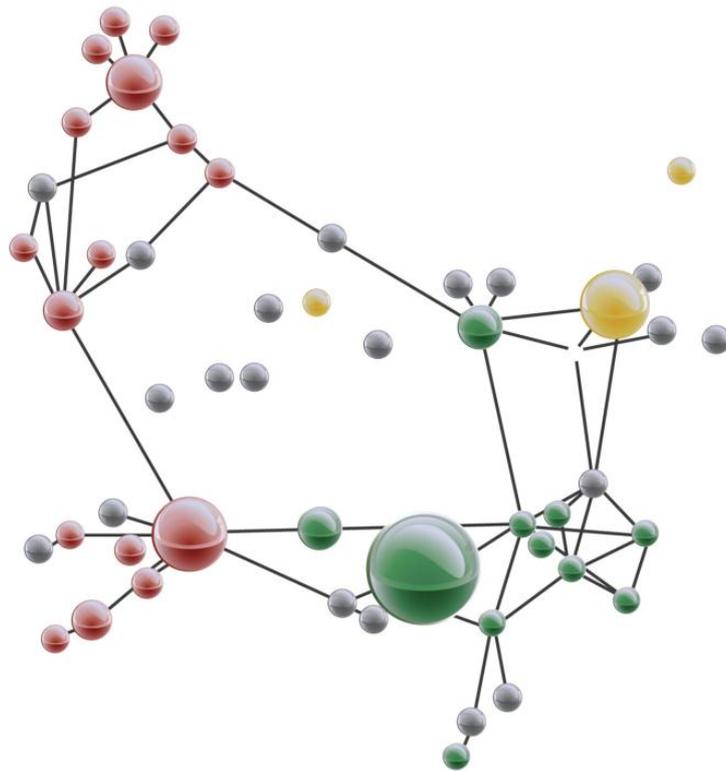


Quarter 4, 2012

# Money Market Review



The Central Bank  
of the Russian Federation  
(Bank of Russia)

This Review is prepared by the Bank of Russia Financial Stability Department jointly with the Market Operations Department and General Economic Department

Comments and proposals on the Review's structure and contents will be welcome at:  
[Reports@cbr.ru](mailto:Reports@cbr.ru)



*In using the materials of this publication, reference to the Central Bank of the Russian Federation is mandatory*

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## **Purpose of the Money Market Review**

In this Review, a money market means an interbank loan market (ILM), currency swap market (SWAP) and interdealer repo market. The focus is made on the repo market due to its intersectoral nature, with the Bank of Russia performing here the bulk of its operations to provide liquidity. The Bank of Russia is going to promote comprehensive development of the money market to:

- redistribute liquidity in a sustainable environment, i.e. with an acceptable volatility and low short-term interest rate spread, as well as an equal access of participants to liquidity sources;
- minimize counterparty risk through quality management of security;
- achieve a balanced development of various market segments, in particular, a full-fledged segment beyond overnight maturity;
- create an environment for central counterparty participation.

### **The importance of money market monitoring is determined by a number of factors:**

- the money market is the first to come under pressure in case of financial instability, with its parameters playing the role of early warning indicators;
- the money market is crucial for intragroup operations of financial groups and conglomerates to be scrutinized as part of consolidated supervision;
- the money market can concentrate the financial sector's systemic risks with regard to interdealer repos and swaps since its players include not only banks but also non-bank professional securities market participants;
- the money market trends allow to conclude on the current level of banking sector liquidity;
- the money market situation affects the central bank's ability to manage banking sector liquidity and short-term interest rates.

In view of the money market's importance for financial stability, the Bank of Russia Financial Stability Department (FSD) is launching a series of **regular quarterly reviews** of its situation and systemic risk levels.

**The ultimate purpose of this publication** is to contribute to financial stability by enhancing the money market transparency. A better awareness of the market structure and trends will allow participants to improve their understanding and assessment of own risks. Moreover, the Bank of Russia wants to communicate to market participants possible collective implications of individual investment decisions in the event of systemic effects which are not fully accounted for in the assessment of market risks.

**The Review, rather than being a Bank of Russia official publication**, is a research paper focused on analysis of market developments in the reporting period. The latest reported data are given as of the last business day of the quarter, while possible significant events after the reporting date are disregarded.

**The information database** for this study included the repos database of OJSC Moscow Stock Exchange and reporting Form 0409701 "Forex and Money Market Transactions Report". The Review is available **in Russian and English** on the Bank of Russia website.

## The Bank of Russia: Towards Higher Market and Its Own Transparency

Bank of Russia priority goals are to increase its own and market transparency, as well as enhance the efficiency of its communication policy. Seeking to be more open, the Bank of Russia aims at the following objectives. First, by disclosing information on market conditions the Bank of Russia helps market participants assess financial risks, above all, equity position risk and interest rate risk, as well as liquidity risk. Second, by showing the level and distribution of systemic risks the Bank of Russia tends to achieve a balance in different market segment exposure to risk. Third, the Bank of Russia is making efforts aimed at introducing the latest financial and technological innovations, as well as developing financial infrastructures. In 2012, the Bank of Russia took a few steps forward to enhance the transparency and efficiency of its communication policy.

- **Public presentation.** To promote a new information product and ensure the target audience awareness of it, the Bank of Russia management began to hold product-specific briefings for business mass media on report release dates.
- **Target audience feedback.** To prepare new issues of the Review, the Bank of Russia launched readership opinion polls (both among the heads of corporate treasury departments of money market largest participants (banks) and reporters from business mass media) to be able to promptly respond to new information requests. The FSD opened an e-mail box, [reports@cbr.ru](mailto:reports@cbr.ru), to receive remarks, comments, and proposals concerning the structure and contents of the Review.
- **Basic data disclosure.** To enhance market transparency and data accessibility, the Bank of Russia made a decision to post on its website all statistical data being relied upon in making reports, save for sensitive information on the transactions of specific financial market participants, which may affect their business interests. To ensure a user-friendly presentation, all the data are available in the MS Excel format at [http://www.cbr.ru/analytics/fin\\_stab/](http://www.cbr.ru/analytics/fin_stab/).
- **Open dialogue with the market.** The Bank of Russia supported the establishment of a Council of Treasurers under the auspices of the National Securities Market Association, a self-regulated entity, to monitor and develop proposals on how to resolve corporate treasury issues that may be faced by financial institutions. Bank of Russia representatives began to participate on an ongoing basis at Council of Treasurers meetings. The Bank of Russia regards the Council as a public ground useful for exchanging opinions with, communicating innovations and the Bank of Russia policy to market participants, as well as coordinating activities aimed at improving the money market efficiency.
- **Systemic risk wide coverage and discussion.** The Bank of Russia is strongly committed to disclose information on market conditions with a view to notifying the market of potential imbalances and financial threats. To this end, the Financial Stability Department in conjunction with other core departments started to hold a Financial Stability Forum on an annual basis and intermediate round-table meetings with banks and non-bank financial institutions.

## Review Summary

### *Market structure and cash flow distribution*

- The rouble money market constitutes a liquidity redistribution tool for the financial system, including the banking sector. In 2012 Q4, the aggregate daily market turnover totalled 1.2 trillion roubles, of which swaps amounted to 0.63 trillion roubles, interbank loans – 0.31 trillion roubles, and repos – 0.22 trillion roubles.
- Resident banks were key lenders and borrowers on the rouble money market. Banks accounted for more than 85% of lending and more than 66% of borrowing volumes, with their net position amounting to 250 billion roubles.
- Money market transactions were mostly short-term: overnight operations accounted for more than 80% of total transactions. The value of open positions with a maturity of seven days exceeded the overnight segment value. Most of the 7-day transactions were repos with the Bank of Russia. Most of interbank loan and swap transactions were closed in the overnight segment.
- In 2012 Q4, the banking sector kept experiencing a liquidity structural deficit which pushed the money market overnight MIACR to the top of the Bank of Russia interest rate band, with fluctuations within a range of 5.48% to 6.45%. More active participation of the Bank of Russia in money market transactions in October-December 2012 was basically due to a steady liquidity gap caused by liquidity generating autonomous factors (in particular, budget funds flows and changes in money supply).
- The Bank of Russia increased the volume of transactions with money market participants and was acting as principal supplier of liquidity to the banking sector. The value of its open positions increased throughout the entire 2012 Q4.
- Maximum length of liquidity transmission<sup>1</sup> saw no decline and remained at a level of three consecutive transmissions of liquidity on the money market. In October-December 2012, tier-1 market participants accumulated 79.7% of entire market liquidity by transmitting a portion of funds to other market participants. Tier-2 market participants did the same and acquired 19.9% of money market liquidity (see p. 17 for details).
- In 2012 Q4, market multipliers showed improvements on the money market transmission mechanism. A model designed for analysis of money market interest rates revealed an indirect relationship between interbank loan rates and Bank of Russia repo auction rates through interdealer repo rates (see p. 21 for details).

### *Money market systemic risks*

- In 2012 Q4, the banking sector was able to provide adequate collateral for refinancing against market assets through Bank of Russia repos (an estimate of 3.7 trillion roubles to 4.0 trillion roubles as of December 1, 2012). It should be noted that the potential to enlarge the repo list is largely limited. The list already covers about 75% of the Russian bank securities portfolio. Non-resident bonds and resident stocks comprise the biggest group of securities which are not included into the list.
- In 2012 Q4, banks were the principal market participants having an effect on market conditions (transaction volumes, interest rates, etc.). Resident and non-resident customers played an important role too.
- Under current (non-crisis) conditions, the risk of wide-scale defaults on the repo market somewhat increased as against 2012 Q3. In general, however, the interdealer repo market is able to cope with a single-day shock on the stock market, whereas in a crisis the risk of wide-scale defaults was material (see p. 25 for details).
- In 2012 Q4, bank borrowings were less risky in terms of collateral in use, while borrowings by customers (especially non-residents) became much more risky (see p. 26 for details).

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<sup>1</sup> *Maximum length of liquidity transmission* – the maximum number of consecutive liquidity providing transactions from tier 0 to the upper tier of liquidity distribution. It is identified as the highest number of liquidity distribution tiers.

- Analysis of potential aggregate losses incurred by interbank loan market participants in the event of default by specific market participants revealed that concentration of risks also decreased on the interbank loan market in 2012 Q4 (as evidenced by a 21% increase in the total of twenty maximum values of the “systemic losses in the event of a bank default” indicator as against a 12% decrease in the total of five maximum values and a 19% decrease in the total of three values of this indicator). Though capital adequacy still remains the principal factor of potential defaults, the significance of other factors (in particular, liquidity problems) has increased (see p. 29 for details).

### ***Developing money market infrastructure***

- Over-the-counter tri-party repos will begin in 2013 Q1, which means that transactions between credit institutions and the Bank of Russia will be backed by a general collateral (securities basket) rather than specific issues of securities. Security management functions (including collateral replacement within a repo transaction period) will be assigned to the National Settlement Depository.
- As part of tri-party repos market participants will have an opportunity to partially execute the first leg of a repo transaction and automatically defer the second leg under overnight conditions at the Bank of Russia refinancing rate; the system of margining of over-the-counter general-collateral repos will see major changes.
- The implementation of the tri-party repo project will diversify access channels to Bank of Russia repos, reduce transaction costs for the participants of the Bank of Russia refinancing system, and create preconditions for the establishment of a single clearing and settlement entity on the money market.

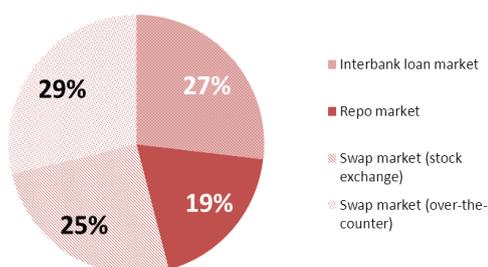
# 1. MARKET STRUCTURE AND CASH FLOW DISTRIBUTION

## 1.1. Money market structure and conditions: swaps, repos, interbank loans

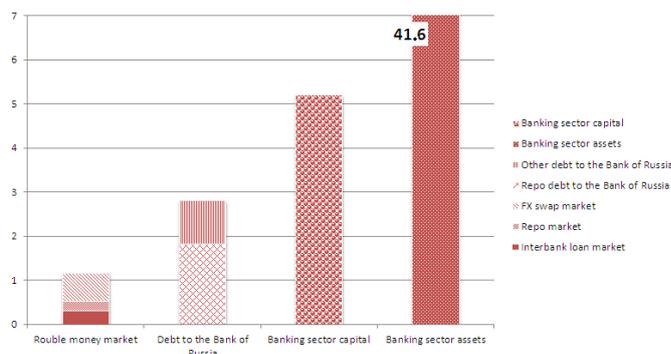
Money market participants<sup>2</sup> comprise banks, non-bank financial institutions, their customers, including non-residents. The Bank of Russia plays an essential role on the money market by using it for refinancing the banking sector. Since short-term transactions are most common on the market, it is the overnight and '1-week' transactions that will be focused upon hereafter. Consequently, unless otherwise specified, estimates are made on the basis of transactions with a maturity of up to seven days.

