Bank liquidity and financial stability[1]

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Introduction

This paper presents new asset-based measures of bank liquidity which capture and quantify the dynamics of liquidity flows within the French banking system between 1993 and 2005. We consider net changes in the "stock" of liquidity in banks' balance sheets as the result of two simultaneous "flows": the purchases and sales of liquid assets. Our flow approach allows us to assess the intertemporal dimension of liquidity fluctuations within the banking system (expansions, contractions and overall reallocation) on the basis of individual bank data.

From a policy perspective, the results suggest that under normal circumstances the cross-checking of liquidity ratios and liquidity flows could prove useful in designing a robust prudential approach to liquidity. Under extreme circumstances, when the provision of emergency liquidity is being contemplated, the traditional concept of "bank liquidity" could be complemented by considering the liquidity of monetary and other financial markets.

1. Measuring bank liquidity

Our analysis of bank liquidity at the aggregate level is presented below. After discussing the concept and measurement of "gross liquidity flows" (1.1), we turn to methodological considerations associated with this concept, (1.2) and then to aggregate liquidity measures (1.3).

1.1 Gross liquidity flows: concepts and measurement

The concept of "gross flows" originates from labour market turnover studies. One key reference in this area is Davis and Haltiwanger (1992). More recently, estimates of gross credit flows have been conducted in a similar way by Craig and Haubrich (1999) and Dell'Ariccia and Garibaldi (2005). Our efforts to measure and quantify liquidity dynamics in the banking sector build on this literature. This approach allows us to describe gross quantities of liquidity flowing in and out of the French banking system's balance sheet, as well as the rate at which overall liquidity is reallocated across banks. These fluctuations lend themselves to an insightful cyclical analysis.

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An individual bank's liquidity expands (contracts) in a given quarter if its liquidity growth is positive (negative). For example, the liquidity of a bank holding € 100,000 worth of liquid assets in 1993:1 and € 110,000 (€ 90,000) in 1993:2 would have expanded (contracted) liquidity at a rate of 10% for the quarter. At the aggregate level, gross liquidity expansion (contraction) is proxied by the sum of the absolute values of all liquidity changes across banks with positive (negative) liquidity growth. Gross rates of expansion and contraction are then computed. For example, if the banking system is composed of two banks of similar size with liquidity expanding and contracting at the same rate, then we consider that liquidity to be unchanged at the aggregate level. A formal definition of those concepts is presented in Box 2.

At the bank level, liquidity contraction (represented by a negative value of liquidity growth) can stem from either active reduction of liquid portfolios, or from the fact that a temporary operation (eg a repo) is not rolled over at maturity, and that there is not a corresponding increase in other liquid items. Either event leads to a reduction in liquidity.

The interpretation of the aggregate series thereby obtained depends on how one measures growth at the bank level. In this paper, we distinguish between gross *nominal* and gross *idiosyncratic* liquidity flows. Nominal flows measure growth in absolute terms, as illustrated above. They reflect nominal liquidity expansion or contraction within the banking system on aggregate. Idiosyncratic flows measure liquidity growth relative to aggregate growth. They are "idiosyncratic" in that they reflect purely bank-specific factors (specific trading strategies, isolated liquidity shocks, changes in corporate governance or internal structures, etc.). For example, if a bank increases its liquid holdings by 10% in a given quarter while the banking industry increases liquidity by 6%, the idiosyncratic component of that bank's liquidity inflow is 4%. Idiosyncratic flows reflect the degree of heterogeneity in banks' expansion or contraction of liquidity.

1.2 Methodological issues

Before describing the proposed liquidity measures in greater detail, it should be noted that they are affected by two major methodological issues. Firstly, they ignore liquidity expansions and contractions that may occur simultaneously within each reporting entity, ie within each bank. This biases our estimates downwards, since liquidity reallocation is likely to occur across a bank's various desks (for example, between the repo desk and the treasury desk). However, our data do account for liquidity flows across entities of the same banking group, since we use the BAFI 4000 Reporting Files, which are collected institution-by-institution on a non-consolidated basis.[4]

Secondly, flow measures may overestimate gross flows by recording unwarranted liquidity reallocations due to mergers and acquisitions. This bias is potentially problematic. We therefore chose to clean the data on the basis of merger files provided by the Banque de France unit (DECEI/CECEI) that registers bank creations, closures and mergers (see Box 2 for details).

[4] Liquidity flows between banks of the same group cannot be isolated from those occurring across different groups. As a result, negative and positive flows across banks that belong to the same group may reflect intra-group reallocation of liquidity. Intra-group liquidity management has gained importance in France – in particular for mutual banks – as the consolidation process has proceeded.

