the FE model because of four reasons: Firstly, the focus is primarily set on the applied repo rates and its components and less on the cross-sectional dimension. Secondly, repo transactions were not concluded every day due to holidays and weekends, leading to an unequally spaced dataset. Thirdly, the dataset is unbalanced as not all banks faced liquidity imbalances and thus did not participate daily. Fourthly, some banks conducted several trades per trading day (up to 54 trades), leading to more than just one observation per day and bank (high frequency pattern). Especially the high frequency dimension as well as the unbalancedness of the data set, makes it almost impossible to analyze the data in a FE setting.

Finally Stata's cluster command is used to produce standard errors robust to intra-class correlation.[23] This is basically necessary as the interbank repo rates possess an intra-class correlation of 0.99 when clustering is done 'by trading day'. Clustering 'by cash taker ID' would be another option, but is disfavored over clustering 'by trading day' because of following considerations. Interest rates are set daily and are highly dependent on common daily shocks such as unexpected interest rate increases or liquidity supply shortages. This thus implies that interest rates on a specific day experience the same shock, which will lead to correlation in their disturbances. Clustering 'by cash taker ID', in contrast, would imply that a specific bank experiences a shock that will cause a correlation in disturbances over the whole time period, i.e. five years. However it is not very realistic to assume that a bank will experience such a persistent shock. And even if it did experience such, it can be assumed that the LSDV regression – where unobserved individual specific characteristics are accounted for – would absorb such a persistent shock, implying less correlation in disturbances.

22 For further information on LSDV, FE or RE, see Baltagi (2005).

23 Note that the Stata's cluster option implies robust standard errors. For more information on robust clustered standard errors, see Wooldridge (2002) and Rogers (1993).

5. Results

Table 1 presents the estimation results for the repo rate for the period before and after the introduction of the 'SNB GC Basket'. Overall, it can be seen that the repo rate moved very closely with the one week Libor rate, implying that the credit risk and liquidity premium remained relatively constant. Furthermore the co-movement implies that the secured and unsecured money market reacted similarly to interest rate changes, uncertainties or shocks.

5.1 Influence of Collateral Categories on Repo Rates

To answer the question if the collateral choice had a significant influence on the repo rate, the coefficients on the basket dummies in the estimation have to be considered. For the period before the introduction of the 'Jumbo Basket' (1a) it can be seen that the coefficient on the 'Euro GC Basket' is not significantly different from zero. A coefficient not significantly different from zero implies that the hypothesis of no difference in pricing between the individual basket and the reference basket (here 'CHF GC Basket') can not be rejected. For the second sample period – after the 'Jumbo Basket' but before the 'SNB GC Basket' introduction (1b) – the same applies. Hence, for both sample periods it can be concluded that all collateral baskets were treated equivalently and no interest rate differentiation with respect to the collateral basket provided had been undertaken.

Regression results for the third sample period (2), where the 'SNB GC Basket' serves as reference basket, show a different pattern. The coefficients on the 'SMI GC Basket' and 'Euro GC Basket' dummies are not significantly different from zero, whereas the ones for the 'CHF GC' and 'Jumbo Basket' are highly significant. It thus seems that the different collateral baskets were not treated equivalently: While no mark-up had been charged for the collateral provided from the first two baskets, an interest rate differentiation had been done with respect to the 'CHF GC' and 'Jumbo Basket'. However, to find out if in fact more than one interest rate curve had been traded or not, the null hypothesis that all four basket dummies are identical is tested (see (1') in Table 2). The null hypothesis can be rejected on the highest level, suggesting that at least two interest rate curves were traded. To eventually find out how many curves were traded, two hypotheses are set up: The first one tests if the coefficients on the 'SMI GC Basket' and 'Euro GC Basket' are equal to each other and equal to zero (2'). The second hypothesis (3'), on the other hand, tests the equality of the 'CHF GC' and 'Jumbo' coefficients. The two hypotheses cannot be rejected on the 40% and 90% level, leading to the conclusion that two interest rate curves were traded for the period

