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FIXING THE FUNDING MACHINE

Why half of the new global financial regulation is misconceived

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ABSTRACT

Much of the regulatory response to the Global Financial Crisis has been aimed at curtailing the liquidity risk taken by banks. The objective has been to avoid the GDP hit of a repeat occurrence, whilst also minimising the risk to the public purse. But in getting stuck straight in to a solution, the mainstream debate has largely bypassed the question of just why the system built up to a cash flow crunch in the first place. This paper gives practitioner's insight into why and how the banks stretched their balance sheets in the run-up to the crisis, delving into the murky area of system-wide "funding liquidity". With this framing, it is possible to conclude that the new regulations could be having the opposite of the desired effect. They may have prolonged the GDP pain, which has now required central banks to step in with broader public support. Key to this line of reasoning is the existence of a Term Liquidity Premium, providing an incentive for banks to manufacture long term liquidity. The paper argues that the manufacturing process lowers the cost of term lending and stimulates GDP growth. Restricting it has the opposite effect, holding liquidity premiums at near-crisis levels in an unnecessary "phony war", which increasingly necessitates central bank lending of first resort.

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(i) PREAMBLE

For many of us managing the balance sheet of a bank during the Great Financial Crisis, the primary dislocation seemed to be a drying up of liquidity. Concerns over cash flow were simply more pressing than concerns over capital positions in respect to (possibly sub-prime) loan books. Something seemed to have imploded in liquidity conditions, both in the ability to easily liquidate securities for cash and in the ability to borrow new funds. As a result, many banks were in danger of simply running out of money and a fair few did. Most banks pulled in their horns, dramatically restricting the amount of new loans and increasing their price, so as to have more cash on hand. This en-masse restriction in lending did, of course, cause the economy to tank, increasing bad loans and raising concerns over capital. By and large, those concerns came later. The immediate issue was cash flow: who would pay you back tomorrow, and who you had to pay back.

At my own institution, which itself had a very conservative funding model, we pulled an analyst's table of the loan to deposit ratio of all significant banks. The thinking was that this was as good a proxy as any for which of our counterparts might be supporting their assets, now largely illiquid and locking up the balance sheet until maturity, through a reliance on disappearing market funding, rather than by their own deposits. Working down from the most over-lent, Northern Rock, which was right at the top, loan to deposit ratios did indeed prove a useful guide for who would fail first.

After some false starts, the government's crisis response proved most effective when it largely focused on shoring up banks' funding base. Broadly, this was achieved through a mixture of central bank lending of last resort against a very wide range of collateral, lengthening the time for which such funds were lent and guaranteeing the issue of long term bonds by the banks, in return for a fee.

Since the heat of that battle, a large part of the subsequent regulatory reform agenda has similarly been focussed on cash flow. The belief is that restricting banks from stretching their funding positions or from becoming too interconnected in their borrowings from other banks will (a) avoid a repeat of the hit to GDP caused by the financial crisis and (b) negate the need for wide-scale public sector support.

What has been surprisingly absent from the mainstream debate is a deeper analysis of why and how banks stretched their balance sheets to such a degree in the first place, despite the apparent risk of a cash flow crunch, and implications of having done so prior to that crunch.

The ***why*** question begins with the expectation of the state bailing out a bank in trouble, creating an implicit subsidy, which the banks then look to maximise. But this subsidy would seem to apply to the risk of capital loss, rather than liquidity support. Or have we made the mistake of viewing the two as the same? So just what is the incentive that encourages the banks to take liquidity risk? The incentive that they can see, touch and produce revenues from?

Analysing ***how*** requires appreciating that individual banks calibrate their expected cash flows such that they can meet their commitments as they fall due, and they then keep a bit aside, just in case. But this calibration depends on the funding capacity of the system as a whole and, as we saw in the financial crisis, this can ebb just as easily as it can flow. How is that funding capacity as a whole determined, and what part does the interconnectedness of banks' balance sheets play in it?

Finally, what were the implications for the wider economy from all that balance sheet stretching, prior to crunch point, and what happens if the banks simply don't?

This paper seeks to frame the regulatory response to liquidity risk in this wider context of why, how and what happens if the banks simply don't. In doing so, it shows how the regulatory reform agenda could be leading us to an outcome directly contrary to its goals. That is, it could have retarded GDP growth as if the financial crisis were on-going; it could be requiring large scale public support as a permanent feature.

(ii) SUMMARY

Following the preamble and this summary, the paper is organised in four main parts:

Part (iii) teases out the liquidity premium component of a bank's pricing of a long term loan, for discussion throughout the remainder of the paper. It considers that the bank has a limited capacity to support long term lending. Limited, that is, to the smaller proportion of its overall liability base that the bank feels it can comfortably rely on having for the life of the long term term loans. This is its 'sticky' funding. The paper then focusses on the additional premium that the bank should charge for use of this limited capacity. Deconstructing loan pricing in this manner is a little tedious and it takes a while to 'set out our stall'. But doing so allows us to be clear how capital costs, which relate to credit intermediation, differ from liquidity costs, which relate to maturity transformation. Credit intermediation and maturity transformation are themselves the two key functions that make banking special. It also allows us to understand estimates of the scale of the liquidity charge, which was a small part of the loan spread at a few basis points prior to the onset of the crisis, but a much more significant part thereafter.

Part (iv) considers the term funding capacity of the system as a whole. It debates how the existence of the liquidity premium creates an incentive for banks to innovate and find new ways to manufacture term lending capacity. These methods often involve exchanges with other banks and shadow banks. Some commentators and regulators have described the growth in interbank commitments in the run up to the crisis as self-serving, purely speculative or socially useless. However, this paper reasons that the increase in supply arising from interbank dealings and other liquidity manufacture drives down the price of term liquidity versus short-date liquidity, boosting GDP growth. However, the paper also concludes that this manufacturing process will likely continue unchecked until a relatively small event triggers a system-wide, cash flow crunch. It finds some circumstantial evidence that the highs and lows of liquidity premiums caused by this ebb and flow of liquidity manufacture could underlie business cycles over a longer timescale. The paper also considers this a different factor in the crisis than lax lending due to poor credit standards eroding capital.

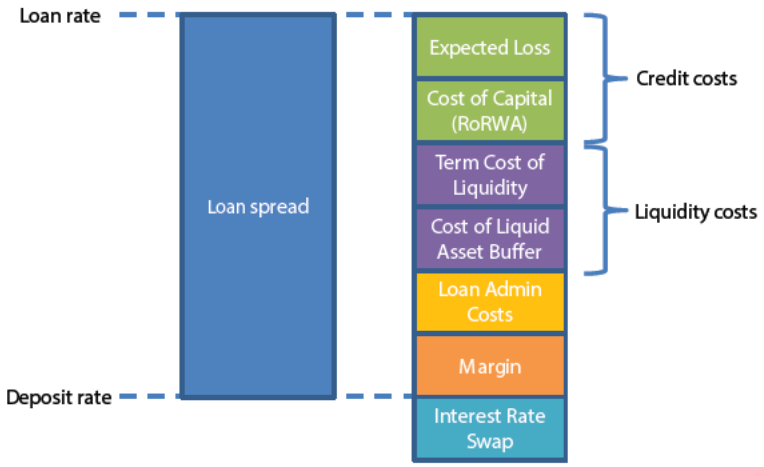
Part (v) looks at the regulatory response to the cash flow crunch part of the global financial crisis. It argues that, in the aftermath of the initial liquidity crunch, actual regulations, pending regulations and regulatory uncertainty kept the banks manufacture of term liquidity at low, crisis-like levels. Correspondingly, liquidity premiums remained elevated, at near crisis levels. It reasons that this heightened state of preparedness for battle was therefore almost as expensive as the battle itself. It calculates that the high level of the liquidity premium from this sustained phony war has a yearly macro-economic cost for the Euro area of 1% of GDP, perhaps much more. It argues that the quantitative impact studies miss this cost already being incurred, since they focus only on the further, additional, cost yet to come. Finally, it concludes that as the central bank's increasingly experimental policy response to the lack of growth moves from quantitative easing to "qualitative" easing, it does restore some term lending capacity, but only through wide scale and likely on-going state support as lender of ***first*** resort.