In 2012 Q4, the aggregate daily turnover on the money market totalled about 1.2 trillion roubles, of which swaps amounted to 0.63 trillion roubles (54%), interbank loans – 0.31 trillion roubles (27%), repos – 0.22 trillion roubles (19%) (Chart 1). The market daily turnover stood at about 20% of banking sector total capital and nearly 2.5% of bank total assets (liabilities)<sup>3</sup> (Chart 2). Comparison of money market value with the debt value to the Bank of Russia shows that the money market remains a key source of short-term liquidity for participants against the record value of debt to the regulator.

**Chart 1. Money market structure (quarterly average), %**



**Chart 2. Money market value as against banking sector characteristics, trillion roubles**

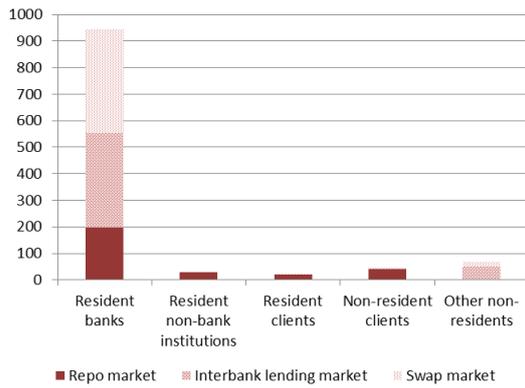


Resident banks were principal creditors and borrowers on the rouble money market (Chart 3 and Chart 4.). They accounted for about 85% of lending and about 66% of borrowing volumes. Thus, the bank net position (lending net of borrowing) remained positive and amounted to about 250 billion roubles, i.e. the banks acted as net creditors on the money market, while customers (of both banks and non-bank institutions) acted as net borrowers, with non-residents accounting for a considerably large share of customers. The interbank loan market and swap market were mostly resident interbank markets, whereas bank loans to customers accounted for a major share of transactions on the repo market (Chart 3 and Chart 4).

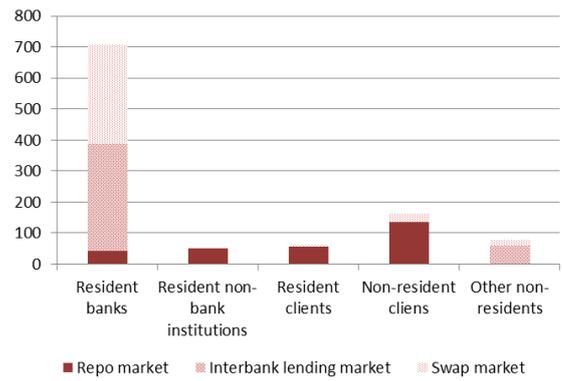
<sup>2</sup> The Review presents analysis of the rouble money market. It should be noted that market participants are actively involved in foreign exchange (mostly US dollar and euro) transactions in addition to rouble transactions. Rouble-denominated interbank loans account for one-third of the interbank loan market, open FX positions on the repo market account for about one fourth of the repo market.

<sup>3</sup> The presented figures would increase by several times by taking account of foreign exchange transactions and mid- and long-term (more than seven days) transactions. For example, the value of the Russian banking system debt to credit institutions amounts to about 4.4 trillion roubles, accounting for about 85% of banking system capital.

**Chart 3. Creditors on the money market in 2012 Q4, billion roubles**

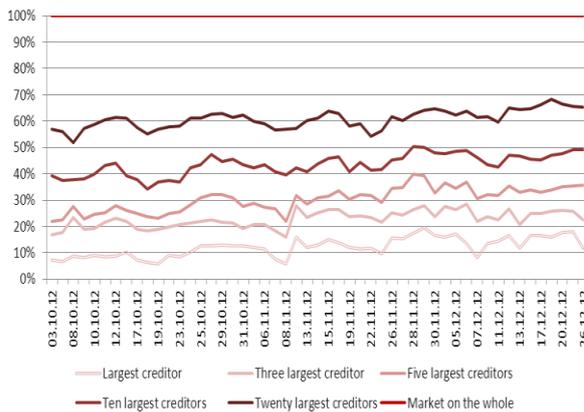


**Chart 4. Borrowers on the money market in 2012 Q4, billion roubles**

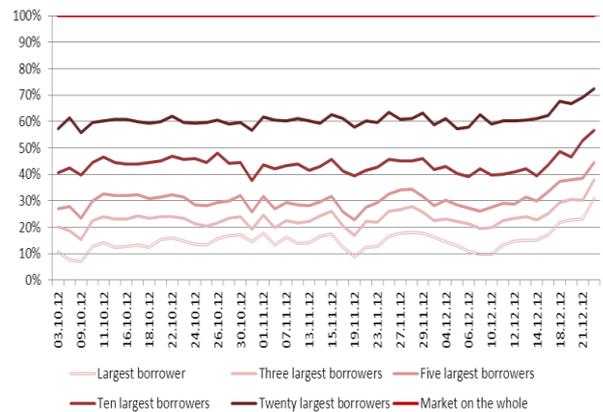


High levels of concentration among creditors and borrowers is worth noting. The twenty largest creditors and borrowers accounted for 60%-70% of the market (Chart 5 and Chart 6).

**Chart 5. Concentration of creditors on the money market, %**

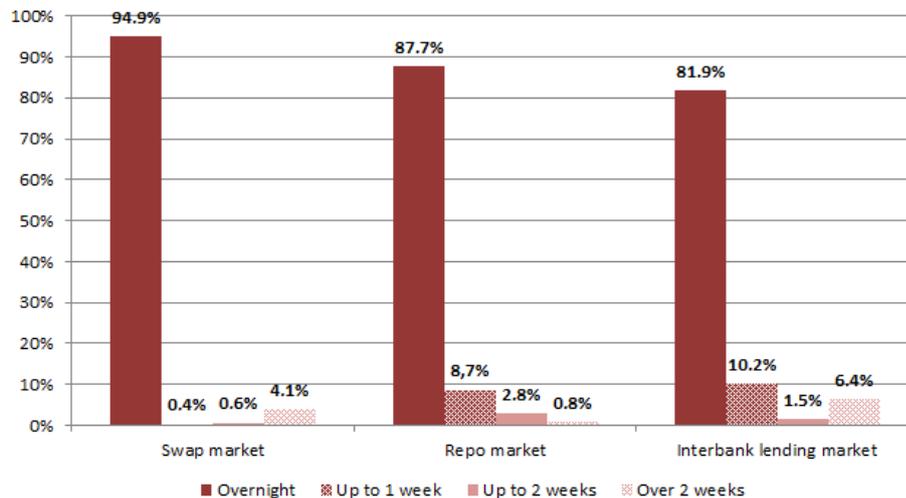


**Chart 6. Concentration of borrowers on the money market, %**



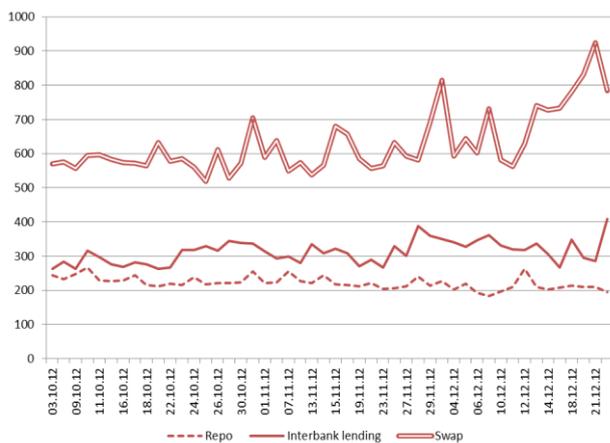
Money market transactions were mostly short-term: overnight transactions accounted for more than 80% of the market segments and about 95% of the swap market (Chart 7). This situation was observed both in 2012 Q4 and throughout the entire year.

**Chart 7. Term structure of money market segments (share in daily turnover, %)**

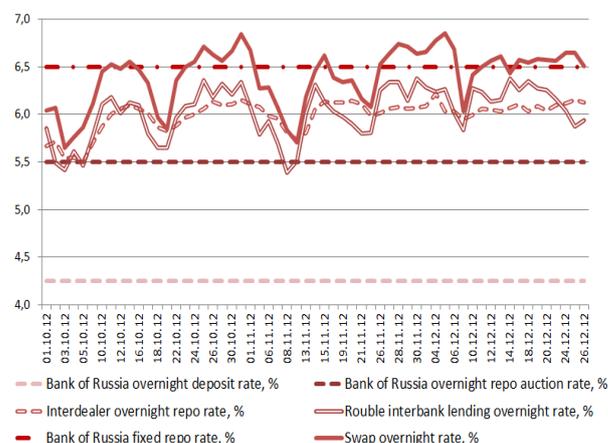


During 2012 Q4, volumes and interest rates were growing on the money market due to a seasonal higher demand for liquidity in November-the first half of December 2012 (Chart 8 and Chart 9). It was the swap market that saw most of the growth in volumes. It should be noted that in spite of a higher demand for liquidity, the situation on the money markets remained stable in general: money market rates remained within the Bank of Russia interest rate band.

**Chart 8. Volumes of operations in money market segments, billion roubles**

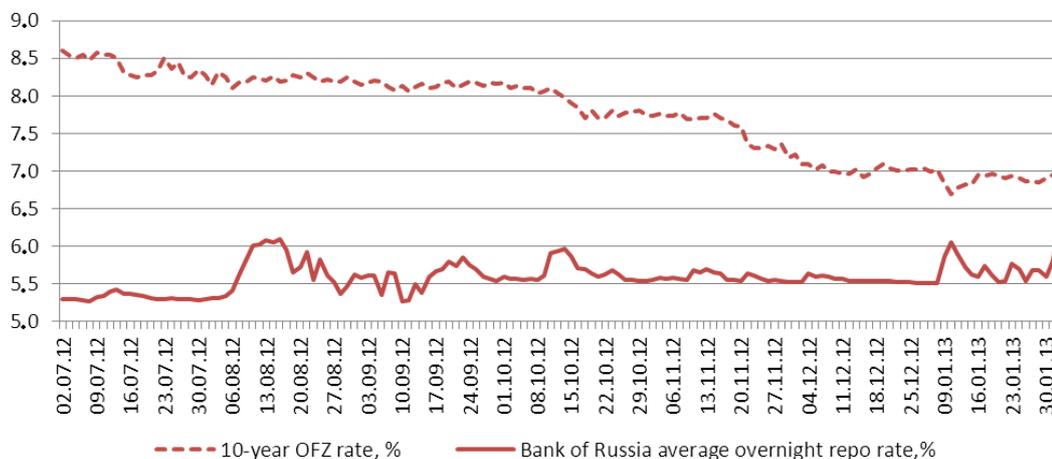


**Chart 9. Overnight money market rates, %**



Growth in rates was accompanied by a decrease in OFZ yields: zero-coupon yield (with a maturity of 10 years) fell from 8.61% to 6.92% between July 2, 2012 and February 1, 2013<sup>4</sup> (Chart 10). The upturn in non-resident customer demand for OFZs was most responsible for the decrease. Thus, the interest rate differential between the risk-free rate and borrowing rate on the repo market decreased, which in turn made some of the participants borrow less for increasing their leverage.

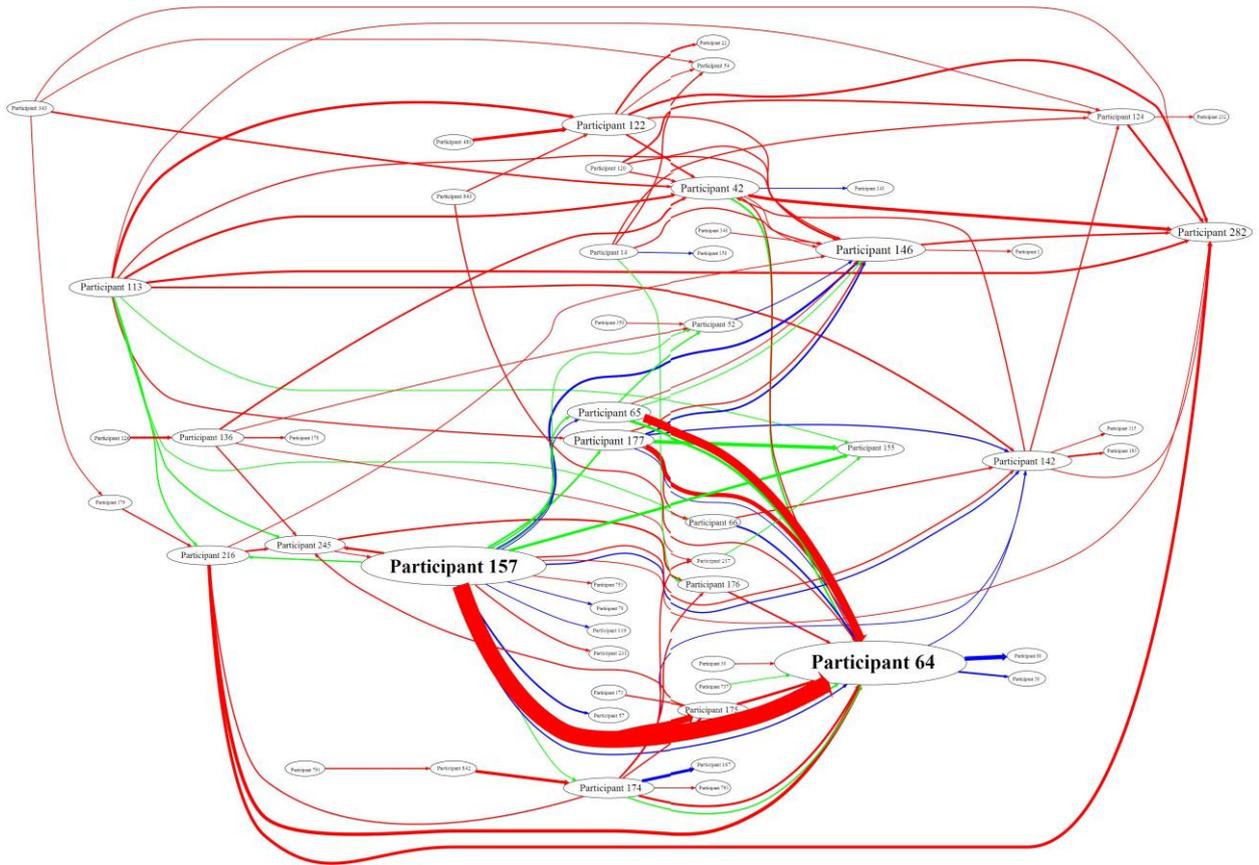
**Chart 10. OFZ yields and Bank of Russia repo rate, %**



A large number of active participants operated on the money market in 2012 Q4 (Chart 11).