Table 1: Least Squares Dummy Variable Estimation Results

	Pre SNB GC Introduction		Post SNB GC Introduction
	(1a)	(1b)	(2)
Libor 1 week	0.975*** (0.008)	0.998*** (0.010)	0.965*** (0.009)
SNB GC	*no obs.*	*no obs.*	*dropped*
CHF GC	*dropped*	*dropped*	0.009*** (0.002)
Euro GC	0.014 (0.029)	0.006 (0.005)	0.001 (0.004)
Jumbo	*no obs.*	0.001 (0.005)	0.009** (0.004)
SMI	*no obs.*	0.006 (0.005)	–0.007 (0.006)
ON Normal	–0.772*** (0.042)	–0.190*** (0.019)	–0.206*** (0.037)
TN Normal	–0.710*** (0.042)	–0.179*** (0.018)	–0.192*** (0.037)
SN Normal	–0.667*** (0.043)	–0.169*** (0.019)	–0.189*** (0.037)
1 Week Normal	–0.601*** (0.039)	–0.169*** (0.018)	–0.187*** (0.037)
2 Week Normal	–0.563*** (0.039)	–0.163*** (0.018)	–0.177*** (0.037)
3 Week Normal	–0.542*** (0.043)	–0.152*** (0.018)	–0.169*** (0.037)
1 Month Normal	–0.493*** (0.040)	–0.138*** (0.018)	–0.157*** (0.037)
2 Month Normal	–0.375*** (0.042)	–0.133*** (0.018)	–0.139*** (0.037)
3 Month Normal	–0.265*** (0.041)	–0.131*** (0.018)	–0.123*** (0.037)
6 Month Normal	*dropped*	–0.063*** (0.018)	–0.018 (0.037)
9 Month Normal	*no obs.*	*dropped*	*dropped*
12 Month Normal	*no obs.*	0.106*** (0.035)	0.051 (0.042)

Table 1 continued

	Pre SNB GC Introduction		Post SNB GC Introduction
	(1a)	(1b)	(2)
ON Inverse	–0.671*** (0.045)	–0.212*** (0.034)	
TN Inverse	–0.595*** (0.050)	–0.169*** (0.033)	
SN Inverse	–0.691*** (0.048)	–0.165*** (0.033)	
1 Week Inverse	–0.683*** (0.049)	–0.173*** (0.028)	
2 Week Inverse	–0.795*** (0.111)	–0.183*** (0.030)	
3 Week Inverse	–0.749*** (0.068)	–0.184*** (0.029)	
1 MonthInverse	–0.708*** (0.055)	–0.210*** (0.028)	
2 MonthInverse	–0.769*** (0.074)	–0.246*** (0.029)	
3 MonthInverse	–0.834*** (0.069)	–0.259*** (0.027)	
6 MonthInverse	–0.892*** (0.109)	–0.340*** (0.035)	
9 MonthInverse	*no obs.*	*no obs.*	
12 MonthInverse	*no obs.*	*no obs.*	
constant	0.533*** (0.045)	0.057*** (0.020)	0.120*** (0.037)
# of observations	6,763	25,211	22,274
adj. R-squared	0.96	0.99	0.92
# cash taker dummies	50	69	68
# of clusters	422	628	467

Notes: Robust clustered standard errors are reported in parentheses.
*, ** and *** indicate significance at the 10, 5 and 1 percent level.

after the 'SNB GC Basket' introduction. Compared to repo transactions where the 'SNB GC Basket' had been used (reference basket in the regression), it can therefore be reasoned that no mark-up applied to transactions where the 'SMI GC Basket' and 'Euro GC Basket' had been chosen explicitly. However, when either the 'CHF GC' or 'Jumbo Basket' were specifically selected as collateral basket, a mark-up of approximately 1*bp* was charged.