Part (vi) concludes, summarising the main policy implications of the overall argument, which are contrary to the perceived wisdom, restating the objective and proposing that a regulatory regime based on simply calculated capital levels is sufficient and that there is no place for liquidity regulation.

(iii) A METHODOLOGY FOR THE PRICING OF TERM LOANS

What makes banks special, carefully licensed and heavily regulated is their taking of deposits and their use of this money for the making of loans, with the bank acting as principal to both counterparties[1]. Though this is the one "pass-through" of money, there are actually two productive functions that the bank is undertaking and it should be pricing for both in its loan/deposit spread. Firstly, and widely understood, is that the bank is intermediating the credit risk. It undertakes the role of assessing, monitoring and pooling the credits to its borrowers. Secondly, and less commonly considered[2], is that the bank is also intermediating the cash flow requirements, in that the depositors generally expect to be able to redeem their funds at short notice but that the borrowers require the funds for a longer period. The bank undertakes the aggregation and modelling of expected cash flows, such that it can make loans of longer contractual maturity than its deposits, yet expects that it will not run shy of funds before these loans are repaid. These two activities of credit intermediation and maturity transformation are the key functions of banking. We can tease apart the pricing that banks charge in loan spreads to reflect these components. Though slightly tedious, this allows us to assess the costs that relate solely to maturity transformation.

Figure 1: components of a bank's loan/deposit spread



Credit intermediation obviously carries the risk that not all of the borrowers will pay back all of the money. The bank expects a portion of its loan book to get in trouble and calculates the Expected Loss on each loan. Typically, this is its estimate of the Probability of Default * Exposure at Default * Loss Given Default, either on an individual loan or a portfolio basis. This gives a formulaic spread to cover the losses that the bank expects in the normal course of business. With Expected Loss covered, the bank then holds capital against the risk of additional, unexpected loss. The bank's investors require it to produce a return on this capital, to compensate them for the risk of an unexpected loss over and above the Expected Loss, i.e. for the risk of unexpected losses eating into their capital including, at an extreme, that their investments are wiped out if all the bank becomes balance sheet insolvent. A common methodology that banks use to calibrate the capital needed to cover unexpected loss is to take the regulatory requirement, which risk weights the loan under Basel methodology. Tying this calibration of the amount of capital needed back to the return the investors require gives a required target Return on Risk Weighted Assets (RoRWA), to cover the Cost of Capital. It formulaically gives the part of the spread on the loan that is required so that banks' capital investors earn sufficient return for their risk.

1 The FSA defines a bank as "an undertaking whose business is to receive deposits or other repayable funds from the public and to grant credits for its own account", subject to various conditions such as being permissioned and not being defined as a building society, friendly society or a credit union. FSA Handbook, Glossary.

2 By example, Santos and Elliot (2012) in a recent IMF staff note give the following standard(ish) formula in loan pricing: $L*(1-t) \geq (E*r_e)+((D*r_d)+C+A-O)*(1-t)$ where L=loan rate; t=marginal tax rate; E=proportion equity backing the loan; re=required rate of return on marginal equity; D= proportion debt and deposits funding the loan; rd=effective marginal interest rate on D, including indirect costs of raising funds such as from running a branch network; C=credit spread (expected loss); A=admin and other expenses; O=other income and expense. This formula covers credit risks but has no explicit consideration of liquidity costs, treating a bank's liability base (D) as one lump without explicitly considering the tenor specific pricing of the loan, the debt or the rate on the debt.

Maturity transformation carries the risk that depositors will withdraw funds that the bank has previously locked up into illiquid lending. Not having the money at hand means that the bank has to borrow fresh funds at whatever rate of interest the market then demands or, at an extreme, that no funds are available at any rate and the bank becomes cash flow insolvent, meaning it cannot meet its commitments as they fall due. As with credit intermediation, cash flow intermediation breaks down into the expected and the unexpected. The bank expects upfront that a certain amount of its deposits will be 'flighty' and a certain amount 'sticky'. Best practice has it ascribing a higher value to the latter and charging this value across to the illiquid loans. This is what this paper refers to as the Term Liquidity Premium. Additionally, the bank keeps a liquidity buffer against the risk of an unexpected outflow of funds. It holds this liquidity buffer in cash (in physical cash or on its reserve account with the central bank) and in highly liquid securities. Typically, the yield it receives on these liquid assets is below its own term cost of funds, leading to a Liquid Asset Buffer cost to be attributed to loans and/or deposits.

For completeness, we need to add in three further components:

1. Firstly, the bank needs to cover the marginal costs of arranging the loan e.g. administrative fees (but not the cost of and risks to capital or costs and risks of raising liquidity, which are taken care of elsewhere).
2. Secondly, the bank may add on a margin, but not necessarily a positive one. Banks often use lending as an 'anchor' product, accepting a lower return than their target Cost of Capital in the belief that they can make additional revenue from the cross-sell of other, less capital-intensive products.
3. Finally, the bank needs to adjust for any mismatch in interest rate risk that the loan introduces against the bank's deposit book. Typically, the bank will have some deposits/debt which track short term interest rate movements (floating rate liabilities) and some which are at a fixed interest rate for a longer period or just not very sensitive to interest rate movements in the first place, like current accounts (fixed rate liabilities). If the interest rate basis of the loan is significantly different from the bank's liability base, then this introduces interest rate risk. In developed markets, though, the bank does not need to charge much premium for this risk, as it can hedge out of it using an interest rate swap[3]. In less developed markets, banks pay more attention to the design of their products so as to avoid a significant mismatch in the interest rate risk on the banking book. The key point is that the uncertain evolution of short term interest rates is not in itself a reason for charging a premium in longer term lending[4]. As such, figure 1 shows the interest rate swap as an adjustment to, rather than a component of, a bank's loan/deposit spread.

LIQUIDITY COSTS IN MORE DETAIL

The regulatory aftermath of the Great Financial Crisis requires that banks incorporate the cost of liquidity in their internal Funds Transfer Pricing. This is the transfer mechanism by which a bank ascribes an internal value to the money coming in from a deposit business and then charges this value to a lending business for the use of the money. The Basel Committee on Banking Supervision (2008) stated number four of its "Principles for Sound Liquidity Risk Management and Supervision" as: "A bank should incorporate liquidity costs, benefit and risks in the internal pricing, performance measurement and new product approval processes for all significant business activities (both on and off balance sheet), thereby aligning the risk-taking incentives of individual business lines with the liquidity risk exposures their activities create for the bank as a whole".

In reality, this requires that the bank draw a Liquidity Transfer Pricing curve and then 'fits' its assets and liabilities to this curve based on their observed cash flow

3 By example, the bank's customer wants a 5 year loan at a fixed interest rate on which the bank needs to charge a spread of 4% for credit costs, liquidity costs and its margin. The bank's liabilities consist of savings deposits, the bulk of which are sticky so long as it pays an interest rate roughly in line with prevalent short term rates, which are currently 3%. So here it will have a fixed rate asset, floating rate deposits and the risk that interest rates rise more than expected and compress or eliminate the spread on its loan vs. deposits. It hedges this risk out by entering into a 5 year interest rate swap, where it agrees to pay fixed rates at, say, 2% and receive floating rates which match its payments on the savings accounts. In this example, the 5 year swap rate is 2%, below the current short term rate of 3% because short term rates are expected to fall, averaging 2% over the 5 years. The bank then charges the borrower this 2%, plus the 4% spread = 6% for the fixed rate loan. The bank is indifferent between this and charging on a floating rate basis of short term tracker rates + 4%, even though the first interest payment on the floating basis would be 7%. Either way, fixed rate loan plus swap or floating rate loan, it has its required 4% spread locked in.

4 The caveat is that if the bank has let the interest rate basis of its assets and its liabilities get really out of whack, then it may incur more significant hedging costs through (i) capital committed to the credit risk of the hedges (ii) bid offer spreads paid away and (iii) skewing the market such that it executes at a rate away from the risk neutral price.