<sup>4</sup> <http://www.cbr.ru/GCurve/GDB.asp>

**Chart 11. Money market participant accumulated positions**



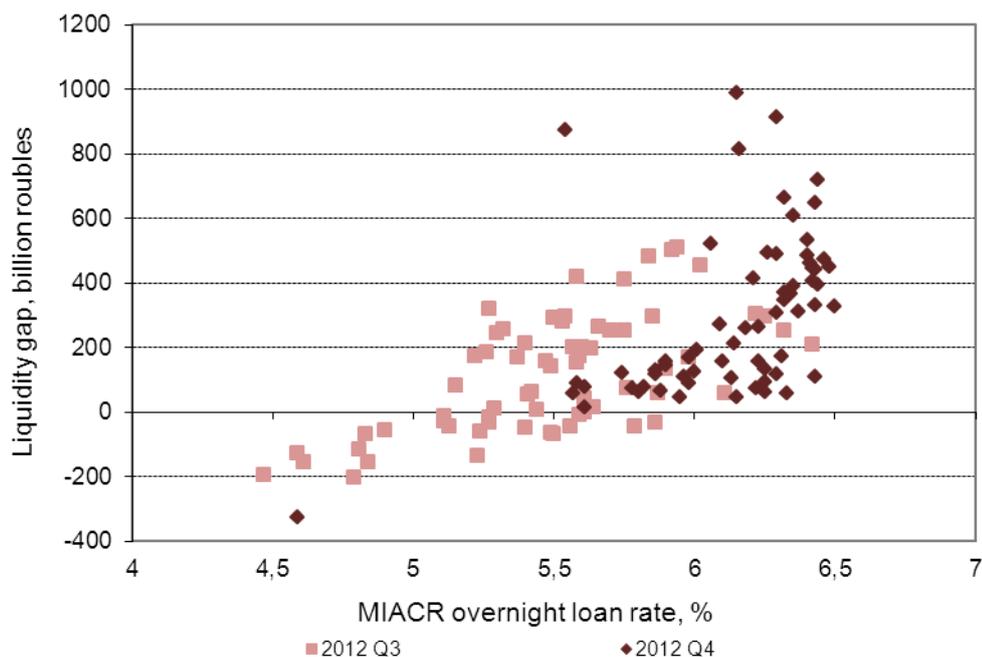
*Note: The Chart presents a directed graph illustrating liquidity flows on the money market. The pointed arrows (graphs) – liquidity providing transactions, while tops – market participants. The directed graph shows cash flows beyond 2 billion roubles. The arrow thickness corresponds to the participant’s accumulated position towards a specific counterparty, the font size – the participant’s volume of transactions on the money market. Red colour – transactions on the swap market, blue colour – transactions on the repo market, green colour – transactions on the interbank loan market.*

The money market was heterogeneous, including, above all, several large participants with a high volume of transactions and a considerable number of small participants. As noted above, most transactions were effected on the swap market. Subsidiary non-resident banks played an essential role among creditors on the swap market, redirecting the acquired foreign currency to their parent banks. Largely, resident banks and financial companies were among final recipients of liquidity. These participants borrowed mostly through repos. The money market also saw a substantial volume of intermediation transactions both within a single market segment (e.g., swap) and between different segments. The intermediation chain length (the number of participants between the source and recipient of liquidity) was insignificant, i.e. the market showed no ‘intermediation’ nature in general. In addition, it should be noted that the money market saw a stable substantial volume of transactions and strong relationships among participants.

## 1.2. Banking sector liquidity and Bank of Russia participation in the money market

In 2012 Q4, the banking sector saw a continuous liquidity structural deficit which kept the money market rate<sup>5</sup> at the top of the Bank of Russia interest rate band, fluctuating within a range of 5.48% to 6.45%<sup>6</sup>. The rate stood at an average of 6.1% in the period, growing 0.6 percentage points as against the previous quarter. This was due to higher interest rates on Bank of Russia operations in September 2012, which rose in response to both increased inflation expectations and liquidity deficit growth (Chart 12 and Addendum 4.1. Liquidity factors forecast).

**Chart 12. Ratio of MIACR on rouble overnight loans to the banking sector liquidity gap<sup>7</sup> in 2012 Q3 and Q4**



Bank of Russia operations kept playing an essential role amidst liquidity structural deficit, providing a balance between money market supply and demand: Bank of Russia gross credit to credit institutions rose by 0.5 trillion roubles in 2012 Q4 to 3.26 trillion roubles by the end of the year.

Bank of Russia repos remained the principal mechanism of refinancing. The average value of overnight auction transactions increased to 330.6 billion roubles in 2012 Q4 as against 180.9 billion roubles in 2012 Q3, while that of '1-week' transactions expanded from 1,053 billion roubles to 1,080.1 billion roubles. However, the average value of interbank overnight rouble loans, which are used to calculate the MIACR, remained unchanged in 2012 Q4, totalling 178 billion roubles as against 169.1 billion roubles in 2012 Q3.

Rouble swaps with the Bank of Russia became more frequent after the Bank of Russia lowered an interest rate on these transactions<sup>8</sup> on December 10, 2012, while their average value increased to

<sup>5</sup> MIACR on overnight rouble loans.

<sup>6</sup> Except for the rate on the last working day of the year, when the Bank of Russia performed no operations on the money market.

<sup>7</sup> The banking sector liquidity gap is determined as the difference between liquidity supply and demand on a specific day (for details refer to "On Determining Limits on Bank of Russia Market Operations on Liquidity Providing/Absorbing" in Section "Monetary Policy" posted on the Bank of Russia website: <http://www.cbr.ru/dkp/>).

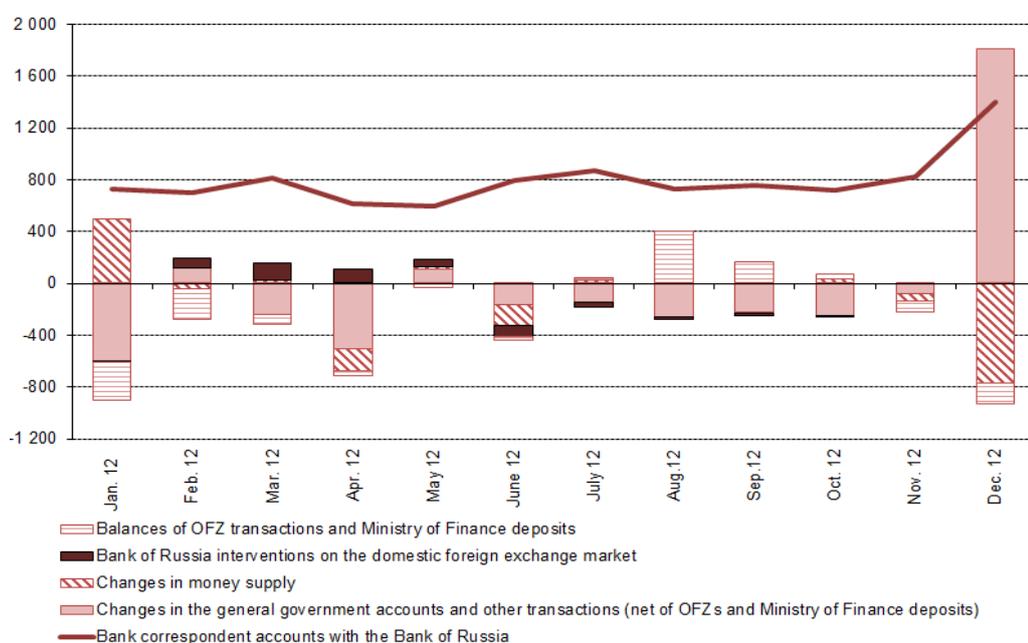
53.6 billion roubles as against 17.8 billion roubles in 2012 Q3. The debt under such transactions reached 300 billion roubles on some days, while it was equal to 50 billion roubles or less in 2012 Q3.

The Bank of Russia became more active on the money market in October-December 2012 in an effort to maintain the liquidity gap resulted from liquidity providing autonomous factors.

Higher flexibility of the exchange rate regime reduced considerably the impact of Bank of Russia foreign exchange interventions on banking sector liquidity. In 2012 Q4, Bank of Russia transactions on the domestic foreign exchange market resulted in that the level of banking liquidity was only -2.5 billion roubles as against +71.7 billion roubles in 2012 Q3 and +285 billion roubles in the 2011 Q4.

Budget funds flows and changes in money supply made a decisive impact on banking sector liquidity in 2012 Q4 (Chart 13). In October-November 2012, the budget channel continued to be the key factor of liquidity outflow from the banking sector, while the traditional December surge of budget expenditures encouraged a total of 1,250.6 billion roubles (-62 billion roubles in the previous quarter) of cash inflow via the budget channel in 2012 Q4.

**Chart 13. Liquidity providing autonomous factors in the banking sector, billion roubles**



In 2012 Q4, the Federal Treasury placed a substantial amount of funds (831.1 billion roubles) on deposits with credit institutions, which, however, failed to considerably increase banking sector liquidity, because in that period the banking sector redeemed a total of 852 billion roubles deposited by the Federal Treasury.

Budget funds inflow to the banking sector in the period under review was largely compensated by seasonal growth in money supply and demand. Traditionally, major changes in money supply are observed at the end of the year due to a substantial amount of payments to individuals and consumer spending in the period prior to New Year holidays. All in all, banking sector liquidity decreased by 791.2 billion roubles in response to growth in money supply in 2012 Q4 as against a growth of 15.9 billion roubles in 2012 Q3.

<sup>8</sup> To reduce volatility of money market rates and enhance the impact of the interest rate channel of the monetary policy transmission mechanism, the Bank of Russia made a decision on June 15 and December 10, 2012 to lower an interest rate on its rouble swaps from 8.0% to 6.5%.

### 1.3. Money market liquidity transmission (involving Bank of Russia)

This section presents the results of analysis of the liquidity transmission mechanism<sup>9</sup> on the money market (in repo, interbank loan, and swap segments) based on transaction data from October 1 to December 28, 2012, which included 64 trading days. The analysis focuses on short-term transactions with a maturity of up to seven days, which account for a substantial share of the money market volume and constitute the principal tool designed to provide liquidity to the banking sector (see Addendum 4.2. Money market liquidity transmission method).

In 2012 Q4, the daily value of open positions on the money market with a maturity of up to seven days (net of reverse repos, T+N futures and other transactions without rouble-denominated instruments) averaged 3,342.5 billion roubles, showing a 12.2% growth on 2012 Q3. Most transactions (55.3%) were effected on the repo market – the daily value of opened positions averaged 1,846.8 billion roubles, of which 1,432.0 billion roubles (43.3% of the total money market value) were Bank of Russia repos. Thus, the interdealer repo market amounted to 414.8 billion roubles (12.0%), while swaps<sup>10</sup> (941.16 billion roubles, or 28.1%, of which stock-exchange transactions stood at 280.9 billion roubles) and interbank loans (554.6 billion roubles, or 16.6%) accounted for the rest of the money market. The repo market volume includes transactions on all types of collateral (bonds, stocks, and depository receipts). Only rouble transactions are recognized in transactions in the interbank loan and swap segments.

The number of participants on the money market averaged about 854 (+3.5% per quarter), more than 640 of them were represented by banks. In 2012 Q4, the term structure of the market saw no significant changes amid growing volumes of transactions. The ‘1-week’ repo segment accounted for most of transaction volumes. Overnight transactions prevailed in the interbank loan and swap segments. All market segments saw a seasonal increase in the volume of transactions by the end of 2012.

Table 1 shows the distribution of monthly average interest rates by term of transactions and money market segment. The rates on 1-week repos, most of which are transactions with the Bank of Russia, are lower on average than the rates on other types of transactions.