Table 2: Results from Hypothesis Testing

	Hypothesis	F-Value	P-Value
(1')	CHF GC = Euro GC = Jumbo = SMI	$F(3,466) = 4.43$	Prob > F = 0.0044
(2')	Euro GC = SMI = 0	$F(2,466) = 0.82$	Prob > F = 0.4398
(3')	CHF GC = Jumbo	$F(1,466) = 0.01$	Prob > F = 0.9114

The findings for the third sample period are irritating to some extent because of the following reason. As mentioned previously the SNB defined a collective basket, namely the 'SNB GC Basket'. This basket was used in 85% of the cases, indicating that participants did not differentiate between the different baskets. However, when a specific basket had been selected, a mark-up was charged on repo transactions based on the 'CHF GC' or 'Jumbo Basket'. Assuming that the cash providers set the final terms and conditions, a LSDV regression with dummy variables for the cash taker as well as for the cash provider is run. This regression specification is comparable to a two-way fixed effects model[24] and will not only account for unobserved individual specific effects on the cash taker side but also for the different behavioral pattern of the cash providers. This specification ensures that the basket dummies do not absorb the behavioral pattern of the cash providers. However, regression results show the same interest rate differentiation with respect to the collateral basket as in Table 1.

On the basis of these findings it can be concluded that several cash providers and/or takers on the Swiss franc repo market behaved inconsistently as they treated the individual collateral baskets differently than the collective one. The interest rate differentiation leads to arbitrage opportunities, e.g. a bank could in a first step obtain the funds via a repo transaction against the collective basket and

24 See Baltagi (2005), pp. 33.

subsequently offer these funds on the market against the 'CHF GC' or 'Jumbo Basket'. From a theoretical and market efficiency point of view the exploitation of these arbitrage opportunities finally leads to a uniform pricing of these baskets.

The persistence of pricing differentiation and resulting arbitrage opportunities on the Swiss franc repo market seem puzzling at first but can be explained by temporarily low market liquidity, transaction costs and trading relationships. Temporarily low market liquidity on the Swiss franc repo market may lead to a situation where a cash taker has no other option than to conclude a trade based on an individual basket. Due to the lack of outside options, a bank's willingness to pay a higher interest rate increases and eventually leads to this pricing differentiation. After conclusion of a repo transaction on the Swiss repo platform, the securities delivered as collateral have to be transferred to the cash provider's securities account at SIS. Apart from the transaction costs on the trading platform, a repo transaction also involves collateral transfer costs. The costs are in general higher than the benefits of exploiting these arbitrage opportunities (i.e. 1*bp*). Furthermore the exploitation of arbitrage opportunities requires that the arbitrageur can conclude trades within a short time with numerous counterparties. On the Swiss franc repo market an interbank relationship has to be enabled by both banks. In the period of observation roughly 25% of all potential interbank relationships were activated bilaterally. After having obtained the funds against the collective basket, the arbitrageur thus faces the risk that he may not be able to pass the liquidity – against the 'CHF GC' or 'Jumbo Basket' – to a bank due to an inexistent trading relationship.[25] The inexistence of a trading relationship in combination with transaction costs may thus hinder a bank from exploiting arbitrage opportunities in the first place.

6. Discussion

Since the introduction of the 'SNB GC Basket' on 1 September 2003, the SNB has explicitly indicated that it treats the three different baskets – from a pricing and implied risk point of view – equivalently. In its monetary operations the SNB does not set different repo rates or apply haircuts regardless of the collateral

25 The inexistence of this trading relationship can result either if the arbitrageur may not enable the bank due to restriction imposed by its risk management or if the counterparty has not enabled the arbitrageur.

provided. The frequent use of the collective basket in interbank repo transactions further suggests that most banks, too, do not differentiate between the different collateral baskets. Hence, one could conclude that banks do not charge a mark-up depending on the collateral basket selected. However, estimation results show that after 1 September 2003 an interest rate differentiation was undertaken, when a specific individual basket had been chosen. Higher repo rates were charged for repo transactions based on the 'CHF GC Basket' or 'Jumbo Basket'. This of course implies that banks trade two different interest rate curves, namely one for the 'SNB GC', 'SMI GC' and 'Euro GC Basket' and another one for the 'CHF GC' and 'Jumbo Basket'. The consultation of repo traders confirmed that several banks did indeed trade two interest rate curves. The main reasons for their behavior lie in the minimum rating requirements that apply to the different baskets as well as in the traders' risk assessment.