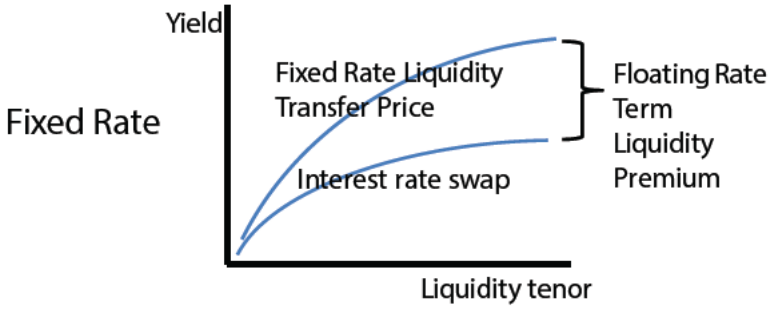
behaviour. The curve values a deposit according to its liquidity tenor: how long the bank reasonably expects to have the money for. It charges a lending business the same price for how long it likely has to borrow the money[5]. The longer the expected tenor of the deposit (or loan), the higher the value (or charge). The price is most easily represented as an annualised interest rate on a floating rate basis, i.e. as a fixed number of basis points (bps) above a variable short term rate (e.g. LIBOR). Once the Term Liquidity Premium is determined for a new loan or deposit (or for a particular vintage of pooled loans or deposits), it remains set at this initial number of bps for the life of the deposit or loan. The set spread is then added on to the variable short term rate each time the latter resets. For instance, in the example given in Table 1, below, the Liquidity Transfer Price for a 2 year floating rate loan when first struck is current 3 month LIBOR + 110 bps. The short term LIBOR rate resets in 3 months' time, and the Liquidity Transfer Price becomes whatever 3 month LIBOR then is, plus 110 bps. In 6 months' time, it again resets at whatever 3 month LIBOR then is, plus 110 bps. For new loans and deposits, a bank's Liquidity Transfer Price curve is dynamic, with the Term Liquidity Premium responding to both the actual or expected evolution of the bank's balance sheet and to market liquidity conditions. As above, for fixed rate loans and deposits, replacing LIBOR with the fixed interest rate swap price gives a fully fixed rate, comprising fixed interest rate swap plus fixed Term Liquidity Premium.

Table 1: Example of a Liquidity Transfer Pricing curve on a floating rate basis

Liquidity Tenor of Deposit or Loan	Floating Rate Liquidity Transfer Price
3 Month	3 month LIBOR + 20 basis points
6 Month	3 month LIBOR + 50 basis points
12 Month	3 month LIBOR + 90 basis points
2 year	3 month LIBOR + 110 basis points
3 Year	3 month LIBOR + 120 basis points
5 Year	3 month LIBOR + 150 basis points
10 Year	3 month LIBOR + 170 basis points

Term Liquidity Premiums

Figure 2: Liquidity Transfer Pricing curve for fixed interest rates



MODELING OF BEHAVIOR TENORS

In applying the Liquidity Transfer Price to deposits and loans, the bank has to estimate how long it can reasonably be expected to have the funds it has secured, and how long it reasonably needs the funds to back the loans it has made. This estimation of the behavioural tenor is not necessarily the same as the contractual tenor. By example, a retail current account deposit can, contractually, be pulled out the same day. But it is not reasonable to expect that all of a bank's current account depositors will take all their money out on the same day. Conversely, contractually a treasury bond will only repay the principal amount on maturity, some years hence.

5 There may or may not be a bid/offer spread applied around the rate.

But in reality, if the bank wanted the money sooner, it holds a highly liquid asset that it can easily sell or otherwise pledge it as collateral in a repurchase agreement (repo) with other financial institutions, including the central bank, to borrow funds.

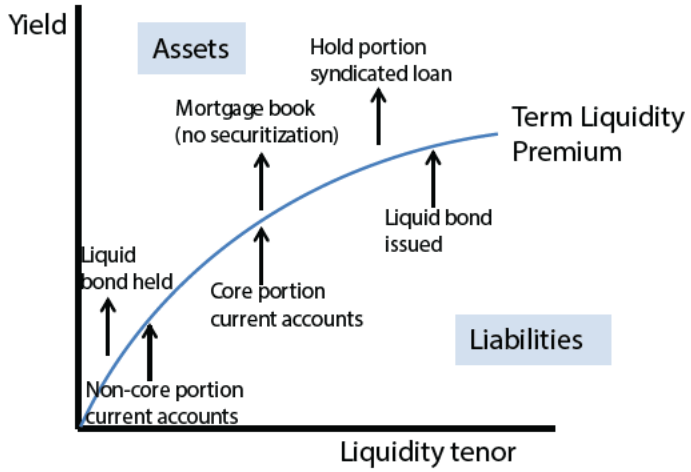
Table 2: Examples of deemed behavioural tenors

Asset Product	Contractual Maturity	Behavioural Maturity
1 year loan to SME (Small or Medium Sized Enterprise)	1 year	1 Year
Retail mortgage	Up to 25 years	4 year weighted average life of book if left on balance sheet; shorter maturity if liquidity returned through covered bond or mortgage backed security issuance programme
5 year fixed rate bank bond held on trading book	5 year	3 month average churn of trading book
5 year treasury bond	5 years	Same day

Liability Product	Contractual Maturity	Behavioural Maturity
Retail current account	Same day	85% deemed core >1 year 15% non-core < 1 year
Corporate time deposits	1 to 3 months	50% expected to roll over > 1 year 50% per 1 to 3 month contractual maturity
5 year fixed rate bank bond (issued by the bank itself)	5 years	5 years

The key principal that the behavioural tenor differs from the contractual tenor allows banks to undertake maturity transformation, as in transforming the perceived maturity of deposits and loans according to their observed behavioural tendencies. Most big banks will have scores of people in their treasury or risk departments analysing the behavioural maturities of the liabilities and assets on their balance sheets.

Figure 3: Application of Term Liquidity Premium to behavioural tenors



QUANTIFYING THE TERM LIQUIDITY PREMIUM

Attempts to quantify the cost of liquidity suffer from several impediments. It would be great if we could access the data set for the weighted average internal transfer price of funding used by all banks to balance the supply of and demand for their term liquidity. But we cannot.

Firstly, the concept of a liquidity premium itself is somewhat abstract and the methodology developed above is not widely understood, even by banks. Grant (2011) sums up the findings of survey of liquidity transfer pricing (LTP) at 38 large

banks from 9 countries undertaken under the auspices of the Australian Prudential Regulation Authority: "Responses to the survey show that many LTP practices were largely deficient. Many banks lacked LTP policies, employed inconsistent LTP regimes, relied on off-line processes to manually update changes in funding costs, and had poor oversight of the LTP process."

Secondly, the cost changes over time, depending on the demand for term borrowing versus available supply, the latter including the banking system's ability to create additional supply.

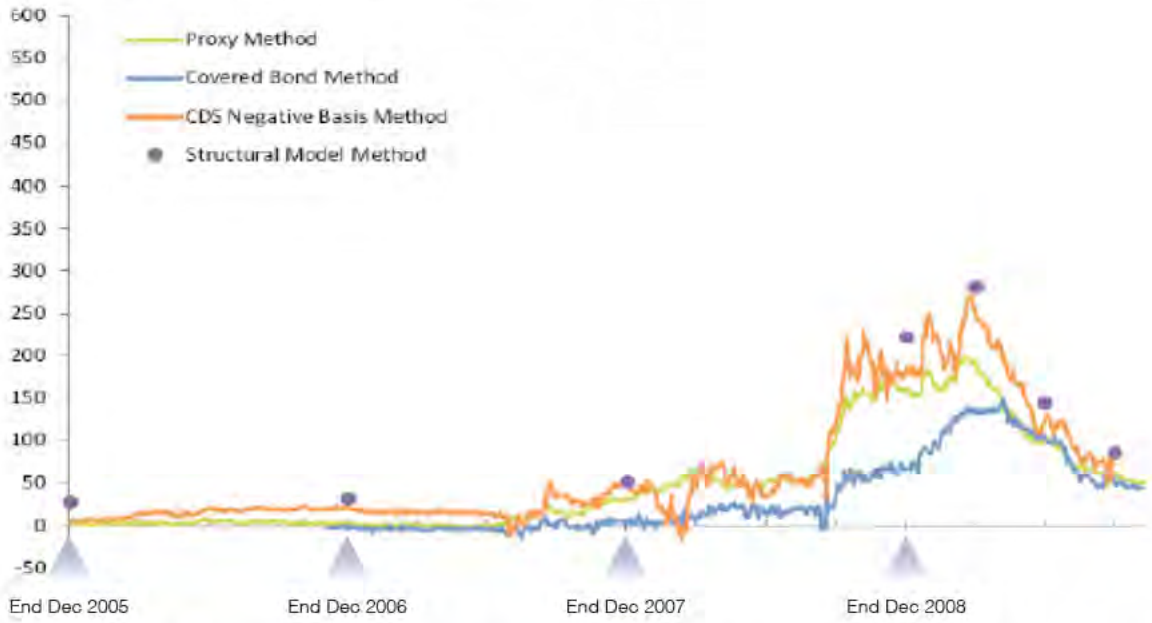
Thirdly, even where a bank has cleanly defined its internal cost of liquidity, the information is proprietary and commercially sensitive. Banks are nervous, in particular, that disclosing an increase in the cost of liquidity could be misconstrued as indicating difficulty in funding, so either necessitating higher payments still to retain funds or, worse, triggering a run. As the methodology presented in Table 1 becomes more standard throughout the banking industry, though, there is certainly a case for the regulator to compile the generic Term Liquidity Premium for various tenors from confidential submissions by the individual banks.