**Table 1. Average-weighted interest rates (%) and monthly average daily value of open positions on transactions (billion roubles) by money market segment**

Period	overnight			2-6 days			'1-week'		
	repos	interbank loans	swaps	repos	interbank loans	swaps	repos	interbank loans	swaps
<b>2012</b>									
<b>July</b>	5.56%	5.39%	5.88%	6.21%	5.54%	5.53%	5.34%	6.08%	6.34%
	595.2	386.3	693.7	19.8	8.6	64.1	967.3	117.3	36.8
<b>August</b>	5.64%	5.12%	5.55%	5.87%	5.48%	5.01%	5.35%	5.77%	6.40%
	344.8	380.7	768.7	19.9	10.0	51.3	1,227.4	226.4	29.2
<b>September</b>	5.49%	5.30%	5.64%	5.82%	5.40%	5.38%	5.43%	5.69%	6.59%
	388.8	351.6	803.7	21.7	8.0	7.1	1,153.2	223.3	31.8
<b>October</b>	5.88%	5.88%	6.33%	6.35%	6.00%	5.65%	5.58%	5.99%	6.54%
	468.9	367.3	730.2	14.7	9.9	71.0	1,136.5	164.0	27.9
<b>November</b>	5.89%	5.92%	6.38%	6.49%	6.03%	6.18%	5.60%	6.14%	6.79%
	525.2	390.8	750.1	15.6	15.5	157.9	1,231.8	151.0	25.1
<b>December</b>	5.83%	6.11%	6.43%	6.59%	6.24%	6.05%	5.60%	6.14%	5.93%
	816.1	388.5	878.0	15.6	24.0	182.5	1,413.4	157.1	48.7

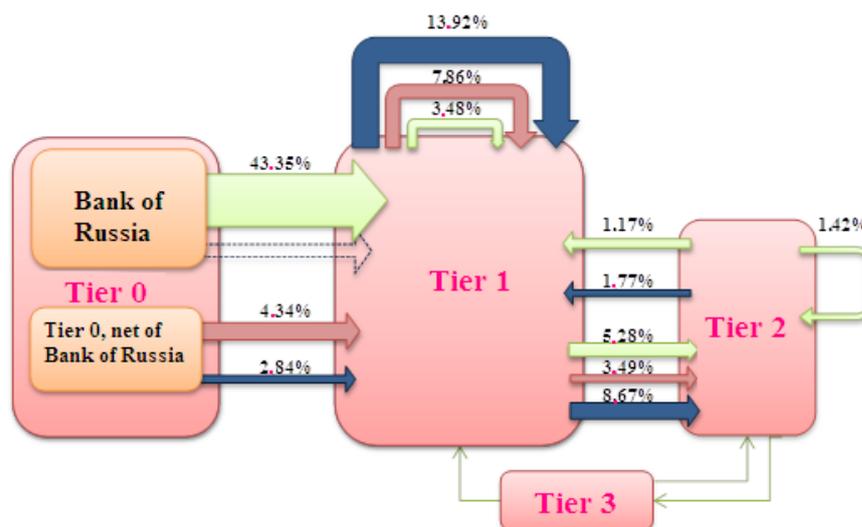
The breakdown of the money market into tiers, which are determined by their proximity to primary liquidity sources, showed that tier-1 participants prevailed in 2012 Q4. Most of the transactions (43.35% in terms of value) were concluded in the repo segment between tier 0

<sup>9</sup> See Conceptual Framework for Liquidity Transmission Analysis in the Interdealer Repo Market Report for 2012 Q1, p. 26. For a detailed description of the analytical system and its indicators please see Моисеев С.Р., Пантина И.В., Сосюрко В.В. Анализ трансмиссии ликвидности на рынке междилерского РЕПО // Деньги и кредит, 2012, №7, с. 65-71.

<sup>10</sup> Here and below, assessments are given, excluding Bank of Russia swaps.

(including the Bank of Russia and other principal creditors) and tier 1, including the largest banks actively leveraging Bank of Russia refinancing facilities. Trading sessions on the swap market were arranged through Moscow Stock Exchange Group, a central counterparty, which gave rise to a high volume of swaps in tier 1. Overall distribution of rouble liquidity flows among the tiers is presented in Chart 14, showing shares of tier-to-tier transactions in the total money market. In 2012 Q4, tier-1 participants accumulated 79.7% of total market liquid assets, transferring a portion of funds to other market participants. Tier-2 participants did the same and accounted for 19.9% of money market liquidity. High intermediation ratio for tier 2 demonstrates a high liquidity retention rate, thereby only 0.6% of market liquidity reached tier 3. The structure of deals remained the same as in 2012 Q3, while the rouble liquidity flow from tier 1 to tier 2 changed insignificantly.

**Chart 14. Liquidity distribution on the money market with a maturity of up to seven days in 2012 Q4**



*Note. The Chart shows a directed graph illustrating cash flows on the money market with a maturity of up to seven days. The pointed arrows (graphs) correspond to rouble liquidity providing transactions, while the blocks represent tiers of market participants. The percentage values demonstrate a share of these cash flows in the total volume of open positions on the money market, amounting to 3,342.5 billion roubles daily. The directed graph presents only cash flows exceeding this sum by 1%. The closed arrows mean that deals are closed between counterparties of the same tier. Rouble liquidity flows on the money market on transactions with a maturity of up to seven days: green arrows – repos, pink arrows – interbank loans, blue arrows – swaps.*

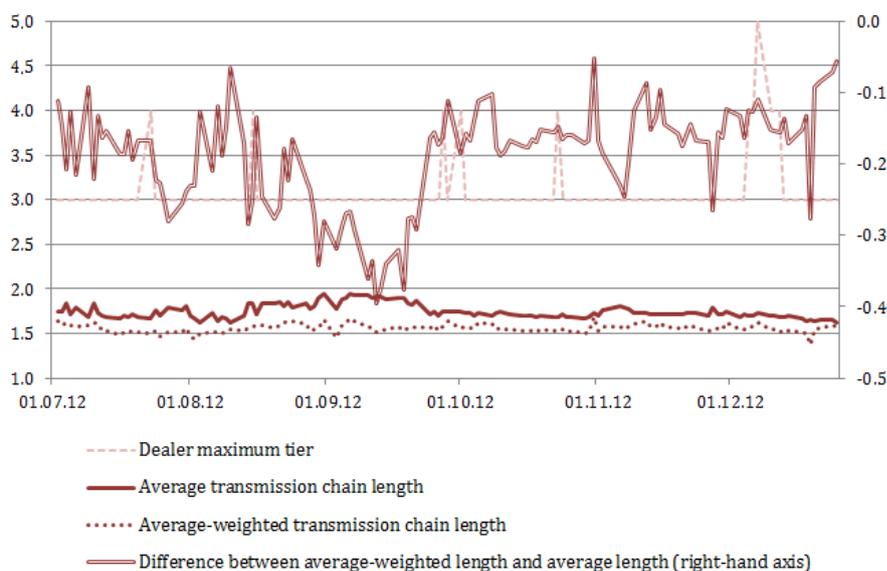
An average of 425 participants (more than 350 banks) were at tier 0; 203 (185 banks) at tier 1; up to 213 (98 banks) at tier 2. Average daily number of dealers on the money market increased from 826 to 855 during the quarter.

The average maximum length of transmission chain rose slightly to 3.14 in 2012 Q4 (+3.1% as against 2012 Q3). In most of the trading days, the maximum length of the transmission chain measured three cash transmissions when liquid assets were provided from tier 0 to 3, which was indicative of normal market conditions. During 8 of 64 days, liquidity was provided consecutively from tier 0 to 4 or 5.

In the second half of 2012, the average-weighted length of the transmission chain (the number of consecutive liquidity providing transactions, taking account of transaction value) was below the average length of the chain (the number of consecutive liquidity providing transactions, taking account of transaction volume, Chart 15) due to a large share of transaction values at lower tiers (between tier 0 and 1 in this particular case). The average-weighted length of the transmission chain decreased insignificantly from 1.56 to 1.55 during the quarter. In September 2012, the difference between the average-weighted and average length of the transmission chain increased amid structural liquidity deficit, thus indicating higher number of transactions at lower tiers. Generally, the market structure looked more stable in 2012 Q4 than in the previous quarter, the

situation with banking liquidity had a positive effect on the transmission mechanism characteristics.

**Chart 15. Transmission chain length on the money market with a maturity of up to seven days in 2012 Q4**



Average-weighted interest rates in the segment with a maturity of up to seven days at each liquidity distribution tier show the average rate, weighted by transaction value, this tier uses to borrow liquid funds. Generally, in 2012 Q4 the money market saw its rates rise in all segments (save for swaps at tier 2 and beyond) (Table 2). Average-weighted rates on repos with a maturity of up to seven days increased to 5.69% (+0.25 p.p.), interbank loans – to 6.13% (+0.55 p.p.), swaps – to 5.66% (+0.75 p.p.) during the quarter.

**Table 2. Average-weighted borrowing rates by tier for transactions with a maturity of up to seven days, %**

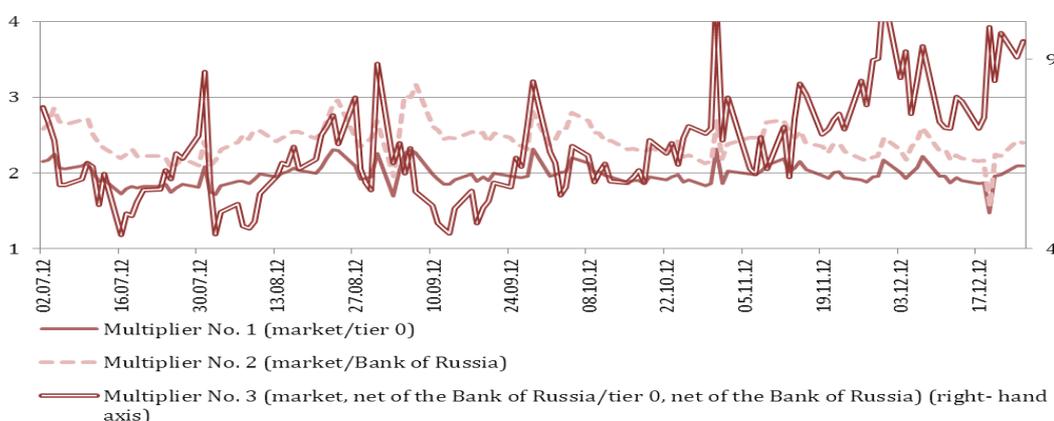
Period	tier 1			tier 2			tier 3 and beyond		
	repos	interbank loans	swaps	repos	interbank loans	swaps	repos	interbank loans	swaps
<b>2012</b>									
<b>July</b>	5.36%	5.43%	5.79%	5.93%	6.15%	5.46%	5.76%	5.57%	6.28%
<b>August</b>	5.36%	5.30%	5.46%	5.92%	5.82%	5.47%	5.51%	5.48%	5.70%
<b>September</b>	5.42%	5.41%	5.49%	5.68%	5.75%	5.47%	4.53%	5.55%	4.00%
<b>October</b>	5.62%	5.85%	6.32%	6.01%	6.28%	6.08%	6.00%	6.09%	3.95%
<b>November</b>	5.61%	5.90%	6.33%	6.22%	6.40%	5.91%	5.91%	6.02%	5.34%
<b>December</b>	5.62%	6.04%	6.58%	6.25%	6.49%	5.62%	5.63%	6.36%	4.04%

Interest rates fluctuations at tier 3 and upper tiers are due to a small number of transactions at these tiers, in particular in July and September. Mostly, these tiers involve either low-cost transactions between related parties or, vice versa, high-cost transactions, because some of the participants have no less expensive sources of financing. High interest rate volatility at the upper tiers leads to a situation when average-weighted rates on transactions go lower than those at the lower tiers.

Late in October-December 2012, higher volumes of Bank of Russia repos resulted in a gradual convergence of the values of *multiplier No. 1* (ratio of total market value to tier 0 transaction value) and *multiplier No. 2* (ratio of total market value to funds provided by the Bank of Russia) (Chart 16). Narrowing of the gap between these multipliers shows that the Bank of Russia increased its share

at tier 0, being the principal primary lender in the specified period. Market *multiplier No. 3* (ratio of total market value, net of the Bank of Russia, to tier 0 value, net of the Bank of Russia) tended to grow in 2012 Q4, indicating high activities of money market participants, net of Bank of Russia operations.

**Chart 16. Money market multipliers**



In the second half of 2012, the intermediation ratio (net liquidity borrowing to total volume of transactions concluded at the tier, Table 3) for tier-1 participants saw a decrease. This testifies to the fact that most funds borrowed by tier 1 were transferred to other money market participants. As opposed to tier 1, tier 2 participants accumulated most of the borrowed funds. The intermediation ratio for tier 2 increased from 0.53 in September to 0.65 in December 2012.