Securities from the 'CHF GC Basket' are subject to a minimum rating requirement of 'A' (Standard & Poor's), while securities from the 'Euro GC Basket', for example, have to be rated at least 'AA'.[26] Categorizing the securities from the 'CHF GC Basket' with respect to their rating, reveals that approximately 30% of the securities (CHF 45 billion) were rated lower than 'AA', whereas this is not possible in the 'Euro GC Basket'.[27] A cash provider will thus face a rather high probability of receiving worsely rated securities than when the 'Euro GC Basket' is selected. This in turn implies that the cash provider may consider the credit risk of a repo transaction – based on the 'CHF GC Basket' – to be higher than when the 'Euro GC Basket' is used and will therefore ask for a higher repo rate. As regards the 'Jumbo Basket' it seems that several traders assess the credit risk of a Jumbo Pfandbrief issued by a municipality or a mortgage bank to be higher than a government bond belonging to the 'Euro GC Basket', albeit the fact that both underlie the same rating requirement. Comparing the average yield on a German Pfandbrief with that on a German government bond – both with a 'AAA' rating and a ten year maturity – shows that the average yield on a German Pfandbrief was approximately 5.5*bp* higher from April 2004 to June 2005.[28] The higher average yield underpins the presumption that – despite equal rating – investors

26 Securities issued by the Swiss Confederation as well as by Swiss cantons or municipalities – which form part of the 'CHF GC Basket' – are exempt from the minimum rating requirements.

27 The calculus is based on the 'CHF GC Basket' from 18 October 2005. The results were compared with the current 'CHF GC Basket'. The share remained approximately unchanged.

28 From April 2004 to mid November 2006 the average yield on a German Pfandbrief was approximately 9*bp* higher than the one on German government bonds. Source: SNB and Verband Deutscher Pfandbriefbanken (VDP).

assess the credit risks involved with a German Pfandbrief to be higher than with a German government bond.

Overall one can conclude that several repo traders consider the credit risk of a repo transaction based on securities from the 'CHF GC Basket' and 'Jumbo Basket' to be higher than when the other baskets are used and consequently ask for a higher repo rate. This interest rate differentiation is based on *subjective* risk perception and leads to arbitrage opportunities, as a bank could obtain funds via a repo transaction against the collective basket and subsequently offer these funds on the market against the 'CHF GC' or 'Jumbo Basket'. As mentioned in section 5.1 temporarily low market liquidity, transactions costs and trading relationships lead to a situation where these arbitrage opportunities are not exploited in the first place.

From a *theoretical* and *practical* point of view an interest rate differentiation is considered as obsolete and not advisable because of following reasons:

1. The risks in the Swiss franc repo market are rather of subjective than of empirical nature. Credit risks arise from price movements of the collateral. If prices decline an under-collateralization is the consequence. The magnitude of under-collateralization depends on the specified variation margin. If no margin call is triggered and the counterparty defaults, the collateral would have to be liquidated at the prevailing (lower) market price, leading to a loss for the cash provider. The loss would even be more substantial if the collateral issuer also defaulted. To quantify the credit risk it is best to calculate the probability of a worst case loss occurrence (cash taker and collateral issuer default). Assuming that the cash taker possesses a long-term credit rating of 'A', the difference in the cumulative probability of default with an 'A' collateral from the 'CHF GC Basket' and an 'AA' rated security from the 'Euro GC Basket', for instance, would be 0.00006%.[29] The difference in credit risk is basically inexistent. Further one should bear in mind, that the SIS revalues thrice daily the collateral at market prices (mark-to-market) and triggers twice daily a margin call, if the net exposure exceeds the unilaterally defined variation margin. Considering that all margin calls were met on the same day and that the variation margin can be adjusted depending on the counterparty, it can be concluded that from a practicable point of view there is virtually no credit risk in the Swiss franc repo market.[30]