Box 1

Measuring bank liquidity

T two criteria are involved in liquidity management within a financial institution. First, the institution must be sure that appropriate, low-cost funding is available at short notice. This may involve holding a portfolio of assets that can easily be sold, holding significant volumes of stable liabilities, or maintaining credit lines with other financial institutions. Second, liquidity management must meet profitability requirements. Financial stability issues lie precisely at this liquidity/profitability nexus: banks must manage liquidity stocks and flows in the most profitable manner that does not jeopardise financial stability.

In France, bank liquidity is monitored on the basis of a liquidity ratio.[1] The liquidity requirement of the Banking Commission consists of a monthly report on banks' overall liquid assets and liabilities, which include cash positions, claims (including repo-related claims with up to one month of remaining maturity) and negotiable securities, as well as off-balance sheet commitments and available liquidity lines. Based on this information, the Banking Commission establishes a ratio of liquid assets to liquid liabilities, using a weighting scheme to reflect the likelihood of items being rolled over or being available in event of a liquidity squeeze. The weighting scheme thus recognises that liquid assets may be realized only with some delay and at some risk. This ratio must be above 100 percent at all times. The liquidity coefficient used by the Banking Commission belongs to the family of "asset-liability" liquidity coefficients, which are based on measures of both liquid assets and liquid liabilities. These coefficients are traditionally preferred for supervisory purposes on the grounds that bank liquidity management involves not only the liquidity of assets but also the nature and structure of, and changes in, liabilities.

The measure presented in this paper departs from the current prudential approach along two main lines. First, it is exclusively asset-based. Second, it is to some extent "agnostic", in that it does not rely on a normative weighting scheme across asset categories, and no threshold value is proposed to assess whether a bank is "too illiquid". We chose to concentrate exclusively on assets in order to decouple the monitored indicator from fluctuations induced by changes on the liability side of banks' balance sheets. No information based on the current prudential ratio is used in this process. The value-added of our indicator lies in its dynamic (flow) and panel-based dimensions. Our liquidity measure is based on the following asset categories: cash management and interbank transactions, securities bought under repurchase agreements, trading securities and investment securities, to which we add net off-balance sheet financing commitments (ie financing commitments received minus financing commitments made to credit institutions). This measure is one of the "asset-based" liquidity indicators and is independent from the liability structure of a bank's balance sheet.

It should be borne in mind here that our aim is to propose a methodology and assess its performance as a broad-based liquidity measure. Alternative indicators could be generated in turn, and ranked according to their degree of liquidity. For example, one may ask whether investment securities are "liquid enough" to qualify for the construction of a liquidity measure, given that such assets are purchased with the intention of being kept on the books over a substantial period of time. Since investment securities are, however, fixed-income instruments that may be sold promptly in case of emergency need, we decided to take them into account in our measure. An alternative would be to concentrate only on specific sub-items of the chosen liquidity categories (in particular, in the cash management and interbank transactions category, which is rather broad). Although a first check of alternative measures seems to produce outcomes consistent with those presented in this paper, refined applications of this approach would certainly generate fruitful and potentially new insights regarding bank liquidity. In any case, cross-checking such measures with liquidity ratios (such as the coefficient currently monitored by the Banking Commission) may prove informative and robust for prudential purposes.

[1] The French supervisory authority, the Banking Commission (Commission Bancaire), collects quarterly balance sheet data on an individual and consolidated basis for all banks subject to its regulation. Complete balance sheets are available from 1993:1 to 2005:1.

Box 2

Bank liquidity flows

Using the individual bank balance sheet data described in Section 2, we define l_{it} as the value of liquid assets of bank *i* at quarter *t*. The change in total liquidity is then given by $\Delta l_{it} = l_{it} - l_{it-1}$. The bias introduced by bank mergers (see Section 1.2) is corrected as follows. Consider that bank *i* absorbs bank *j* between *t* and *t* – 1. In the absence of any other change in the structure of balance sheets, the liquidity registered for bank *j* at time *t* will be zero, while that registered by bank *j* will be equal to the sum of its own liquidity plus that of the absorbed bank *j*. Taking into account the changes in liquidity that occurred between *t* – 1 and *t*, the liquidity of bank *i* at *t* will be equal to its own liquidity at *t* – 1, plus the changes in its own liquidity, plus the liquidity of bank *j* at *t* – 1, plus the changes in bank *j*'s liquidity between *t* – 1 and *t*. Correspondingly, the liquidity of bank *j* at *t* will be zero. Without further corrections, the liquidity of *j* at *t* – 1 would be counted twice, leading to an overestimation of both positive and negative liquidity flows. We therefore need to subtract the *t* – 1 liquidity of bank *j* from the *t* liquidity of bank *i*, and add it to the liquidity of bank *j* at *t*. Thus, the formula for our corrected measure $\Delta l'_{it}$ reads