**Table 3. Average-weighted intermediation ratio for tier 1 and tier 2**

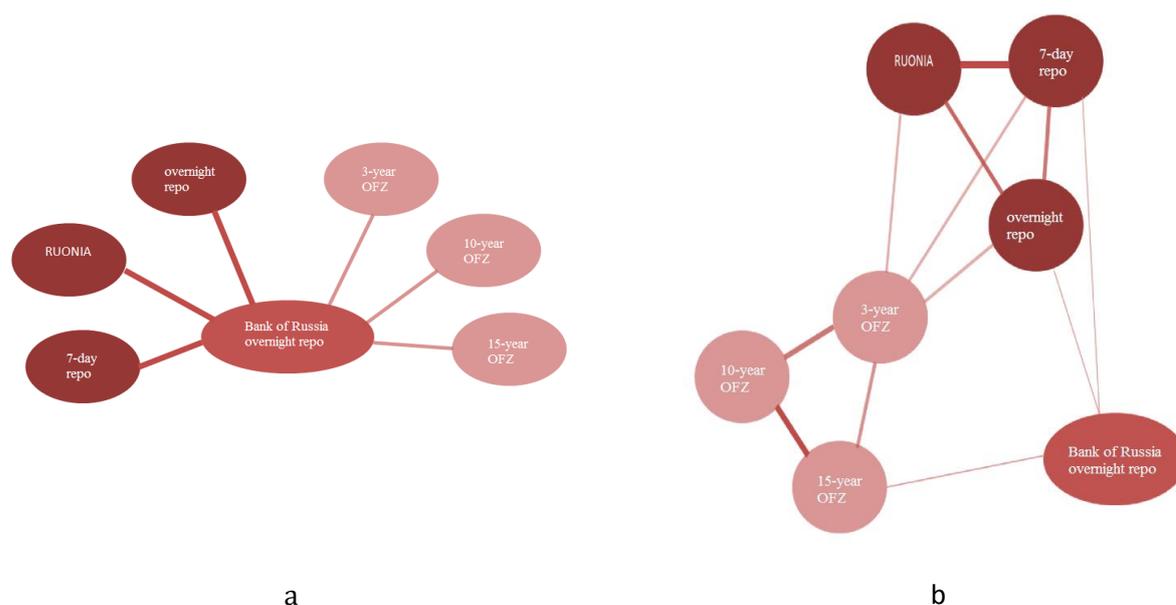
Period	tier 1	tier 2
<b>2012</b>		
<b>July</b>	0.38	0.60
<b>August</b>	0.38	0.55
<b>September</b>	0.39	0.53
<b>October</b>	0.38	0.59
<b>November</b>	0.36	0.57
<b>December</b>	0.36	0.65

## 1.4. Relationships among money market interest rates

Analysis of systemic risks on the money market requires an on-going monitoring of interest rate relationships. It is hard to fulfil this task by employing the traditional approach (correlation and regression methods) due to a high noisiness of source data. To this end, the FSD used the harmonic oscillator model,<sup>11</sup> which allows relations to be revealed in case of high noisiness. The period from January 11, 2010 to November 28, 2012 was analysed. To take account of the delayed effect of interest rates on each other, all variables were entered with two lags: one day and two days. The results of the analysis are presented in Chart 17. Analyzed were average-weighted rates resulted from an overnight repo auction with the Bank of Russia, RUONIA interbank rate on unsecured loans, interdealer rates on repos secured by overnight bonds (see 'overnight repo' in Chart 17) and 7-day bonds (7-day repo), yields on federal government bonds with maturities of 3 years, 10 years and 15 years (3-year OFZ, 10-year OFZ, and 15-year OFZ, respectively). The line thickness and contrast correspond to how strong the relationship is.

The model allowed two types of changes in rates to be identified: a shift in the interest rate band and daily changes in borrowing rates in the different segments of the money market. The first type (Chart 17 a) corresponds to a general movement of money market rates and takes place at certain points of time. In the second type (Chart 17 b), the relationship is much stronger inside each group than between the groups. The model revealed a close relationship between interbank deposit rates and secured transactions (interdealer repos). In addition, the analysis showed a relationship between money market rates and a short-term segment of the zero-coupon yield curve, which is in line with empirical researches made in other countries<sup>12</sup>.

Chart 17. Relationships among money market interest rates



The relationships among money market interest rates provide for more accurate forecast of how the money market would respond to changes in interest rates on transactions with Bank of Russia instruments and external shocks, and, if required, prepare in advance financial stability measures.

<sup>11</sup> The harmonic oscillator model was used to identify relationships among noisy variables. See Raffaelli G. Collective phenomena in socio-economic systems: from interacting voters to financial markets instabilities: Thesis submitted for the degree of Doctor of Philosophy, International School of Advanced Studies, 2005, 111 p.

<sup>12</sup> Gigineishvili N. Determinants of Interest Rate Pass-Through: Do Macroeconomic Conditions and Financial Market Structure Matter? // IMF Working Paper, 2011, 20 p.

## 2. MONEY MARKET SYSTEMIC RISKS

### 2.1. Issuing activity on the stock market

A capacious securities market is a necessary condition for the development of the repo market, a money market segment. New securities issues enlarge the list and volume of instruments which can be used as collateral. Amid bank higher demand for refinancing, an enlarged securities market may help resolve the problem of potential shortage of marketable collateral to secure Bank of Russia refinancing. The issuing activity on the debt market is most important for supplying adequate collateral for refinancing, as bonds traditionally dominate Russian bank portfolios and presently feature substantially low discounts in Bank of Russia repos.

Table 4 contains data on Russian stock market issues. According to FSD estimates, in 2012 Q4, the issue of OFZs, municipal and corporate bonds (net of Eurobonds) amounted to about 0.9 trillion roubles, with a total of 131 new debt issues being placed. Overall issuing activity on the Russian market was high in 2012 Q4 as against 2012 Q3 due to large issues of corporate bonds. The volume of Russian Eurobond issues was comparable with the volumes of debt issues on the domestic market.

The new OFZ issue is included into the Bank of Russia repo list. As regards municipal and corporate bonds, 50 new issues were already included into the repo list by the end of 2012 Q4<sup>13</sup>.

**Table 4. Stock market issuing activity in 2012 Q4, billion roubles**

Type of securities	Issuing volume par value	Number of issues (auctions)
OFZs	297	1 new issue (14 auctions within 5 issues)
Municipal bonds	78	18 issues
Corporate bonds	532	112 issues
<b>Russian market total</b>	<b>907</b>	<b>131 issues</b>
Eurobonds	453	37 issues
<b>Total</b>	<b>1,360</b>	<b>168 issues</b>

Sources: *RUSBONDS, the Bank of Russia, FSD estimates.*

New securities issues are actively used on the interdealer repo market. Seventy of the 131 securities issues were used as collateral for interdealer repo transactions over the last two weeks in 2012 Q4.<sup>14</sup> About 650 different securities issues were involved in repo transactions over the period under review. According to FSD estimates, the volume of transactions with the new securities issues accounted for 12% of the total volume of all transactions over the period. New corporate bond issues were involved in most transactions.

### 2.2. Bank collateral adequacy

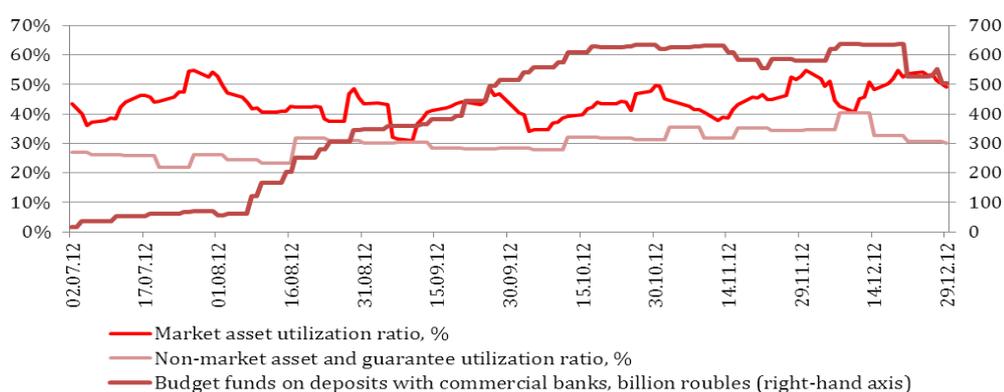
The Bank of Russia pays special attention to a regular assessment of the refinancing potential due to a steadily high volume of credit institutions debt to it. To this end, the Bank of Russia uses so-called 'collateral utilization ratios' – the ratio of credit institution debt to the Bank of Russia by a certain refinancing instrument to total collateral held by the credit institutions, which can be used for refinancing with the use of this instrument. At present, the FSD estimates two types of the utilization ratio: the market asset utilization ratio (used for refinancing through Bank of Russia

<sup>13</sup> A certain period of time lapses between a new issue and its inclusion into the Bank of Russia repo list. To be included, the security should be on the Bank of Russia Lombard List. In particular, decisions on inclusion or non-inclusion of a particular security are based on its liquidity which can be evaluated only after a certain period of time. Moreover, even if the security meets all the requirements, it takes time to make a decision its inclusion into the Lombard List and an approval of a new Lombard List.

<sup>14</sup> The FSD selected the last two weeks (December 17-30, 2012) of 2012 Q4 as an estimation period. The idea was, on the one hand, to make estimates for a period when most securities under review were already issued, and, on the other hand, to have a long enough period for estimation. This approach provides most representative estimates.

repos),<sup>15</sup> and the non-market asset and guarantee utilization ratio (used for refinancing through Bank of Russia secured loans)<sup>16</sup>.

**Chart 18. Utilization ratios and budget funds on bank deposits in 2012 Q3 and Q4**



Growth in utilization ratios suggests that a share of the collateral, which is not involved in refinancing operations, in the total volume of available collateral is shrinking. A high utilization ratio is indicative of collateral deficit in the banking sector, which may entail growth in money market rates and cause problems in bank current liquidity management. Some participants may face liquidity problems with a utilization ratio being far less than unity due to uneven distribution of the collateral.

In 2012 Q4, Bank of Russia repos remained the principal instrument of credit institution refinancing: bank debt by this instrument varied between 1.2 trillion roubles and 2.0 trillion roubles, while the market asset utilization ratio - between 40% and 50% (Chart 18). The non-market asset and guarantee utilization ratio remained steadily less than the market asset utilization ratio throughout the entire 2012 Q4 and stood at 30%-35% for most of the quarter. The utilization ratios became stable in response to growth in budget funds on bank deposits, beginning with the mid-third quarter of 2012.

All in all, in 2012 Q4, demand for liquidity outgrew the value of collateral used for refinancing. The Bank of Russia cannot rule out that this phenomenon would continue. If demand for refinancing keeps growing and collateral deficit occurs, credit institutions may be more actively involved in foreign exchange swaps with the Bank of Russia.

In response to increased demand for refinancing the Bank of Russia extended its list of securities eligible to serve as collateral for repos by including resident stocks in 2012 Q2. At present, however, there is hardly any room left for further extending the repo list. It already includes about three fourths of the current securities portfolio. Excluded securities largely represent non-resident bonds and resident stocks (Table 5).

**Table 5. Russian bank securities portfolio, %**

	Portfolio of	Share of total portfolio		
		01.09.2012	01.12.2012	
Included into repo	Bonds	Ministry of Finance	34.0%	33.2%
		banks	9.1%	10.5%

<sup>15</sup> Market asset utilization ratio was calculated by using bank reports, based on the value of the securities owned by the banks which at least once borrowed from the Bank of Russia through repos in 2012 Q3 and Q4.

<sup>16</sup> Non-market asset and guarantee utilization ratio was calculated on the basis of a regular poll of the largest credit institutions. Thus, the value of this ratio fails to reflect the use of collateral in the banking sector as a whole.

		Russian regions and municipalities	3.4%	3.3%
		other residents	17.2%	18.4%
		non-residents	3.8%	4.3%
	Stocks	residents	6.4%	5.0%
		non-residents	0.0%	0.0%
		TOTAL included into repo list	75.1%	74.6%
Excluded from repo list	Bonds	banks	1.4%	1.4%
		Russian regions and municipalities	0.3%	0.1%
		other residents	3.3%	4.1%
		non-residents	11.9%	10.9%
	Stocks	residents	7.9%	7.6%
		non-residents	1.3%	1.2%
			TOTAL excluded from repo list	24.9%
		Total	100.0%	100.0%

Note: calculated on the basis of the custodian accounting data available in reporting Form 0409711 "Statement on Securities".

According to estimates based on the December 2012 data, the value of marketable collateral held by credit institutions (adjusted by Bank of Russia repo discounts) expanded from 2012 Q3 due to increased volume of debt securities included into the repo list (their value was estimated at 3.4 trillion roubles in September 2012).

**Table 6. Bank collateral as of December 2012, trillion roubles**

Collateral	Outstanding volume	On bank balance sheet	On bank balance sheet (conservative estimate)
<b>Debt securities</b>	7.2	3.8	3.5
<b>Equity securities</b>	3.7	0.2	0.2
<b>TOTAL</b>	10.9	4.0	3.7

Note. The data were calculated taking account of Bank of Russia repo discounts; outstanding debt securities include no Russian Eurobonds; conservative estimate recognises that some collateral is held by banks which are not engaged in Bank of Russia repos (the observation period covers 2012 Q4).

### 2.3. Interdealer repo market stress testing

Stress testing of the interdealer repo market is aimed at assessing the impact of potential stock market shocks (collapsing prices) on the interdealer repo market. Stress tests address the following questions:

- Will a stock market shock trigger mass defaults on the interdealer repo market (a domino effect)?
- What participants, groups of participants are most vulnerable to shocks?
- What market segments (repos with stock, government bonds, corporate bonds, etc.) are most vulnerable to shocks?
- Are the current interdealer repo discounts adequate?