29 See Corrigan et al. (1999), p. 99 and Csoport (2000), p. 145.

30 See Kraenzlin (2007) for a discussion about the risks in the Swiss franc repo market and more information on the number of triggered margin calls.

2. A mark-up of approximately 1*bp* for collateral provided from the 'CHF GC Basket' or 'Jumbo Basket' seems negligibly small. Comparing the mark-up with the average one week Libor rate for that period, shows that the surcharge did not even amount to 3%. It thus seems exaggerated to differentiate between the various collateral baskets as outlays for such differentiation are most probably higher than the expected utility of such a measure.
3. Last but not least it should be borne in mind that by differing between the different collateral baskets one would segment the interbank repo market. Consider the case where the cash provider only accepts government bonds ('Euro GC Basket') as collateral. If the cash taker only possesses a small amount of such securities, he may not be able to conclude a repo transaction on the amount desired. As a consequence the cash taker will have to get the remaining liquidity – if possible – from another cash provider. On the other hand, if no other cash taker possesses securities belonging to the 'Euro GC Basket', the cash provider will not be able to lend cash on a secured basis. This collateral-mismatch will eventually reduce activity on the repo market and lower market liquidity on each of these markets. The collateral differentiation would again complicate matters, without yielding considerable increases in utility.

Provided that this *subjective* credit risk perception persists, that participants – most especially cash providers – continue to behave in such a way and that the popularity of the individual baskets increases at the expense of the collective basket, one could consider to apply haircuts (or initial margins) on the different collateral categories. In the Eurosystem, for instance, different valuation haircuts apply, depending on the market and liquidity risk – and not credit risk – of the collateral provided.[31] However, as credit risk seems to be the main reason for an interest rate differentiation in Switzerland, one would have to assess the degree of over-collateralization on both, credit as well as liquidity and market risk considerations. This would make an interest rate differentiation unnecessary, would preserve market liquidity and could be done with reasonable outlays. Additionally, the current system with a collective basket could be maintained, as haircuts can be applied without affecting the collateral selection process.

A further advantage of applying haircuts is, that the SNB can expand the range of eligible collateral to lower rated securities, without affecting the interest rate curve nor the current system with a collective basket. This so-called vertical expansion would not affect the repo rate curve, as higher haircuts would apply

31 Papadia (2006), p. 35.

to lower rated securities, compensating the cash provider for higher credit risks. Expanding the range to lower rated securities could be an issue in the near future because of following reasoning. To obtain liquidity on a secured basis a bank has to deliver collateral, which must be purchased in advance. As cash takers will repurchase the securities delivered at the end of the repo transaction, they virtually stay exposed to the market risk, which is why they remain beneficial owner of these securities. This implies that they retain the right of dividend and/or interest distribution. To minimize opportunity costs, cash takers will thus prefer to hold lower-rated securities, as these are typically associated with a higher yield. In circumstances where no liquidity on a secured basis is needed, a bank will on the other hand try to reduce its opportunity costs of collateral holding, by using the securities in so-called Securities Lending and Borrowing (SLB) transactions. A vertical expansion would thereby increase the range of collateral and the chances of holding a 'special' security. Especially under the circumstances – where the spread between unsecured and secured interest rates is only approximately 10*bp* – opportunity cost considerations might induce cash takers to switch back to unsecured borrowing. This would in turn increase risks in the financial system and alter the stability of the Swiss banking sector.