Finally, in looking for an externally observable market proxy of the term cost of liquidity, one requires a market price for a bond. That there is a market price rather implies that the bond is, in itself, somewhat liquid. It is therefore of only limited use in estimating the cost of locking up the money in a ***fully*** illiquid investment. As we noted above, a five-year treasury bond is fully liquid and its price only reflects the interest rate expectation (assuming no capital requirement or risk of credit loss). We would be looking for the price of locking up the money in a risk-free but ***non-saleable*** investment for five years.

With these caveats, though, we can give estimating the term cost of liquidity a bash. Much work has been undertaken by the Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS) who formed a Task Force on the Illiquidity Premium (2010) to assess the level that might be applied to insurance liabilities under the forthcoming Solvency II directive. Drawing on papers prepared by Barrie and Hibbert (2009), they used three methodologies. All essentially take a market yield and strip out the components that relate to credit costs and interest rate risk to leave the residual attributable to the Term Liquidity Premium, focusing on a tenor around five years.

- Covered Bond Method: Direct computation by selecting a pair of instruments which, other than liquidity, are assumed to offer equivalent cash flows. The difference in price should then be the liquidity premium. The task force chose covered bonds and interest rate swaps. Covered bonds are proxy of what a bank will pay to secure term liquidity without the purchaser taking significant credit risk. They are issued with dual recourse to both the issuing bank and to an over-collateralised, ring fenced pool of high-grade assets, typically mortgages. They have a very long history with no defaults. The comparison to interest rate swaps is simply the stripping off of the interest rate risk as discussed above.
  Term Liquidity Premium = covered bond index yield – swap yield
- CDS Negative Basis Method: Taking the credit risk component out of 3-5 year corporate bond yields by subtracting the cost of credit insurance, as given by Credit Default Swaps. Again then stripping off interest rate risk to leave a residual assumed to equate to the liquidity premium.
  Term Liquidity Premium = corporate bond index yield – CDS premium – swap yield
- Structural Model Method: Subtracting from the market price for a corporate bond a fair spread for default risk as implied by a model based on that proposed by Merton (1974). Again taking off the risk free interest rate for that tenor to leave the residual for liquidity.
  Term Liquidity Premium = Corporate bond yield – model implied fair spread for default risk – fixed interest rate

Chart 1: EUR liquidity premiums calculated by the CEIOPS Task Force



The results tally closely with the standard story line of the Great Financial Crisis, that a previous glut of liquidity was replaced by pressure on banks term funding throughout 2007 and early 2008 and then a scramble to shore up cash flows, following the collapse of Lehman Brothers in Q3 2008.

RELATING THIS QUANTIFICATION BACK TO A BANK'S TERM LIQUIDITY PREMIUM

The Boston Consulting Group's (BCG) 2012 benchmarking survey of 25 European Banks' treasury practices asks "Which curve should be used for pricing liquidity?" and finds "Over the past few years, the senior unsecured curve has been the standard answer to this question". Like Grant though, the consultants note that there is plenty of room for inconsistency, that there is more discussion on applying different curves to different parts of the business and that the issue is "very technical" and "needs board-level input". However, both BCG and Grant agree on marginal funding cost as current best practice.

Following this best practice, we could use the cost of issuing senior unsecured debt, over and above the cost of short date funding, as a proxy for a bank's Term Liquidity Premium. However, many of the components we have looked at in a bank's loan pricing obviously also apply to the yield that the investor requires for holding senior unsecured debt. So using the whole rate would overestimate the Term Liquidity Premium component that we wish to isolate.

The interest rate component is easily stripped out using interest rate swaps to produce a floating rate. Subtracting this from a LIBOR base then produces a term spread not involving short term bank credit risk. This term spread is a standard representation of debt prices (shown as mid-swaps plus X bps). There are three main elements left in this spread: (i) an additional price for the expected loss of a longer term credit being more than the compounding of the short dates; (ii) an additional price for unexpected loss (also incorporating information asymmetry or the risk that the issuer is knowingly selling a "lemon") and (iii) the Term Liquidity Premium itself. The first two long term credit components are additional to the short dated funding rate (in our example in Table 1, 3 month LIBOR + 20bps) as, simply, there is more time for things to go wrong. There is not a fourth component for the cost of the liquid asset buffer as, unlike deposit funding, the debt is raised for its full term and the funds secured therefore cannot run. Finally, we are making a reasonable assumption that issuance fees and other administrative costs are negligible when amortised across a benchmark transaction of several hundred million USD equivalent over five years or so.

For most of the bank's liability base, the long term credit spreads do not apply. Although behaviourally sticky, most depositors are not formally locked-in longer term. Further, they would not normally undertake the credit assessment that the buyer of senior unsecured debt would. Retail current account depositors, in particular, have been protected by the shield of deposit insurance. Finally, secured funding raised through covered bonds or repurchase agreements does not include the same credit risk for the purchaser.

In summary:

Senior unsecured debt yield ***minus*** interest rate swap ***minus*** short term funding rate = Term Liquidity Premium (applicable to behavioural maturity) ***plus*** Residual Term Credit Spreads (when contractual maturity > floating rate interest rate base e.g. 3 month LIBOR)

Where

Residual Term Credit Spreads = additional premium for expected loss ***plus*** additional premium for unexpected loss

The CEIOPS Task Force provide us with a simple formula to proxy liquidity premiums which aligns to our methodology:

$$\text{Liquidity Premium}_{\text{assets}} = \text{Max}(0; x*(\text{Spread} - y)$$

Where

Spread is the total spread between corporate bonds and the risk free rate. They use the swaps rate for the latter, so this also strips out the interest rate risk.

Y is a fixed rate to cover long term expected loss, which they calibrate at 40 basis points[6].

X is the proportion of the Spread after expected loss that can be attributed to the Liquidity Premium, which they calibrate at 0.5.

(1-x) is the risk premium for unexpected credit risk (uncertainty).

This proxy, shown by the green line in chart 1, closely tracks the observed evidence of liquidity premiums without the credit components. The pattern also aligns with the author's own experience. We will use this proxy in part (v) to estimate the economic damage from restricting banks' ability to fund long term investments in the real economy.

ADDING THE COST OF THE LIQUID ASSET BUFFER

A bank's modelling of the behavioural stickiness of its balance sheet is based on its historic data. Typically, this does not cover the effects of unexpected outflows such as those caused by name-specific stress (a run), against which the bank holds its liquidity reserve. However, as no bank undertaking maturity transformation can fully tailor its cash flow to withstand all stress, it has to calibrate the size of its Liquid Asset Buffer by defining its risk appetite somewhere short of "withstand everything". The risk appetite is often expressed as a survival horizon: the time period the bank wishes to withstand stress outflows, the pace of which is derived from the experience of banks that have suffered a run[7]. Two key considerations for the bank are the implications of falling short of liquidity and the cost of maintaining an effective buffer. For the former, the calibration is likely to be very different for a bank that knows it can tap a central bank emergency lending facility without stigma, all be it at a punitive rate, than for a bank that feels uncertain that it could rely on its central bank or that doing so might trigger official intervention to write off its equity. For the cost, the nearer to cash the assets in its buffer, the lower their yield and the more effective they are likely to be in providing liquidity, but the higher expense against the bank's own cost of funds.