$$\Delta l'_{it} = \Delta l_{it} - \sum_{k=1}^{N} A_{ikt} l_{k,t-1} - B_{it} \Delta l_{it}$$

where A_{ikt} and B_{it} are indicator variables and *N* the total number of banks at time *t*. A_{ikt} takes the value 1 when bank *i* absorbs bank *j* at *t*, 0 otherwise. Bit takes the value 1 when *i* is absorbed at *t*, 0 otherwise. Note that this approach allows for simultaneous mergers where a bank absorbs more than one institution.

The adjusted growth rate of liquidity is therefore given by

$$g_{it} = \frac{\Delta l'_{it}}{(l_{i,t-1} + l_{i,t})/2}$$

for each bank *i*. At the bank level, all liquidity contractions (expansions) give rise to a negative (positive) value of g_{it}. The cross section of gits obtained for each quarter is then aggregated using two simple positive/negative partition rules.

Partition rule 1: nominal gross liquidity flows

Nominal gross flows are defined according to partition around zero. The aggregate liquidity expansion rate between *t* – 1 and t $POS^{nom}{}_t$ is defined as

$$POS^{nom}{}_t = \sum_{i|g_{it} \geq 0}^{N} g_{it} \left(\frac{(l_{i,t-1} + l_{i,t})/2}{\sum_{i=1}^{N} l_{i,t-1}} \right)$$

The term in parentheses weights individual growth rates by the bank's average share of the total liquidity. Likewise, the aggregate liquidity contraction rate $NEG^{nom}{}_t$ is defined over the absolute value of aggregated weighted growth rates:

$$NEG^{nom}{}_t = \sum_{i|g_{it} \leq 0}^{N} |g_{it}| \left(\frac{(l_{i,t-1} + l_{i,t})/2}{\sum_{i=1}^{N} l_{i,t-1}} \right)$$

Nominal measures are principally useful in analysing cyclical properties of liquidity flows.

Partition rule 2: idiosyncratic gross liquidity flows

Idiosyncratic gross flows are defined according to a partition rule around the trend followed by the banking industry as a whole. This relative measure reflects the extent to which each bank distinguishes itself from the industry trend. The latter is proxied using the Hodrick-Prescott filter of the aggregate liquidity growth (noted g_t^{tr}) with a standard quarterly smoothing parameter λ. For

Box 2 (cont)

Bank liquidity flows

each bank *i*, we obtain an idiosyncratic growth rate g_{it}^{id} equal to

$$g_{it}^{id} = g_{it} - g_t^{tr}$$

The idiosyncratic positive and negative liquidity flow rates are defined as

$$POS^{id}{}_t = \sum_{i\left|g_{it}^{id} \geq 0\right.}^{N} g_{it}^{id} \left(\frac{(l_{i,t-1} + l_{i,t})/2}{\sum_{i=1}^{N} l_{i,t-1}} \right)$$

$$NEG^{id}{}_t = \sum_{i\left|g_{it}^{id} \leq 0\right.}^{N} \left| g_{it}^{id} \right| \left(\frac{(l_{i,t-1} + l_{i,t})/2}{\sum_{i=1}^{N} l_{i,t-1}} \right)$$

Idiosyncratic measures are relevant for the analysis of average liquidity flows.

Overall, one should keep in mind that at the aggregate level, negative flows do not necessarily reflect a generalised reduction in liquidity buffers. Likewise, positive flows do not imply an expansion of liquidity buffers. Positive and negative flows may coexist, but only the net measure of liquidity flows can tell whether the liquidity of the banking system's balance sheet has expanded or contracted as a whole. Net liquidity flows are simply defined as

$$NET^{nom}{}_t = POS^{nom}{}_t - NEG^{nom}{}_t$$

and

$$NET^{id}{}_t = POS^{id}{}_t - NEG^{id}{}_t$$

$NET^{nom}{}_t$ shows the net growth rate of gross liquidity, while $NET^{id}{}_t$ reflects the cyclical component of net liquidity growth.