7. Conclusion

The Swiss franc repo market has substantially developed throughout the last five years and has reached outstanding volumes of up to CHF 90 billion in December 2005. Since the launch of the platform the SNB in collaboration with Eurex and SIS has evermore been aiming to increase the degree of standardization and automation – among others by defining a collective basket. The collective basket comprises three individual baskets. Considering that the Swiss repo platform is one of the forerunners in its domain, it can be ascertained that the aim of increasing efficiency has been achieved. However, by analyzing the transactions that have been conducted via this platform, a peculiarity on the Swiss franc repo market is identified. Repo traders have an inconsistent interest rate setting behavior with respect to the different collateral baskets. The frequent use of the collective basket in interbank repo transactions suggests that banks do not differentiate between the different collateral baskets. However, estimation results show that after 1 September 2003 an interest rate differentiation was undertaken, when specific individual baskets had been selected for a repo transaction. Several repo traders consider the credit risk of a repo transaction based on securities from the 'CHF GC Basket' and 'Jumbo Basket' to be higher than when the other baskets are used

and consequently ask for a higher repo rate. Subjective credit risk perception is the main reason for the interest rate differentiation. The estimation results were confirmed by several repo traders. Provided that this *subjective* credit risk perception persists, that participants – most especially cash providers – continue to behave in such a way and that the popularity of the individual baskets increases at the expense of the collective basket, one could overcome this by applying haircuts (or initial margins) on the different collateral categories.

Overall it can be concluded that several cash providers and/or takers on the Swiss franc repo market behaved inconsistently as they treated the individual collateral baskets differently than the collective one. The interest rate differentiation also leads to arbitrage opportunities, e.g. a bank could in a first step obtain the funds via a repo transaction against the collective basket and subsequently offer these funds on the market against the 'CHF GC' or 'Jumbo Basket'. The persistence of pricing differentiation and the fact that these arbitrage opportunities are not exploited seem puzzling at first but can be explained by temporarily low market liquidity, transaction costs and trading relationships. Temporarily low market liquidity on the Swiss franc repo market may lead to a situation where a cash taker has no other option than to conclude a trade based on an individual basket. Due to the lack of outside options, a bank's willingness to pay a higher interest rate increases and eventually leads to this pricing differentiation. A repo transaction also involves – apart from the transaction costs on the trading platform – collateral transfer costs. Total costs are in general higher than the benefits of exploiting arbitrage opportunities of approximately 1*bp*. Furthermore the exploitation of arbitrage opportunities requires that the arbitrageur can conclude trades within a short time with numerous counterparties. On the Swiss franc repo market an interbank relationship has to be enabled by both banks. In the period of observation roughly 25% of all potential interbank relationships were activated bilaterally. After having obtained the funds against the collective basket, the arbitrageur thus faces the risk that he may not be able to pass the liquidity – against the 'CHF GC' or 'Jumbo Basket' – to a bank due to an inexistent trading relationship. The inexistence of a trading relationship in combination with transaction costs may thus hinder a bank from exploiting arbitrage opportunities in the first place.

Appendix

The Different Baskets Used

Table 3: The Different Baskets Used From June 1999 to June 2005[a]

Year	'CHFGC'		'EuroGC'		'Jumbo'		'SNBGC'		'SMIGC'	
	IB	SNB	IB	SNB	IB	SNB	IB	SNB	IB	SNB
1999	1,210	2,162	3	92	–	–	–	–	–	–
2000	4,395	4,381	156	849	–	–	–	–	–	–
2001	7,090	4,292	499	956	149	1,279	–	–	76	–
2002	10,350	4,069	568	1,250	615	2,200	–	–	103	–
2003	7,051	1,934	1,019	1,559	925	2,418	2,076	724	18	–
2004	828	–	139	–	400	–	10,733	6,698	20	–
2005	532	–	13	–	142	–	6,893	3,266	5	–
Total	31,456	16,838	2,397	4,706	2,231	5,897	19,702	10,688	222	–