6 By using interest rate swaps, CEIPOS are taking the spread against short date bank funding rates as given by LIBOR. The LIBOR rate includes a generic charge for short term expected loss. CEIOPS accept that no account is taken of this and that using a different risk free curve could change the parameters.

7 Schmieder et al (2012) give a list of empirical evidence, including the flowing examples of short term losses of customer deposits: Indy Mac (US, 2008) 7.5% over 1 week; Banesto (ES, 1994) 8% over 1 week; WaMu (US, 2008) 8.5% over 10 days; DSB (NL 2009) 30% over 12days.

As with the term liquidity cost under business as usual (BAU), different balance sheet components likely exhibit different behaviours under stress. For instance, retail savings deposits taken over the internet may run faster than salaries automatically paid into current account. Facilities committed to wholesale clients may draw more quickly than retail overdrafts. Correctly reflecting the liquidity buffer cost associated with these behavioural differences would require the bank to overlay a second set of adjustments, charging liabilities and contingent assets. This charge needs to reflect the differences in the amounts and tenors of the potential stress cash flows from those already modelled under BAU and relate these differences to the Liquid Asset Buffer requirement. This is hard to explain and harder still to implement. The complexity is such that the BCG survey indicates that banks may be only partially successful in this regard. Current best practice indicates banks calculating the cost of the buffer centrally and then reallocating this to business units in line with their stressed liquidity requirements[8]. This after the fact recharge may only partially make it through to a tailored spread between loan and deposit rates at the point of sale, with the residual effectively functioning as a flat rate tax on the business.

8 The bank may also 'fudge' through not assigning behavioural stickiness to liabilities likely to run under stress, e.g. money market deposits, and so reducing the gap between stress and BAU modelling. One method of doing this is to choose to model the historic rollover of each deposit, rather than the portfolio.

(iv) LIQUIDITY PREMIUMS AS A SOURCE OF FINANCIAL INSTABILITY

There is a cost of term liquidity because the supply of longer-date funding is limited compared to more readily available, short-date funding. This price of long term funds is the incentive that encourages banks to take liquidity risk. This maturity transformation could be through a bank stretching the use of available short term funding directly, on its own balance sheet. Alternatively, the bank could interact with other financial institutions to increase the long term funding capacity of the system as a whole. This is often done through the creation of markets for securities, where the ability to quickly liquidate an otherwise long term asset flips its behavioural maturity to being short term. In good times, financial institutions innovate to create more supply, the volume of production steps up and this drives or holds down the price, even as term lending expands. There is a momentum to this manufacturing process that can lead to an extreme degree of maturity transformation and a fragile financial system, prone to a "sudden stop".

LIMITED SUPPLY OF LONG TERM FUNDING

For there to be a price for term liquidity, over and above the cost of short term funds, there must be a restriction in supply. This requires that across the entire financial system, there is a greater demand for long term funding than there is supply of (contractually) long term funds, were long term interest rates to reflect just the evolution of short term rates, i.e. were there no liquidity premium.

The shortfall of term liabilities in the banking system is well known. Tenor specific data is provided by the ECB for loans and deposits by Euro area banks to non-government residents[9].

Table 3: Loans and deposits of Euro area monetary financial institutions (banks and money market funds) with Euro area insurance corporations; pension funds; non-financial corporations and households, end 2011

EUR (billions)	Tenor < 2 years	Tenor > 2 years	Total
Deposits	6950	1334	8284
Loans	1798	8247	10045
Excess (Shortfall)	5152	-6913	-1761

Source: ECB, author's calculations

Critically, this shortfall is unlikely to be made up by additional term liabilities gleaned from private sector elsewhere. The analysis indicates that long term investors such as insurance companies and pension funds acquire term assets only to the degree that they have term liabilities, in fact slightly less so.

Table 4: Estimated contractual tenor of assets and liabilities of Euro area insurance companies and pension funds

Insurance Co's and Pension Funds			2010
EUR (billions)	Short Term	Long Term	Total
Liabilities	155	6680	6835
Assets	1019	5651	6670
Excess (Shortfall)	-864	1029	165

Source: Quignon 2011, for BNP Paribas

9 Some minor assumptions are required to produce this table. The ECB data splits most (but not all) deposits by less than 2 years or more than 2 years. However, loans are split by less than 1 year; 1-5 years and more than 5 years. The assumption is that 1-5 year lending is spread evenly per year over 1-2 year and 2-5 years. The amounts are relatively small. Deposits redeemable at >3 months notice have been included in the <2 year bucket. Again, the amounts are small. That the ECB's tenors do not match is, perhaps, telling as to how under-researched bank maturity transformation has been.

The Euro area banks' net financing with the rest of the world was roughly in balance at the end of 2011, with EUR 4.25 trillion of assets held against EUR 3.8 trillion of liabilities raised[10]. This position of about flat in Euro area banks net financing from abroad has been maintained over the period from 2001[11]. So it seems that when it comes to the domestic private sector undertaking maturity transformation to manufacture term funding, the Euro area banking system is on its own.

THE INCENTIVE TO INNOVATE

From a bank's point of view, capturing the Term Liquidity Premium represents a source of profit. The more a bank can find ways to stretch its funding base to make long term loans or otherwise hold long term assets, the more profit it makes on at any given yield curve for the Term Liquidity Premium. Whilst a Term Liquidity Premium exists, we can expect the financial system to find ways to innovate to capture the yield.

Table 5: The principal tools that the banks use to manufacture long term funding include

Tool	How it works
Maturity transformation own balance sheet liabilities	Modelling of propensity to roll-over plus pooling of individually volatile liabilities to create behaviourally sticky core
Sell down and maximum holding periods (e.g. sell down of syndicated loans; maximum holding period for assets held on trading books)	Intent or ability to sell asset allows short term funding of it
Interbank money markets	Pooling of non-core funds to create shorter term borrowing opportunity for over-extended banks (typically to one year)
Repurchase Agreements (Repo)	Allows term debt to be held and refinanced short term by banks and shadow banks (e.g. hedge funds) beyond their capacity for unsecured borrowing
Issue unsecured term bonds to other banks	Issuing bank has long term funds, holding bank has liquid asset which can therefore be funded short term
Issue secured term bonds to other banks (covered bonds; asset backed securities)	Further creation of liquid assets beyond the issuing institution's capacity for unsecured borrowing. Security may be repackaged in shadow banking sector before asset backed securities are returned to the banks.
Issuing term bonds to investment vehicles (e.g. Structured Investment Vehicles; Asset Backed Commercial Paper programmes)	Financed by short term debt issuance by investment vehicle

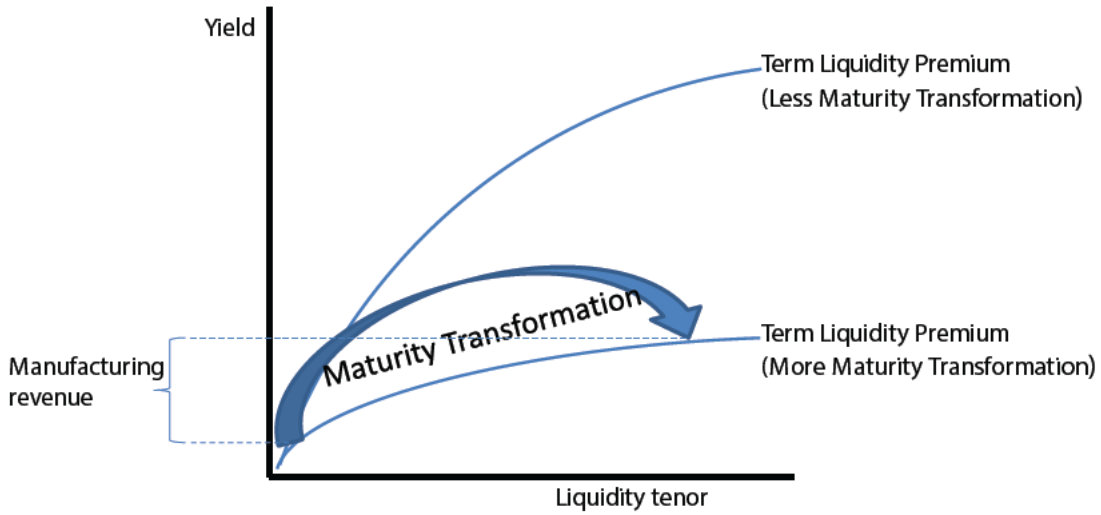
10 Source: ECB, external liabilities include debt securities issued up to 2 years only.