Stress tests consider two stock-market shock scenarios:

- 1) Moderate shock. This scenario simulates a stock-market shock under the current (non-crisis) conditions. The size of the shock is assumed with regard to a potential drop in the securities value at the crisis onset. The key purpose of running this scenario is to assess the interdealer repo market resilience to a stock market shock as of the last date of the period under review (i.e. with regard to the actual market situation).
- 2) Severe shock. This scenario simulates a stock-market shock during a potential crisis. The size of the shock is assumed with regard to a potential drop in the securities value at the crisis height. The key purpose of running this scenario is to determine whether there would be a need to change repo parameters in the event of a crisis.

Stress testing under the **moderate shock scenario** was based on the data as of December 3, 2012.

Systemic risk (risk of mass defaults) was slightly higher in 2012 Q4. In particular, the value of defaulted transactions increased from 96.1 billion roubles to 112 billion roubles, collateral deficit – from 6.1 billion roubles to 10.7 billion roubles (Table 7). However, the absolute values were not so high, suggesting that the interdealer repo market would be able to go through a single-day shock on the stock market.

**Table 7. Comparative results of interdealer repo market stress tests in 2012**

Parameter	Q1	Q2	Q3	Q3	Q4
		Old methodology		New methodology <sup>17</sup>	
Market value, billion roubles	519.1	418.7	427.5	427.5	508.8
Number of transactions, units	8,106	7,367	7,510	7,510	7,805
Accountable value of transactions, billion roubles	361.5	314.8	295.1	426.2	451.4
Accountable number of transactions, units	6,561	6,214	6,050	7,479	7,476
Value of defaulted transactions, billion roubles	114	102.9	114.3	96.1	112
Number of defaulted transactions, units.	3,898	3,928	3,788	3,436	3,543
Collateral deficit, billion roubles	8.2	6.9	10.2	6.1	10.7

Like in 2012 Q3, stock-backed transactions were found to be most vulnerable to stock-market shocks (Table 8) due to a high share of securities lending in repos with stocks<sup>18</sup>.

**Table 8. Results of interdealer repo market stress tests by collateral**

Type of collateral	Market value, billion roubles	Value of defaulted transactions, billion roubles	Share of defaulted transactions, %	Collateral deficit value, billion roubles
Government bonds	103.3	14.3	13.9%	2.36
Corporate, regional and municipal bonds	174.5	27.5	15.7%	1.59
Stocks	173.5	70.2	40.5%	6.71

However, repo transactions in which banks acted as borrowers were the least risky in Q4 as against 2012 Q3 (Table 9). A visible growth in a share and risk of non-resident customer operations is worth noting: the value of operations increased from 166.5 billion roubles to 218.7 billion roubles, collateral deficit – from 1.7 billion roubles to 7.7 billion roubles. Counterparty risks were the highest in making operations with non-bank financial institutions and these participants.

**Table 9. Results of interdealer repo market stress tests by borrower**

Type of borrowers	Market value, billion roubles		Value of defaulted transactions, billion roubles		Share of defaulted transactions, %		Collateral deficit value, billion roubles	
	3	4	3	4	3	4	3	4
Quarter								
Banks	74.1	78.3	18.2	13.2	24.6%	16.9%	1.23	0.93
Non-bank institutions	55.9	61.6	18.4	19.1	32.9%	31.0%	1.02	1.07
Resident customers	123.7	84.9	31.1	18.3	25.1%	21.6%	2.19	0.97

<sup>17</sup> The presented results of the new methodology are applicable to a moderate shock.

<sup>18</sup> Securities lending was identified as negative rate repos.

<b>Non-resident customers</b>	<b>166.5</b>	<b>218.7</b>	<b>28.4</b>	<b>61.4</b>	<b>17.0%</b>	<b>28.1%</b>	<b>1.70</b>	<b>7.69</b>
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Banks and non-bank institutions were stable on the repo market: only one company showed a 3% increase in the ratio of its collateral deficit to capital (to reach 10.7%). A similar situation was observed in 2012 Q3, while customer resistance to shocks dropped noticeably: a share of operations of customers in default rose from 4.5 billion roubles to 47.2 billion roubles to account for more than 10% of the market value. Though a large-scale non-payment crisis (a domino effect) is unlikely in current environment, mass defaults by customers under the second leg of repos constitute a material risk on the interdealer repo market.

Similar to results obtained in the third quarter, market participant losses under *the severe shock scenario*<sup>19</sup> were found to be substantial: potentially defaulted transactions accounted for more than half of total transactions (234.4 billion roubles), collateral deficit – 28.5 billion roubles. Thus, in the event of a crisis the current interdealer repo market discounts would be inadequate. To prevent substantial losses under such a scenario, repo market participants should revise discounts upwards and reduce the acceptable market risk size.

## 2.4. Network indicators of systemic importance of money market participants

Money market stability depends largely on its key (systemically important) participants, whose actions may trigger a systemic risk on the money market. Such participants conduct large volumes of operations, have a wide range of counterparties, actively involve in intermediation operations, and exert substantial impact on the market<sup>20</sup>.

To identify systemically important participants in assessing the foregoing characteristics, the FSD used both traditional indicators which show market participant activity (volume of operations, number of counterparties), and indicators calculated on the basis of network analysis (the method is described in Addendum 4.3). The specified indicators were calculated individually for each participant. The results were further aggregated by type of participants. The aggregation process included several stages:

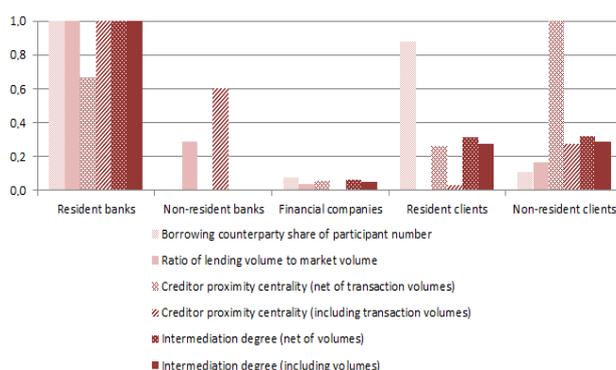
- ten participants with the highest values of a target indicator were selected for each type;
- the average value of a target indicator was calculated based on the selected ten participants;
- for comparative analysis, the estimates obtained for each type of participants were normalized (scaled [0;1]).

In 2012 Q4, it was banks who were the principal participants determining the money market conditions (Chart 19). In addition, both resident and non-resident customers were relevant among creditors. Resident customers were characterized by a large number of borrowing counterparties, because some brokers and banks had subsidiaries which extended loans to the customers of these participants. Among borrowers, customers played an essential role together with banks (Chart 20). One may assume that a big number of non-resident counterparties was determined by non-bank borrowings on the repo market through foreign firms. Non-resident banks and financial companies played a less important role: the former were mostly involved in swap operations, while the latter provided brokerage services, with a small number of operations being executed on their own account.

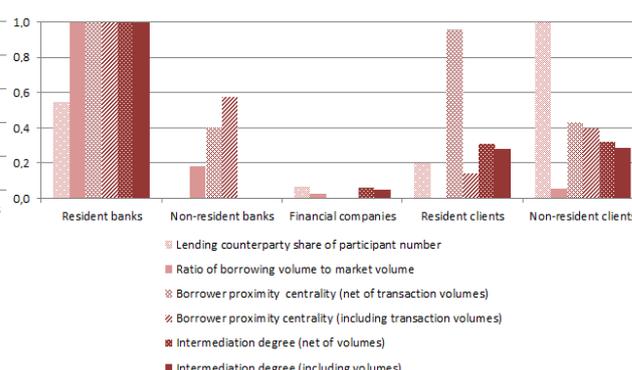
<sup>19</sup> Steady (for a month or longer) and substantial (by 30% and more) fall of stock prices, substantially increased (doubled and more) market volatility, manifestation of recessionary trends in the global economy, including crisis situations in specific developed or major developing countries, drastic fall of key world indices.

<sup>20</sup> In this section, the impact on the market is defined as participant ability to change through its transactions the key market indices, namely volume of transactions, interest rates, etc.

**Chart 19. Indicators of systemic importance of creditor groups**

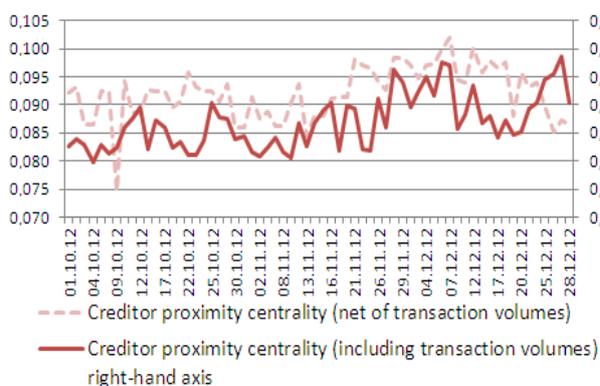


**Chart 20. Indicators of systemic importance of borrower groups**

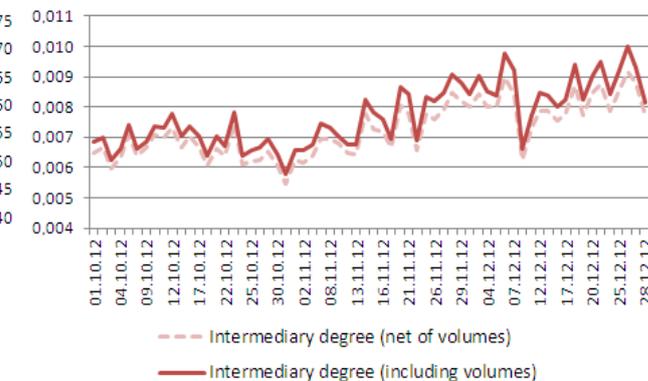


It should be noted that creditor proximity centrality<sup>21</sup> saw some growth during the quarter (Chart 21), which can be interpreted as growing influence of major creditors – systemically important participants – on the market. In addition, intermediaries strengthened their role on the market (Chart 22). Thus, during 2012 Q4, higher money market centrality and intermediation were responsible for increased systemic risks, i.e. market performance indices were getting more dependent upon actions of a few organizations. In general, however, the indices of centrality and intermediation remained at acceptable levels. Specifically, not particularly high market concentration levels and a moderate intermediation chain length testify to this.

**Chart 21. Money market centrality**



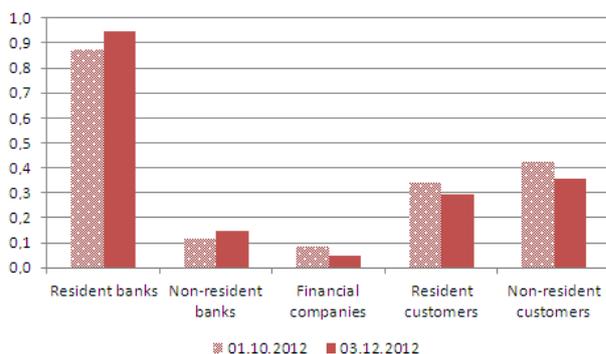
**Chart 22. Intermediation degree on the money market**



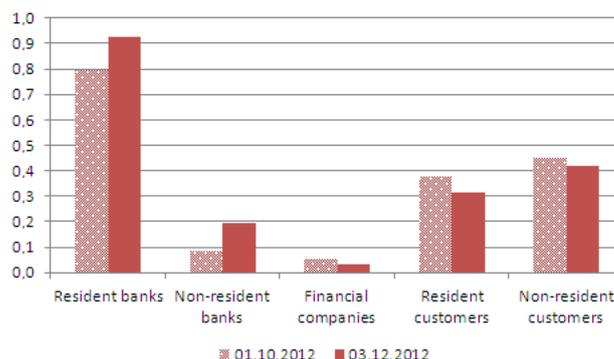
Both resident and non-resident banks contributed most to strengthen the influence of systemically important participants on the money market (Chart 23 and Chart 24), while the influence of customers and financial companies weakened. The key reason for this phenomenon was banking sector higher demand for liquidity in November-the first half of December 2012. For example, in December 2012, the value of swap operations with the Bank of Russia exceeded 300 billion roubles (normally, there is no demand for such operations or their value is no more than 50 billion roubles).

<sup>21</sup> Market centrality is an indicator reflecting proximity to an ideal ‘centralized’ market in which liquidity is provided from a participant (center) and then redistributed among other participants.

**Chart 23. Systemic importance aggregate by creditor**



**Chart 24. Systemic importance aggregate by borrower**



## 2.5. The assessment of a domino effect on the interbank loan market

The Snow Vector method<sup>22</sup> describes a degree of systemic importance of each participant on the interbank market as a sum of losses incurred by market participants in the event of a certain bank default. Thus, the Snow Vector provides the assessment of liquidity systemic risk and credit risk through the prism of intramarket relations among counterparties (see Addendum 4.4. Assessment method of a domino effect on the interbank loan market).