Note: Transactions based on 'SNB GC' before 1 September 2003 were added to 'CHF GC'. 'SMI GC' includes all SMI baskets whether it was composed of 10, 15 or 27 equities. The 'GER GC Basket' used before the introduction of the 'Euro GC', was added to the 'Euro GC Basket'.

a Division was made according to the purchase date. *Source:* Eurex

SNB Test-Regression

For SNB trades two additional dummies were included in the regression, namely one for Overnight (ON) special-rate repos and one for SNB bilateral repos. ON special-rate repos are priced two percentage points above the Repo-Overnight-Index[32] of the previous day, while latter transaction type is priced 25 basis points (bp) above the daily auction rate.[33] To control for these mark-ups, two dummy variables thus had to be included.

The SNB sample was split in four, namely into two pre and two post 'SNB GC' samples. The post 'SNB GC' sample was split in two, as transactions with the SNB were exclusively based on the 'SNB GC Basket' after 31 October 2003. Regression (2a) is thus based on the observations from 1 September to 31 October

32 The Repo Overnight Index is a volume weighted interest rate of overnight GC transactions between commercial banks traded on the Eurex platform. In addition, transactions will only be taken into account if the securities provided belong to the 'SNB GC Basket'.

33 For additional information see Kraenzlin (2007).

2003, while (2b) is based on all transactions that were concluded between 1 November 2003 and 30 June 2005. In all sub-sample periods the SN maturity dummy (under the normal interest rate curve) was dropped to avoid perfect multicollinearity. In the pre (post) 'SNB GC' introduction period the 'CHF GC Basket' ('SNB GC Basket') was used as reference basket.

Table 4: Least Squares Dummy Variable Estimation Results

	Pre SNB GC Introduction		Post SNB GC Introduction	
	(1a)	(1b)	(2a)	(2b)
Libor 1 week	0.984*** (0.010)	0.991*** (0.005)	0.000 (0.000)	0.987*** (0.006)
SNB GC	*no obs.*	*no obs.*	*dropped*	*dropped*
CHF GC	*dropped*	*dropped*	0.000 (0.000)	*no obs.*
Euro GC	0.015 (0.010)	0.001 (0.002)	0.000 (0.000)	*no obs.*
Jumbo	*no obs.*	0.000 (0.002)	0.000 (0.000)	*no obs.*
SMI	*no obs.*	*no obs.*	*no obs.*	*no obs.*
ON Normal	–0.054 (0.053)	–0.027 (0.018)	0.000 (0.000)	–0.010 (0.009)
TN Normal	–0.105** (0.063)	–0.004 (0.020)	*no obs.*	–0.020** (0.010)
SN Normal	*dropped*	*dropped*	*dropped*	*dropped*
1 Week Normal	–0.012 (0.051)	–0.010 (0.018)	0.000 (0.000)	–0.020*** (0.008)
2 Week Normal	0.042 (0.055)	–0.015 (0.018)	0.000 (0.000)	–0.018* (0.010)
3 Week Normal	0.036 (0.054)	–0.020 (0.023)	*no obs.*	0.009 (0.010)
1 Month Normal	–0.051 (0.071)			
3 Month Normal	0.047 (0.054)			
ON Inverse	–0.074 (0.070)	0.003 (0.022)		
TN Inverse	*no obs.*	0.030 (0.025)		

Table 4 continued

	Pre SNB GC Introduction		Post SNB GC Introduction	
	(1a)	(1b)	(2a)	(2b)
SN Inverse	0.027 (0.052)	0.052 (0.085)		
1 Week Inverse	0.015 (0.052)	–0.019 (0.021)		
2 Week Inverse	–0.042 (0.077)	–0.010 (0.024)		
3 Week Inverse	–0.109 (0.072)	–0.018 (0.021)		
SNB Bilateral	0.284*** (0.025)	0.250*** (0.008)	0.250*** (0.000)	0.211*** (0.012)
ON Special	*no obs.*	*no obs.*	*no obs.*	1.997*** (0.018)
constant	–0.170*** (0.059)	0.108*** (0.019)	0.110*** (0.000)	–0.071*** (0.008)
of observations	8,373	18,164	908	10,684
adj. R-squared	0.98	0.99	1.00	0.99
# cash taker dummies	57	66	42	58
# of clusters	395	618	45	418

Notes: Robust clustered standard errors are reported in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent level.