Finally, one may wish to get a sense of the overall reallocation of liquidity occurring between banks. In the nominal case, the total, or "excess", liquidity reallocation needs to be corrected for the net liquidity changes, ie

$$TOT^{nom}{}_t = POS^{nom}{}_t + NEG^{nom}{}_t - \left| NET_t^{nom} \right|$$

In the idiosyncratic case where the trend component has already been adjusted for, the overall reallocation growth $TOT^{id}{}_t$ is simply the sum of the positive and negative flow measures, ie

$TOT^{id}{}_t = POS^{id}{}_t + NEG^{id}{}_t$.

1.3 Aggregate liquidity measures

Gross liquidity flows are constructed as a cross-sectional aggregation of positive and negative changes in stocks as reflected in quarterly balance sheet statements. The positive/negative partition of the cross-sectional distribution is done in two ways, nominal and idiosyncratic. Nominal aggregates are the sums of the individual banks' liquidity growth rates relative to zero, weighted by market share. Idiosyncratic aggregates are the weighted sums of the individual banks' liquidity growth rates relative to the industry trend. The construction of liquidity measures is presented in Box 2.

The two aggregation strategies shed light on different dimensions of liquidity dynamics. Nominal growth rates show the macroeconomic evolution of liquid balance sheet items,

which may be substantial in a context where, for exogenous reasons, aggregate liquidity grows strongly. An example would be the steep growth in bank liquidity witnessed since the start of Stage III of EMU, also reflected in the strong dynamics of nominal monetary aggregates in the euro area. Nominal measures are therefore suitable for studying the cyclical properties of bank liquidity. Idiosyncratic flows reflect, in a banking system that grows along a trend, individual differences in bank liquidity management. These flows are the macroeconomic symptom of heterogeneous bank behaviour at the micro level.

We can also derive net growth rates of liquidity, along with "shadow" measures of liquidity reallocation. Net flows simply indicate whether banks lost or gained liquidity over a quarter. "Shadow" (or excess) flows show the extent to which overall liquidity reallocation actually occurred across banks. For example, a bank whose liquidity grew in net terms by 1% over a given quarter may in fact have actively engaged in liquidity trading to a much greater extent than what the net variation alone would suggest. These effects can be accounted for by looking at nominal reallocation, ie aggregate expansion and contraction in excess of the net liquidity change, and idiosyncratic reallocation.

2. Results

2.1 Gross nominal liquidity fluctuations

Estimates of gross nominal liquidity flows are shown in Chart 1. They show that, on average, positive flows have been greater than negative flows, resulting in net nominal liquidity flows growing by some 1% per quarter. This is not surprising in a context in which bank liquidity is expanding overall. More interestingly, substantial liquidity expansion and contraction take place simultaneously along the sample, in the order of 6% and 5%, respectively, per quarter (Table 1), implying an active market, trading beyond already substantial growth in aggregate bank liquidity. A check of the behaviour of each liquidity subcomponent reveals that this trading intensity has occurred in all market segments involved in liquidity trading (money markets as well as capital markets for liquid instruments).

Negative and net nominal flows reveal that aggregate behaviour may have been atypical on two occasions, in early 1996 and early 2000. In both 1996 and 2000, liquidity outflows markedly – but temporarily – increased, translating into large negative net liquidity adjustments.

Although causality cannot be assessed, it is very likely that developments in 2000:1 reflect a correction of liquidity loadings in anticipation of Y2K.

Explaining the 1996:1 episode is less straightforward. An examination of regulatory events around that time reveals that this quarter coincides with the implementation of a number of European Council Directives aimed at harmonizing banking activities. In particular, the directive authorising the inclusion of legally binding netting agreements for prudential purposes was approved and implemented at that time.[5] However, nothing guarantees that