11 Net external assets and liabilities grew from 2.4 trillion and 2.7 trillion respectively in 2001. Part of this growth could contain different tenors, with long term liabilities raised by the euro area banks from abroad in return for short term lending. However, as most of these balances are with financial institutions, this factor would simply increase the "self-financing" argument laid out later in this section.

Naturally, the more that the banks manufacture term liquidity, the more the increase in supply will push down the term liquidity premium. But even when the production lines are running apace and the premium is fairly low, the activity can still appear profitable. By example, under reasonable assumptions, the cost of regulatory capital employed for the banking system to manufacture term liquidity through one bank purchasing another banks' term debt can be as low as just 21 bps[12]. Issuance costs amortised across the life of a 5 year bond could add another 4 bps[13]. Other marginal costs are likely not significant to a benchmark issue of USD 500 million. This gives an initial hurdle rate for the manufacturing process of just 25 bps[14]. The bank may be able to do even better in the perceived efficiency of its regulatory capital use through techniques such as using the Basel II "Advanced Internal Ratings Based" approach; buying a "Capital Resources Directive Compliant" covered bond; holding the bond on its trading book rather than the banking book (this being re-calibrated in latest regulatory reforms) or by placing the bond off-balance sheet.

The bank's alternative to increasing manufacturing, even as the liquidity premium falls, is to see a reduction in the current earnings stream. But the lack of transparency in just how a business unit is creating earnings through capturing the liquidity premium often causes revenue budgets internally to be set simply as growth on previous performance. This gives a major incentive for managers to up the amounts and tenors, even as the premium falls.

Figure 4: Evolution of Term Liquidity Premiums with manufacturing



12 Required return to cover cost of regulatory capital = WACC * RWA * Reg Cap / (1-tax) where WACC is the weighted average cost of capital, comprising equity and debt capital, assumed 10%
RWA is the risk weight for senior unsecured bonds of OECD bank (Basel I) or bank rated better than AA- (Basel II standardised approach) at 20%
Reg Cap is the minimum regulatory capital as % of RWA under Basel I and as base to Basel II, at 8%
Tax is an assume effective corporate tax rate assumed 24% (KPMG global average)

13 0.25% issuance cost amortised across 5 years post tax.

14 There could be a debate internally over whether the LIBOR base sufficiently covers long term expected loss or whether an additional margin is needed, per CEIOPS adjustment. On the other hand, the overnight to 3 month LIBOR spread may give additional revenue to the holder of the bond, if they are comfortable funding very short term.

The risk is obviously that the bank stretches its liquidity to such an extent that an unexpected outflow overwhelms its liquidity buffer and it runs out of cash. But with much more term liquidity available in the system as a whole, this risk will look increasingly remote. Managers are able to evidence plenty of term funding to be had should the bank start to run shy, and just how quickly its own holdings of term securities can be liquefied in a market flush with term funds. Indeed, this will be apparent to the regulators and other external observers, perhaps including savvier investors in the bank's non-capital debt, who might otherwise start demanding higher premiums. Bernanke and Blinder created a model of credit creation encompassing a bank's certainty of funding in 1988. Bernanke and Gertler commented on it in 1995 thus: "A key assumption of the Bernanke-Blinder model is that banks cannot easily replace lost (retail) deposits with other sources of funds… However, since about 1980, as emphasised by Romer and Romer (1990), banks' ability to raise funds on the margin…has become less restricted…Markets for bank liabilities have greatly deepened…Clearly, the Bernanke-Blinder model is a poorer description of reality than it used to be, at least in the United States." Until it wasn't, of course.

FINANCIAL INSTABILITY

Minsky (1986) built up to his famous "moment" of financial crisis with a focus on "position making": how banks adjust their balance sheets daily to ensure sufficient cash at hand. He argued that, just after World War II, this was primarily through holding large stocks of liquid government securities. Finance then innovated, introducing new short term instruments of the interbank money markets; negotiable Certificates of Deposit (CDs); then Repurchase Agreements (Repo) and Eurodollar borrowings. Finance also innovated in fringe banking, through finance company lending; corporate Commercial Paper (CP) and Real Estate Investment Trusts (REITS). Minsky saw the growth of short term financing as increasing the fragility of the banking system directly, through new instruments to support "speculative" and "Ponzi" finance. It also added additional layers of non-bank financing, to which the banks were exposed. Minsky argued that monetary tightening then inevitably induced a financial crisis, which reduced demand in the economy. The arguments laid out in the previous passage extend Minsky's notion, introducing the tenor specific liquidity curve as an incentive to innovate in maturity transformation, which then supports longer term lending.

We have already seen in Chart 1 that term liquidity premiums were depressed in the run-up to the financial crisis, and then suddenly "blew". But was the price held down as a result of "innovation" increasing the supply of term liquidity, which then stopped post Lehman Brothers default? That is, does Minsky's argument translate to the longer term and explain the behavior we observe in Term Liquidity Premiums? The ECB data provides evidence that this was, indeed, the case. For the domestic private loans and deposits of the Euro area's banks, the mismatch between term lending and term borrowing doubled over a ten-year period, 2001 to 2011. Almost all of this dramatic increase in the manufacture of term liquidity occurred in the period 2001-2008, when EUR 3.2 trillion of extra term-loans were created, of which EUR 3.1 trillion were not backed by new term deposits. Additionally, Euro area banks derecognised some EUR 530 billion[15] of term loans through "true-sale" securitization. As with manufacturing in the real economy, there has been little increase in manufacturing of term liquidity since.

15 Euro zone data on securitization is sketchy pre 2010, but can be estimated as 58% of securities issued by shadow banks to banks with the percentage arrived at by extrapolating back data from ECB monthly bulletin Jan 2012. This gives EUR 530 billion, which closely aligns with the ECB's own guesstimates.

Table 6: Loans and deposits of Euro area monetary financial institutions with Euro area insurance corporations; pension funds; non-financial corporations and households, actuals and growth 2001, 2008, 2011

End 2001			
EUR (billions)	Tenor < 2 years	Tenor > 2 years	Total
Deposits	4113	1033	5146
Loans	1532	4552	6084
Excess (Shortfall)	2581	-3519	-938

Growth End 2001 - End 2008			
EUR (billions)	Tenor < 2 years	Tenor > 2 years	Total
Deposits	2410	87	2497
Loans	556	3173	3729
Excess (Shortfall)	1853	-3086	-1233

End 2008			
EUR (billions)	Tenor < 2 years	Tenor > 2 years	Total
Deposits	6523	1121	7643
Loans	2089	7725	9814
Excess (Shortfall)	4434	-6604	-2171

Growth End 2008 – End 2011			
EUR (billions)	Tenor < 2 years	Tenor > 2 years	Total
Deposits	428	213	641
Loans	-291	522	231
Excess (Shortfall)	718	-309	410

End 2011			
EUR (billions)	Tenor < 2 years	Tenor > 2 years	Total
Deposits	6950	1334	8284
Loans	1798	8247	10045
Excess (Shortfall)	5152	-6913	-1761

Growth End 2001 – End 2011			
EUR (billions)	Tenor < 2 years	Tenor > 2 years	Total
Deposits	2837	300	3138
Loans	266	3695	3961
Excess (Shortfall)	2572	-3395	-823

Source: ECB data, author's calculations

Maturity transformation of the growth in the short term customer deposits can account for a little under half of the EUR 3.6 trillion of new term lending capacity[16]. This leaves us looking for how the banks manufactured some EUR 2 trillion of additional term liquidity.