References

Baltagi, Badi H. (2005), *Econometric Analysis of Panel Data*, John Wiley & Sons, 3rd edition, 2005.

Benito, Francisca, Ángel León, and Juan M. Nave (2006), "Modeling the Euro Overnight Rate", WP-AD 2006-11, Working Paper Serie AD from Instituto Valenciano de Investigaciones Económicas (Ivie).

Bank for International Settlements (2005), *International Convergence of Capital Measurement and Capital Standards – A Revised Framework*, Basel Committee on Banking Supervision.

Corrigan, Daniel J., Christopher K. Georgiou and Jonathan M. Gollow(1999), *Repo – The Ultimate Guide*.

Csoport, Peter (2000), *Repurchase Agreements – Eine Analyse des Repo-Geschäfts unter besonderer Berücksichtigung der Einsatzbereiche und Risiken*, Verlag Paul Haupt.

Fleming, Michael J., and Kenneth D. Garbade (2004), "Repurchase Agreements with Negative Interest Rates", Federal Reserve Bank of New York, *Current Issues in Economics and Finance* 10 (5).

Furfine, Craig(1999), "The Pricing of Bank Lending and Borrowing: Evidence from the Federal Funds Market", BIS Working Paper no. 62.

Jordan, Thomas J. (2007), "Das Repo-Geschäft in Schweizerfranken und die Innovation des geldpolitischen Instrumentariums der Schweizerischen Nationalbank", *Aktuelle Rechtsprobleme des Finanzplatzes Schweiz 2007*.

Jordan, Thomas J., and Peter Kugler (2004), "Implementing Swiss Monetary Policy: Steering the 3M-Libor with Repo Transactions", *Schweizerische Zeitschrift für Volkswirtschaft und Statistik*, 140 (3), pp. 381–393.

Kraenzlin, Sébastien (2007), "The Characteristics and Development of the Swiss Franc Repurchase Agreement Market", *Financial Markets and Portfolio Management* 21 (2), pp. 241–261.

Papadia, Francesco (2006), "The ECB's Collateral Framework", *Central Banking* 16 (3).

Rogers, William (1993), "Regression Standard Errors in Clustered Samples", *Stata Technical Bulletin* 13, pp. 19–23.

Swiss National Bank (2006), "Circular Letter to Banks: Revision of Basket Structure and Extension of List of Collateral Eligible for SNB Repos", available on the SNB homepage.

Veyrassat, Antoine (2004), "The Swiss Franc Money Market: Instruments and Market Participants", *Quarterly Bulletin* 3 of the Swiss National Bank, pp. 42–55.

Wooldridge, Jeffrey M. (2002), "Econometric Analysis of Cross-Section and Panel Data", MIT.

SUMMARY

Repurchase agreements (repos) are secured money market transactions. The cash taker provides collateral in the form of securities and in return receives money from the cash provider. To ensure the continuous covering of the cash amount, the definition of eligible collateral, its handling and valuation play an important role. This is mainly because the collateral nearly eliminates credit risk. In Switzerland, Swiss franc repos are almost exclusively conducted via the highly

standardized repo platform, with four different pre-defined collateral baskets. Each basket comprises different security categories, such as government bonds or covered bonds. This paper analyzes the interest rate setting on the repo market with data from June 1999 to June 2005. It evaluates if the securities provided as collateral influenced the repo rate or not. A price differentiation with respect to the collateral provided is found.