Calculation of the Snow Vector in the period<sup>23</sup> of December 3 to 7, 2012 showed that the distribution of losses under individual scenarios saw some changes as compared with the same period of 2012 Q3. Based on the obtained results, maximum contribution to banking sector total losses by a leading systemically important market participant was 167.1 billion roubles, a 13% growth on the same period in 2012 Q3. The sum of twenty maximum values of the 'system losses caused by bank default' indicator grew by 21% amid a 12% decline in the sum of five maximum values of this indicator and a 19% decline in the sum of three values of this indicator. This testifies to a reduced risk concentration on the interbank loan market.

The increase in twenty maximum values of the 'system losses caused by bank default' indicator is explained by higher average multiplier effect in the system: the average multiplier increased by 4.4 times to a level of 17.7 in 2012 Q4. Table 10 and Chart 25 contain comparative statistics by multiplier value<sup>24</sup> in the first week of the last month of 2012 Q3 and Q4.

<sup>22</sup> Моисеев С.Р., Снегова Е.А. Системная значимость участников денежного рынка // Банковское дело, 2012, №3. с. 24-29.

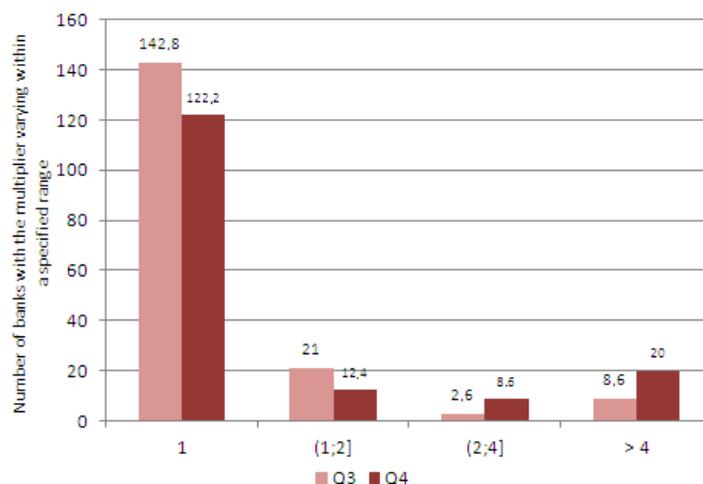
<sup>23</sup> Snow Vector is calculated for each day of the specified period and averaged for the purpose of data smoothing. The first week is selected with a view to exclude seasonal effects relating to year ending.

<sup>24</sup> Bank multiplier is referred to as the ratio of banking sector total losses as a result of a bank potential default to the bank debt value.

**Table 10. Comparative statistics by multiplier value in the first week of the third month of 2012 Q3 and Q4**

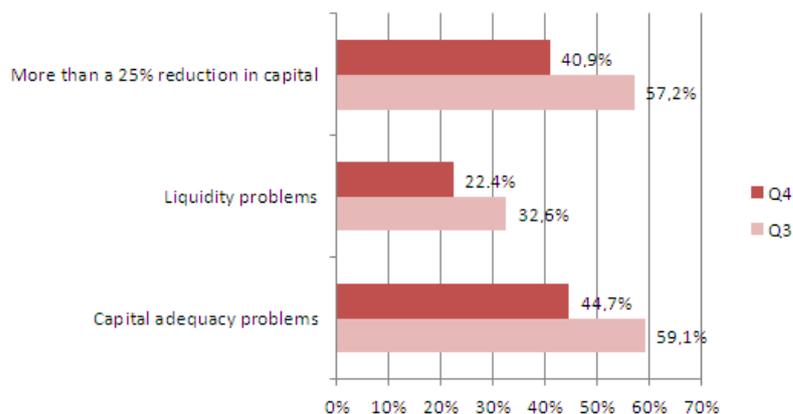
Statistical indicator	Q3	Q4
Average value	4.04	17.4
30% percentile	1.00	1.00
80% percentile	1.60	1.63
90% percentile	4.04	7.82

**Chart 25. Distribution of multiplier values in the first week of the third month of 2012 Q3 and Q4**



The average number of rounds grew in individual scenarios in response to an increase in the average multiplier in the system: in 2012 Q4, this indicator rose by 14% to 1.78 rounds. At the same time, the maximum number of rounds was 4 under all scenarios, like in the previous quarter.

**Chart 26. Distribution of potential default factors on the interbank loan market<sup>25</sup>**



Capital adequacy problems still remained the principal potential default factor in 2012 Q4 (Chart 26), while the number of scenarios, in which more than one factor played a key role simultaneously, decreased. Thus, modelling results show that certain banks should take measures aimed at maintaining a higher capital adequacy to minimize adverse effects of interbank loan market participants in default.

<sup>25</sup> For scenarios with realized default factor.

### 3. MONEY MARKET INFRASTRUCTURE DEVELOPMENT: BANK OF RUSSIA TRI-PARTY REPO WITH NSD

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As part of the development of refinancing operations, the Bank of Russia is implementing with the National Settlement Depository (NSD) the first stage of a project called *Collateral Management, Clearing, and Settlements in the NSD Under Bank of Russia Over-the-Counter Repos*, over-the-counter tri-party<sup>26</sup> general collateral<sup>27</sup> repo transactions. These operations are scheduled to begin in 2013 Q1.

The project is aimed at:

- diversifying access channels to Bank of Russia repos, and mitigating infrastructure risk;
- creating preconditions for the establishment of a single clearing and settlement entity on the Russian money market to enhance competitiveness of the national clearing and settlement infrastructure on the international capital market;
- reducing transaction costs for the participants of the Bank of Russia refinancing system;
- widening a range of post-trading services for Russian participants, including the introduction of a collateral replacement in a repo transaction.

The project will allow banks to perform with the Bank of Russia transactions secured by a general collateral rather than specific issues of securities to potentially ease the load on front-offices, as well as allow market participants to replace collateral within the period of a repo transaction. Collateral management functions, namely automatic selection of securities, collateral replacement, repo margining, etc., will be assigned to the NSD acting as a collateral managing agent, which is a key feature of tri-party repos. The Lombard List securities eligible for collateral under repos are used as general collateral under over-the-counter repos, save for exchange-traded bonds which only may be traded on the stock exchange under the Federal Law “On the Securities Market”.

At the moment of a transaction, banks may select both a list of securities, which on a first-priority basis should be used as collateral under closed general-collateral repos, and a certain issue of securities. In the latter case, a transaction will be regarded as general collateral one, but the basket will initially include one security. Thus, the new instrument offered to market participants is flexible enough to meet any participant need.

Ordinance No. 2936-U, “On the Requirements for Credit Institutions to Conduct Transactions with the Bank of Russia” was introduced on December 13, 2012 to provide regulatory support to new operations. All legal aspects concerning over-the-counter general-collateral repos will be specified in a Master Agreement to be concluded with participants.

At the first stage, Bank of Russia over-the-counter repos will be made using the Bloomberg system and fully integrated into the running system of Bank of Russia repos, while general collateral operations may be closed both as part of repo auctions and at a fixed rate. These operations will be conducted in single standard conditions applicable to already existing operations, namely:

- a single minimum repo auction rate and a fixed repo rate to be set by the Bank of Russia Board of Directors;
- single limits on a Bank of Russia counterparty, and applicable to all trading floors restrictions on operations with securities issued by affiliates;
- a single limit on repo auctions on all trading floors and, consequently, a single cut-off rate;
- single time limits for Bank of Russia repo auctions;
- common repo periods: overnight, 1 week, 3 months, and 12 months.

Thus, participants will be able to use Eurobonds for refinancing for a period of more than one day versus current over-the-counter repos (secured by unlisted foreign securities) which are overnight only.

The Bloomberg information terminal will provide participants with the following:

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<sup>26</sup> Tri-party repo – a repo transaction under which a trading partner transfers securities and cash to a third party, an independent agent responsible for maintaining adequate collateral values.

<sup>27</sup> General collateral – a basket of securities which serve as collateral for cash provided under a repo transaction.

- current day schedule of Bank of Russia repo auctions;
- participant individual limit at opening;
- on-line table (list) of participant bids and a table of closed transactions (once transaction collateral is selected, the table will show a list of securities selected as initial collateral by the NSD)<sup>28</sup>;
- a bid manual input form and bulk download of bids using Microsoft Excel software;
- front-office notification of margin debt on opening.

Bidding and trading through the Bloomberg system will be subject to the following procedure:

- bids are submitted through the Bloomberg system by a credit institution dealer authorized to perform such operations on behalf of a bank;
- both auction repo bids and fixed rate repo bids may be submitted using the Bloomberg system;
- bids include a repo rate and amount, and general collateral identifier, while the participant provides no repo rate in its fixed rate repo bids.

A bid may also contain some extra information:

- specific issue or type of collateral (stocks/bonds);
- type of settlement on a DVP basis: specifically for each transaction or with netting of securities and cash liabilities (DVP1/DVP3<sup>29</sup>).

To further develop the project, there is a plan to provide the possibility to select the Banking Electronic Speed Payment System (BESP) as a mechanism of settlements under over-the-counter Bank of Russia repos. Information on settlements in accounts through the BESP will be transmitted by the Bank of Russia as part of the information on closed over-the-counter repos. The introduction of this service will enhance the efficiency of settlements.

In terms of discharging obligations under general-collateral repo transactions and the effect of default on such obligations, the following principles common for other operations and new opportunities can be emphasized. Partial acceptance by the Bank of Russia of bids submitted at cut-off price at the repo auction is scheduled for introduction in the near future on all trading floors, including over-the-counter repos with NSD clearing. Moreover, all operations will include standard default interest rates and be subject to the approved settlement procedure for residual liabilities and cross-default procedures.

However, participants of general-collateral repos will be allowed to partially fulfil the first leg of a repo transaction (subject to a penalty payable for the defaulted part of liabilities). Another important innovation is automatic rollover, i.e. automatic carrying over the second leg date of an overnight repo transaction at the Bank of Russia refinancing rate. Transactions will be treated as defaulted after three consecutive automatic rollovers.

The system of margining of over-the-counter general-collateral repos will see fundamental changes. The principle under which discounts in general-collateral repos correspond to current overnight repo discounts will remain in force for all repos. As for the rest, the system of margining of over-the-counter repos closed using the Bloomberg system will be based on other principals, namely:

- collateral will be assessed by a pool of the participant total over-the-counter transactions with the Bank of Russia which are closed using the Bloomberg system;
- the participant's margin liability in this margining model arises when the amount of unsecured liabilities on the transaction portfolio is beyond the threshold value set by the Bank of Russia;
- single (overnight) discounts will be used for all terms of over-the-counter general-collateral repos;
- margin will be automatically calculated and written off on a settlement date.

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<sup>28</sup> It should be noted that each issue of securities included into a general collateral transaction is not considered as a stand-alone transaction.

<sup>29</sup> DVP – 'delivery versus payment' settlement models: DVP1 (settlements under each particular transaction), DVP2 (settlements with netting of cash), DVP3 (settlements with netting of cash and securities).

In addition, as part of over-the-counter general-collateral repos, income and other yields on securities transferred to the Bank of Russia will be returned to the original seller of the securities without reducing the liabilities for the second leg of a repo transaction as opposed to the existing system.

The plan for the next stage is to provide online interaction between the NSD and the Moscow Interbank Currency Exchange (MICEX) to allow online replacement/supply of securities held in credit institution's trading accounts with the MICEX or the account with NSD (used for Bank of Russia repos). Furthermore, a work is to be done to establish a NSD single clearing pool, including both over-the-counter transactions closed using the Bloomberg information system and Bank of Russia repos closed in the St Petersburg Currency Exchange and MICEX. It will support the transition to unified clearing, settlements and margining of Bank of Russia repos on the basis of unified principles, as well as maximum integration of stock-exchange and over-the-counter services, and enhance the effectiveness of collateral management. These measures will improve the efficiency of the secondary stock market assets and liquidity thereby strengthening the Russian financial system and encouraging the development of the entire financial market.

## 4. ADDENDA

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### 4.1. Liquidity factors forecast

In December 2012, the Bank of Russia began to publish its weekly forecasts of the factors effecting banking sector liquidity<sup>30</sup>, which allow market participants to understand the reasons for changes in the limits which the Bank of Russia announces each Tuesday for 1-week repo auctions. This information reflects expected liquidity flow movements: the effect on banking sector liquidity of changes in money supply, banking sector operations with the budget system, changes in required reserves, credit institutions compliance with the required ratios, as well as changes in debt on Bank of Russia operations. For example, a weekly limit may increase due to tax payments due on next-week certain dates, while it may decline in response to upcoming budget payments. Since the Bank of Russia intervenes on the foreign exchange market basically on a t+1 basis, it is only the completed interventions that are to be recognized in the calculation of a weekly limit within the 'Balance of Bank of Russia liquidity providing/absorbing operations' indicator for a certain period, and no weekly intervention forecast is therefore made. The computation algorithm for published indicators is provided in a weekly limit calculation sample<sup>31</sup> available on the Bank of Russia website.

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<sup>30</sup> Section Monetary Policy/ Statistics/ Banking Sector Liquidity Indicators/ Forecast of Factors Affecting Banking Sector Liquidity Used to Determine the Limit on Bank of Russia 1-week Market Operations [http://www.cbr.ru/statistics/?PrtID=pffl&pid=plbs&sid=ITM\\_60899](http://www.cbr.ru/statistics/?PrtID=pffl&pid=plbs&sid=ITM_60899).