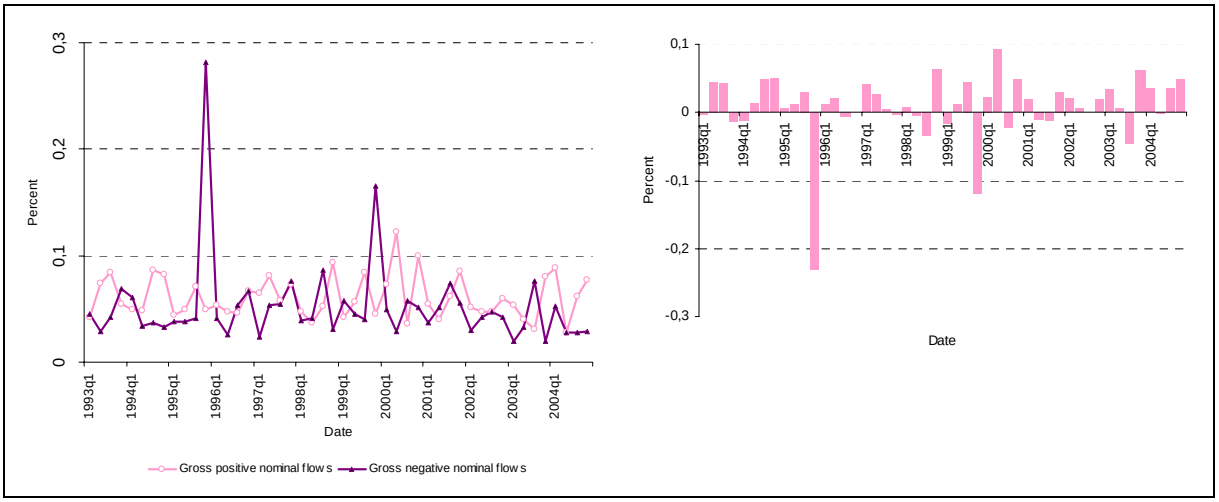
[5] Preparatory work authorising the inclusion of legally binding netting agreements for prudential purposes had led to a common proposal, adopted by the European Council on 5 September 1995. The European Directive was finally approved in early 1995. In parallel, the post-BCCI European Directive, ensuring that control of a credit institution is not dictated by the structure of the group to which it belongs, was adopted by the European Parliament and the European Council on 29 June 1996, and implemented in the first quarter of 1996. At the same time, the Basel Committee on banking supervision finalised its framework on the prudential treatment of market risk (use of own funds to cover market risk, and acknowledgement of internal credit risk models; see Commission Bancaire, 1996). The inclusion of netting agreements in prudential ratios reduced de facto own funds requirements for solvency ratios, since it meant that off-balance sheet interest rate and foreign exchange instruments would be taken into account in net, rather than gross, terms – ie after all contracts with

solvency regulation is the crucial factor here. After all, measures of own funds are usually determined on the basis of liabilities positions with, at best, an ambiguous effect on the sign of liquidity flows. In this light, it is more likely that the prudential acknowledgement of netting agreements simply led to a reduction of liquidity risk exposure for commercial banks, allowing them to hold less liquid assets.

Chart 1

Gross nominal liquidity flows

Percent



Gross excess nominal flows.

Source: Authors' calculations.

Table 1

Nominal and idiosyncratic liquidity flows – descriptive statistics

Flows	Obs.	Average	Std. Error	Min	Max
Nominal					
Positive	49	0.059	0.021	0.000	0.122
Negative	48	0.052	0.041	0.020	0.281
Net	48	0.009	0.049	–0.232	0.093
Idiosyncratic					
Total reallocation	48	0.081	0.022	0.039	0.134
Positive	49	0.041	0.031	0.000	0.175
Negative	48	3.58e-8	3.22e-8	1.02e-8	2.25e-7

Source: Authors' calculations.

a given counterpart had been settled . This type of adjustment would need to appear only once in liquidity growth rates.

Turning to deviations of flows in relation to the industry trend, the idiosyncratic build-up of liquidity is substantial (idiosyncratic and nominal positive flows being at comparable orders of magnitude). This suggests a large number of banks expanding in excess of trend growth. We visually checked whether idiosyncratic positive flows could result from aggregation issues or aggregate structural changes (which could be due to factors affecting the banking sector as a whole) and found that only a small part of aggregate heterogeneity seems to be accounted for by composition effects across liquidity lines, or by differences across banks of different sizes. This conjecture could be investigated more formally.

Finally, total, or "shadow", liquidity reallocation – expansion and contraction in excess of net changes – amounts to about 8% per quarter. In other words, some 8% of the aggregate liquidity in the banking system's balance sheet is reshuffled among individual banks each quarter.

Bibliography

Craig, B., Haubrich, J. (2000), "Gross Loan Flows", *working paper 00-14*.

Davis, E.P. (1994), "Market Liquidity Risk", *mimeo, paper for the SUERF conference, Dublin, May*.

Davis, S., Haltiwanger, J. (1992), "Gross Job Creation, Gross Job Destruction, and Employment Reallocation", *Quarterly Journal of Economics*, Vol. 107, No. 3, 819–863.

Dell'Ariccia, G., Garibaldi, P. (2005), "Gross Credit Flows", *Review of Economics Studies*, 72, 665–685.