Table 7 indicates that it was, indeed, the banking and shadow banking systems[17] themselves boosting their overall share of bank financing, i.e. "self-financing", with shadow banking broadly consisting of non-bank financial intermediaries such as investment and hedge funds and off-balance sheet securitization vehicles, but not pension funds or insurance companies. Though loans and deposits with the domestic private non-banking sector grew significantly in nominal terms, their contribution as a proportion of the banks' balance sheets actually fell by 3.5%. At the same time, the banks' financing arrangements[18] with other banks and shadow banks grew to comprise an additional 3.1% of the banks' balance sheets.

Table 7: Aggregated balance sheet of Euro area monetary financial institutions, contribution by sector

Euro Area MFI's Aggregated Balance Sheet	2001	2008	2011
Loans and deposits with resident households; non financial companies; pension and insurance	30.9%	27.4%	27.3%
Self financing by domestic banks and shadow banks	29.9%	33.0%	31.2%
Financing external to euro area	14.0%	14.4%	12.0%
Government, euro system, corporate debt, capital and reserves and other	25.1%	25.2%	29.5%

Source: ECB data, author's calculations

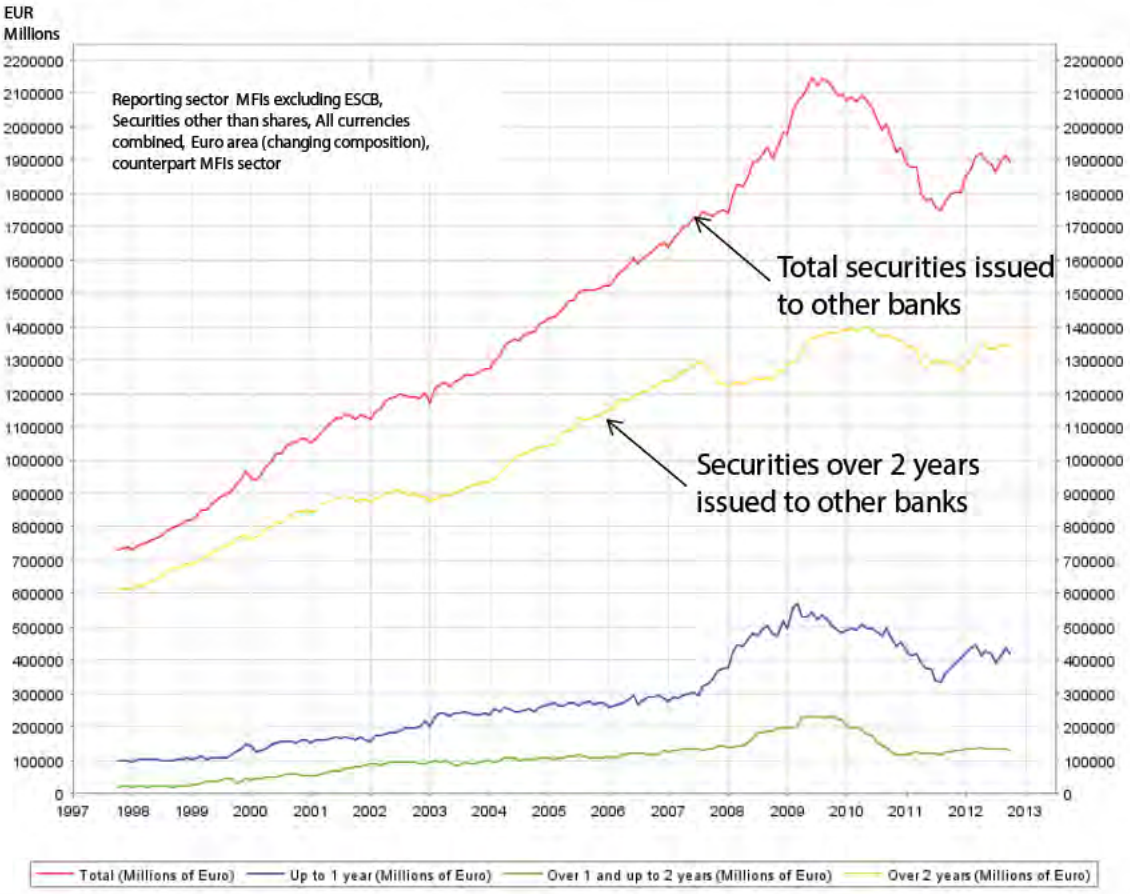
An analysis of the tenor of the transactions indicates that this was about much more than the standard story of capital arbitrage. The banks were using the tools described above to manufacture long term funding. Chart 2 shows the growth in the banks' holdings of other banks debt issues. Within the Euro area, this contributed some EUR 411 billion of term liabilities to the issuing banks over the period 2001 to 2008, whilst the banks buying the securities considered them liquid and therefore appropriate to be funded using short term liquidity.

16 Assuming: 10% of the total growth goes to the Liquid asset buffer (part wholesale funded); 85% of the short term household deposits are deemed sticky; 50% of short term funds from non-financial corporations; insurance companies and pension funds are deemed sticky. This implies EUR 1.6 trillion of the total growth in deposits of EUR 2.4 trillion can be used to support the long term customer lending, leaving a shortfall of EUR 1.5 trillion against the EUR 3.1 trillion on-balance sheet mismatch, plus the EUR 530 billion of derecognised term loans. An alternative calculation assuming that all the Liquid Asset Buffer is wholesale funded but that part of the overall growth in short term customer deposits goes into short term customer lending reaches the same result.

17 Comprises other financial intermediary (OFI) and financial auxiliary, as defined by the ECB. This captures investment funds including bond funds, equity funds, hedge funds (but not pension funds or insurance corporations); special purpose vehicles including those to securitise assets; security and derivative dealers; non-bank financial corporations involved in lending.