<sup>31</sup> Section «Денежно-кредитная политика/ Пример расчета лимитов по рыночным операциям Банка России по предоставлению (абсорбированию) ликвидности», - [http://cbr.ru/dkp/standart\\_system/raschet.xls](http://cbr.ru/dkp/standart_system/raschet.xls).

## 4.2. Money market liquidity transmission analysis

Analysis of the money market transmission liquidity mechanism applies in full the interdealer repo market liquidity analysis method<sup>32</sup> to all segments of the money market.

The money market liquidity transmission analysis is based on data on transactions closed in three segments, namely repos, interbank loans, and swaps. Data on repos are compiled on the basis of trading information provided by Moscow Stock Exchange Group. Data on interbank loan and swap transactions are available in Form No. 0409701 "Statement on Foreign-exchange and Money Market Operations" reported by credit institutions.

The ultimate objective of transmission analysis is to identify rouble liquidity flows between different groups of market participants, as well as conditions for liquidity distribution between these groups. The borrower and the creditor for each transaction are identified through the rouble borrowing principle. For example, for swaps the buyer is considered as borrower, while the seller of roubles as creditor.

Similar to the previously used repo market liquidity transmission analysis, the new money market analysis tool relies upon the concept of market tiers. The entire money market is viewed as a multitier system which describes the sequence of liquidity distribution between the groups of market participants. A money market tier describes a liquidity pool running through a group of participants. Tiers are sequentially aligned subject to participant proximity to the Bank of Russia refinancing system and other sources of liquidity (primary creditors).

The compiled data are used to calculate liquidity transmission tiers by using the following algorithm. At the initial stage, coefficient  $k_0$  is determined for each participant, which is equal to the ratio of participant's rouble borrowings to placements. The Bank of Russia and other market creditors with a low value,  $\leq 0.05$ , of coefficient  $k_0$  pertain to tier 0.

Market participant membership in consecutive tiers is determined iteratively. Coefficient  $k_1$  is used to calculate each consecutive tier, which is equal to the ratio of a given participant's borrowings from the preceding (already identified) tiers (first step – borrowing volumes from tier 0, second step – total borrowings from tiers 0 and 1, etc.) to the participant's total borrowings from all market participants. Given that coefficient  $k_1$  for a participant is higher than 10%, the participant is assigned a number of tier being equal to the current iteration step. For example, if a participant has borrowed from tiers 0 and 1 more than 10% of its borrowings, this algorithm will define him as tier-2 participant. The coefficients are used to ensure that small transactions with participants from the preceding tiers have no effect on assigning a tier number to a given market participant.

Iterations are basically intended to ensure that every consecutive tier include borrowers who closed transactions with creditors of the preceding tiers. Thus, a tree of relationships among market participants in different tiers can be developed.

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<sup>32</sup> See Conceptual Framework for Liquidity Transmission Analysis in the Interdealer Repo Market Report for 2012 Q1, p. 26. For a detailed description of the analytical system and its indicators please see Моисеев С.Р., Пантина И.В., Сосюрко В.В. Анализ трансмиссии ликвидности на рынке междилерского РЕПО // «Деньги и кредит», 2012. - №7 – p. 65-71.

### 4.3. Network indicators method to identify money market systemically important participants

It is expedient to use network indicators together with traditional indicators (borrowing volumes, number of creditors, and number of customers, etc.) to identify money market systemically important participants.

The traditional indicators describe systemic importance by relying solely upon participant's own operations while ignoring the entirety of relationships prevailing on the market.

Network indicators, on the contrary, can describe systemic importance of participants by taking account of interconnection between all market operations, participant influence on the market structure, and participant 'location' on the market.

#### *Money market network indicators*

##### 1. Degree centrality

The indicator describes how many counterparties the participant has.

$$0 \leq d_{borr}(p_i) = \frac{\sum_{j=1}^n (p_j, p_i)}{n-1} \leq 1$$

$$0 \leq d_{cred}(p_i) = \frac{\sum_{j=1}^n (p_i, p_j)}{n-1} \leq 1$$

$p_i$  – participant  $i$ ;

$n$  – number of participants;

$(p_j, p_i)$  – equal to 1 if participant  $j$  lends to participant  $i$ , if otherwise, equal to 0.

##### 2. Valued degree centrality

The indicator describes the value of the participant's operations.

$$0 \leq Valued_{d_{borr}}(p_i) = \frac{\sum_{j=1}^n w(p_j, p_i)}{\sum_{i=1}^n \sum_{j=1}^n w(p_i, p_j)} \leq 1$$

$$0 \leq Valued_{d_{cred}}(p_i) = \frac{\sum_{j=1}^n w(p_i, p_j)}{\sum_{i=1}^n \sum_{j=1}^n w(p_i, p_j)} \leq 1$$

$w(p_j, p_i)$  – participant  $j$  to participant  $i$  lending volumes.

##### 3. Proximity centrality

The coefficient describes the degree of interconnection between the participant and its counterparties or, in other words, participant 'centrality': the higher is the coefficient, the higher is the participant 'proximity centrality'<sup>33</sup>.

Proximity centrality is determined as the ratio of a share (in total number of participants) of a particular participant's creditors (borrowers), also through intermediaries, to average proximity to the respective creditors (borrowers). The participant proximity to its creditor is measured as the number of intermediaries between them in the lending chain, multiplied by 1.

$$0 \leq d_{borr}(p_i) = \frac{J_i / (n-1)}{\sum_{j=1}^n d(p_j, p_i) / J_i} \leq 1$$

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<sup>33</sup> Hypothetical proximity centrality is referred to as a participant acting as a single source of liquidity on the ideally centralized market.

$$0 \leq d_{cred}(p_i) = \frac{I_i / (n-1)}{\sum_{j=1}^n d(p_i, p_j) / I_i} \leq 1$$

$I_i$  – number of participants who borrow from participant  $i$  (also through intermediaries), i.e. if participant  $i$  lends to  $k$ , participant  $k$  to  $l$ , and participant  $l$  to  $j$ , then participants  $k, l, j$  lend to participant  $i$ , where participants  $l$  and  $j$  borrow through intermediaries;

$I_i$  – number of participants lending to participant  $i$  (also through intermediaries);

$d(p_j, p_i)$  – minimum credit chain length from participant  $j$  to participant  $i$  (corresponds to minimum number of intermediaries in lending from participant  $j$  to participant  $i$ , multiplied by 1) – i.e. if participant  $j$  lends directly to  $i$ , then  $d(p_j, p_i)=1$ , whereas if participant  $j$  lends to  $k$ , and  $k$  to  $i$ , then  $d(p_j, p_i)=2$ , etc.

Thus, the higher is the participant's centrality,

- the more creditors (borrowers) the participant has (including creditors (borrowers) through intermediaries);
- the closer are creditors (borrowers) to the participant (i.e. the fewer intermediaries are between them).

#### 4. Weighted proximity centrality

The coefficient is similar to the foregoing one and describes the degree of interconnection between the participant and its counterparties, including volumes of operations.

Proximity centrality is determined as the ratio of a share (in total number of participants) of a particular participant's creditors (borrowers), also through intermediaries, to average proximity to the respective creditors (borrowers), taking account of the weights of the lines of graph (volumes of operations):

$$0 \leq d_{borr}(p_i) = \frac{\sum_{j=1}^n wc(p_j, p_i) / L}{\sum_{j=1}^n d(p_j, p_i) \cdot wc(p_j, p_i) / \sum_{j=1}^n wc(p_j, p_i)} \leq 1$$

$$0 \leq d_{cred}(p_i) = \frac{\sum_{j=1}^n wc(p_i, p_j) / L}{\sum_{j=1}^n d(p_i, p_j) \cdot wc(p_i, p_j) / \sum_{j=1}^n wc(p_i, p_j)} \leq 1$$

$L = \sum_{i=1}^n \max_{j,k}^l (w(p_j, p_k))$  – transaction aggregate volume (n-1), with the maximum lending/borrowing volume;

$d(p_j, p_i)$  – minimum credit chain length from participant  $j$  to  $i$  (corresponds to a minimum number of intermediaries in lending from participant  $j$  to  $i$ , multiplied by 1) – i.e. if participant  $j$  lends directly to  $i$ , then  $d(p_j, p_i)=1$ , whereas if participant  $j$  lends to  $k$ , and  $k$  lends to  $i$ , then  $d(p_j, p_i)=2$ , etc.;

$wc(p_j, p_i)$  – credit chain weight is calculated as the minimum (lending volume) weight of all transactions within the chain. For example, chain weight A-12->B, will be equal to 12, chain weight A-12->B-8->C, will be equal to 8, etc.

Thus, the higher is the participant's centrality,

- the more creditors (borrowers) the participant has, including creditors (borrowers) through intermediaries;

- the bigger are the participant (its counterparties) lending (borrowing) volumes;
- the closer are creditors (borrowers) to the participant (i.e. the fewer intermediaries are between them).

### 5. Betweenness centrality

The coefficient describes participant's intermediation degree on the market: the higher is the coefficient, the more intermediation operations the participant performed.

The coefficient is calculated as mean value of the ratio of number of the shortest credit chains running through the participant in question to total number of the shortest credit chains:

$$0 \leq b(p_i) = \frac{\sum_{i \neq j \neq k} \frac{g_{jk}(p_i)}{g_{jk}}}{(n-1) \cdot (n-2)} \leq 1$$

$g_{jk}$  – number of minimum length credit chains from participant  $j$  to  $k$ ;

$g_{jk}(p_i)$  – number of minimum length credit chains from participant  $j$  to  $k$  in which participant  $i$  is involved.

Thus, the bigger is the number of credit chains in which the participant is involved, the higher is its **betweenness** centrality.

### 6. Weighted betweenness centrality

This coefficient is similar to the foregoing one, however the weights of the lines of graph (volumes of market operations) are taken into account.

The coefficient is calculated as the mean value of the ratio of the number of the shortest credit chains running through a particular participant to total number of the shortest credit chains.

Taking account of graph line weight (volumes of operations):

$$0 \leq b(p_i) = \frac{\sum_{i \neq j \neq k} \frac{SWG_{jk}(p_i)}{SWG_{jk}}}{(n-1) \cdot (n-2)} \leq 1$$

$SWG_{jk}$  – total weights of minimum length credit chains from participant  $j$  to  $k$ ;

$SWG_{jk}(p_i)$  – total weights of minimum length credit chains from participant  $j$  to  $k$  in which participant  $i$  is involved.

Thus, the higher is the participant weighted **betweenness** centrality,

- the larger is the number of credit chains in which the participant is involved;
- the larger is the number of credit chains with big weights (high lending/borrowing volumes) in which the participant is involved.

#### **4.4. Domino effect evaluation method on the interbank loan market**

The Snow Vector method is aimed at examining credit shock spread channels on the interbank market (except for the interdealer repo market), identifying systemically important borrowers, most vulnerable market participants, as well as bank individual losses and banking sector total losses caused by a domino effect<sup>34</sup>.

The Snow Vector is defined as a method to analyse network relationships on the interbank loan market and describe adverse financial effect (a domino effect) in the event of default by one or more counterparties on their debt obligations. The vector is calculated through analyzing all possible combinations (scenarios) of credit shock spread. The number of scenarios corresponds to the number of participants on the interbank loan market.

A hypothesis has been made on that every interbank loan market participant may become a potential defaulter, i.e. a party in default. Credit risk losses which are equal to the amount of interbank liabilities (i.e. the value of all bilateral transactions which mature on a working day in question) are estimated for each of the defaulter's counterparties by using simulation modelling. Once losses have been estimated, contracting banks are tested for being able to meet their obligations to other interbank market participants. The original counterparty default has the two-way impact on participant financial position: losses affecting capital adequacy, and liquidity lost as a result of payment schedule disruption.

To find out whether the original defaulter's counterparty may subsequently default on its obligations, the Snow Vector employs a few formal criteria, namely lower actual required ratios: N1 capital adequacy, N2 bank instant liquidity, N3 bank current liquidity that are below specific thresholds (estimated as 1% percentiles of distribution of the respective values among all Russian banks), as well as capital reduction by more than one fourth. Should at least one of the criteria be met, a bank is to be regarded as potentially vulnerable to a domino effect and subsequently treated as a defaulter.

Thus, analysis of network relationships on the interbank loan market provides estimates of losses caused by default on all previously extended loans which mature within 5 working days. At the end of a working day, a list of counterparties in default and credit shock spread directions, bank individual losses and banking sector total losses caused by the original counterparty default are determined. These are calculated as total losses incurred at the stages of domino effect spread – banking sector subsequent losses are estimated at each stage and added to the previously obtained values. The algorithm has no limits as to the number of default spread rounds, which depends on the number financially unstable counterparties. More than one default rounds may occur within a day, because banks are linked in the overnight segment. A series of estimates based on Russian interbank loan data show that the entire banking sector can normally be affected by a domino effect within 1 to 4 rounds.

According to the Snow Vector, systemic importance of a bank as borrower is determined by several factors, namely the number of relationships on the market (number of lending counterparties); counterparty financial soundness; overall bank position on the interbank loan market; bank position with regard to its counterparties, i.e. risk concentration.

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<sup>34</sup> Моисеев С.Р., Снегова Е.А. Системная значимость участников денежного рынка // Банковское дело, 2012. - №3. -с. 24-29.