18 Calculated as loans to, deposits from and securities held of other banks and shadow banks.

Chart 2: Euro area MFI's holdings of Euro area MFI's debt securities



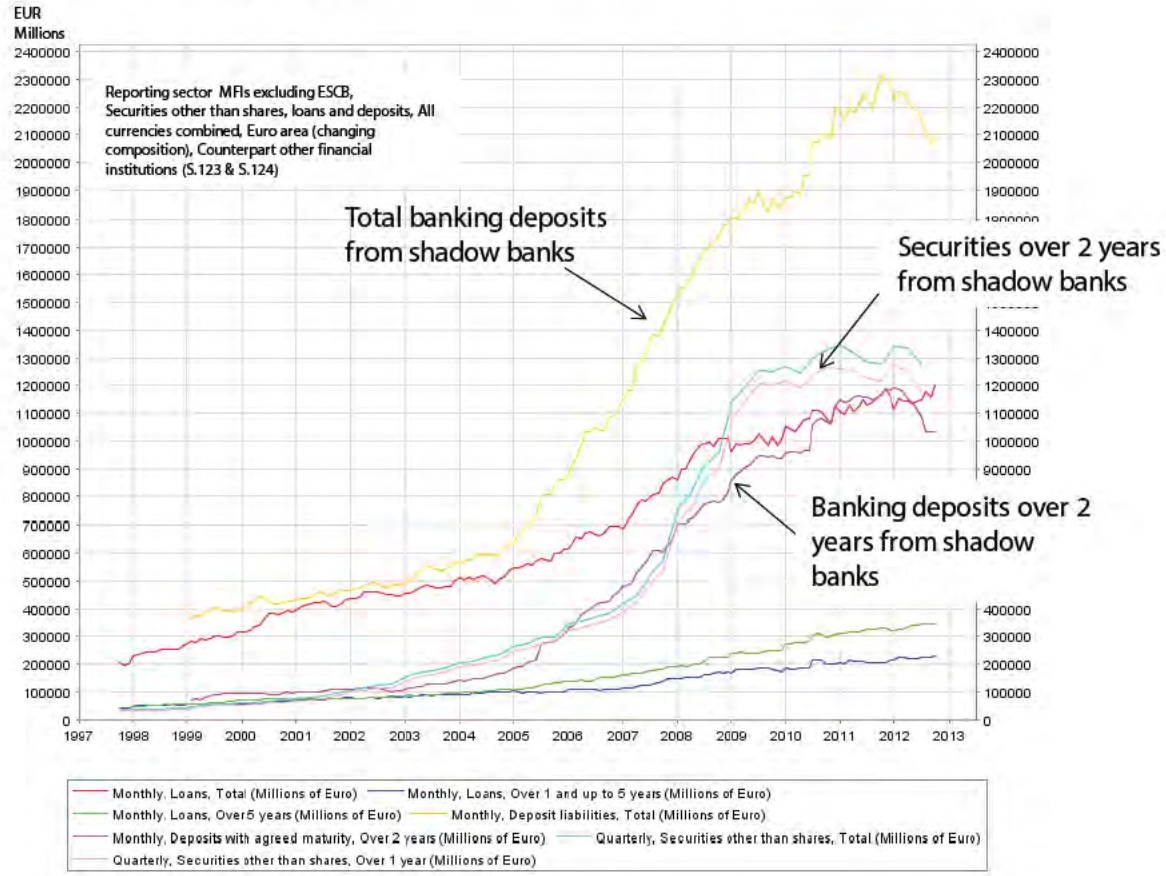
Source: ECB

More manufacturing still seems to have taken place via the rapidly growing shadow banking system. Chart 3 shows the interaction from a bank's point of view. From mid-2004, the total deposits that the banks received from the shadow banking system grew much more rapidly than the loans they made to it. In particular, long term deposits received by the banks grew by an estimated 512 billion[19] more over the period 2001 to 2008 than the long term loans that the banks made back. Further, behavioural modelling of even the short term deposit growth would allow the banks to deem a portion of this as core, sticky funding.

Finally, the banks acquired an estimated EUR 918 billion of securities issued by the shadow banks. Part of these may have made up the shortfall in shadow banking funding, i.e. that the banks were happy to hold liquid securities in exchange for receiving stickier deposits back. A greater portion was very likely securitization[20], whereby the banks sold loans to special purpose vehicles, which issued the banks with asset backed securities in return. The banks were swapping illiquid loans held on their balance sheets for liquid securities.

19 Calculation assumes loans 1 – 5 years are spread evenly by tenor.
20 Flow analysis indicates that increases in banks' holding of shadow banking debt securities corresponded in magnitude to the estimated reduction in banks loans portfolios due to true sale securitization. See ECB Monthly bulletin February 2008 p. 89.

Chart 3: Euro Area monetary financial institutions loans to, deposits from and securities held of Euro area other financial intermediaries (shadow banks), total and by original tenor

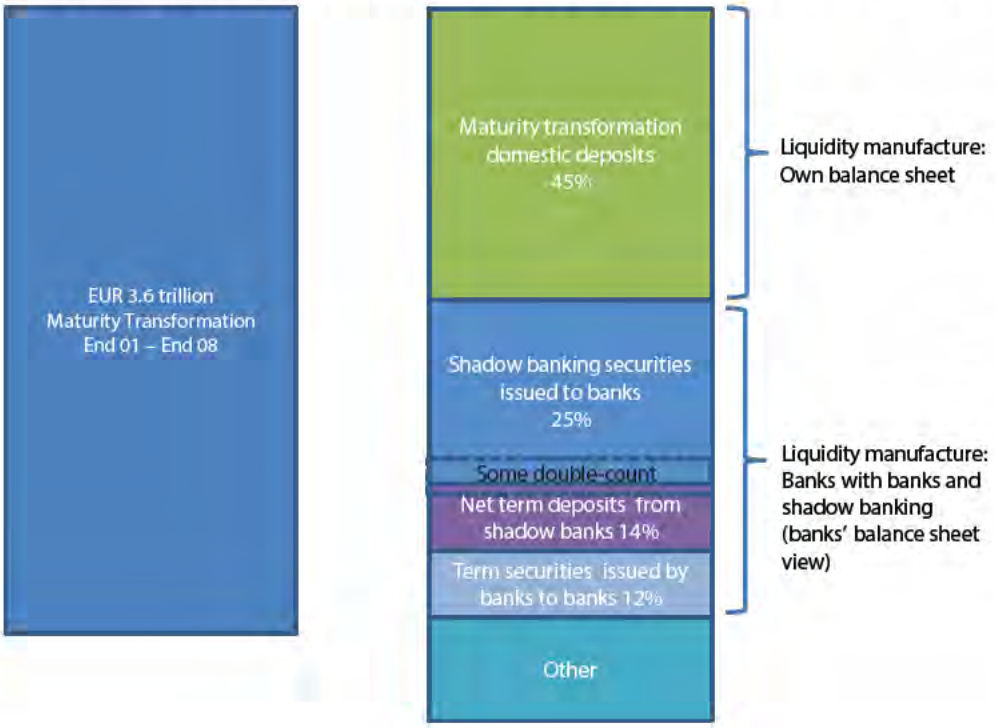


Source: ECB

Notably, growth in all these sources of term liquidity have been dramatically curtailed over the five years since the financial crisis erupted.

Figure 5 represents the overall story of how the quantity of term liquidity that the banks manufactured aligns closely to the additional quantity of term loans that they made which were not otherwise backed by term deposits.

Figure 5: Estimates of the manufacture of term liquidity by Euro area banks (domestic private sector) 2001 to 2008



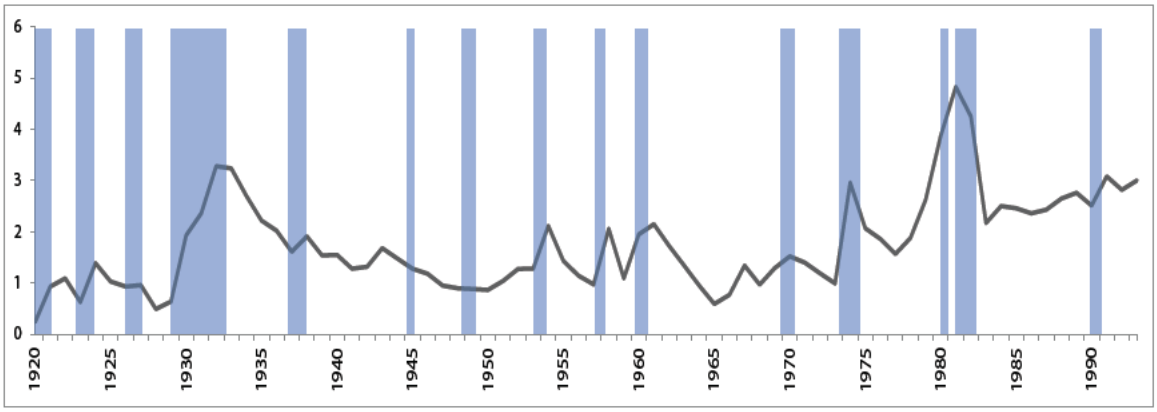
One further factor becomes evident from the evolution of the Eurozone's core banking deposits. As we have seen, term deposits form the minority of term funding. This might be expected when banks' manufacture of term liquidity is in full swing, liquidity premiums are low and so the incentives for depositors to lock up funds slight. But despite the resurgence of higher term liquidity premiums from 2008, depositors have not placed their funds in time deposits en-masse to capture the additional yield. About 14% of deposits were placed longer than 2 years at the end of 2011, a figure largely unchanged from 15% at the end of 2008 and 16% at end 2007. Either through a broken transmission mechanism of the incentive, increased transaction demand for cash, lower opportunity cost of holding cash as short term rates fell more than liquidity premiums rose, or otherwise, depositors have maintained a strong preference for liquidity.

A LONGER PERSPECTIVE

Looking further back gives some additional evidence that the Term Liquidity Premium seem to play a significant role in business cycles, though more circumstantial. We are again hampered by the lack of data on liquidity premiums. But it seems reasonable that there will be some relationship between the spread a bank charges for lending to its prime clients over and above the risk free interest rate, and the actual liquidity premium. As with the proxy the CEIPOS task force developed, in using this rate we are implicitly assuming that the charge for credit risk remains fixed, which is not entirely unreasonable for clients deemed prime. A further caveat is that the tenor of the lending is shorter than we would like. But unlike securities, these loans are fairly illiquid and are often provided on a revolving basis, as part of a longer maturity committed facility.

A long time series for the Prime Lending Rate minus Treasury bill rate in the US is given below, mapped to periods of recession. The series is truncated post 1993 when US banks set prime rates more mechanically at about 3% over the FOMC's target rate for Federal Funds[21].

Chart 4: US prime rate minus T-Bill rate and recessions



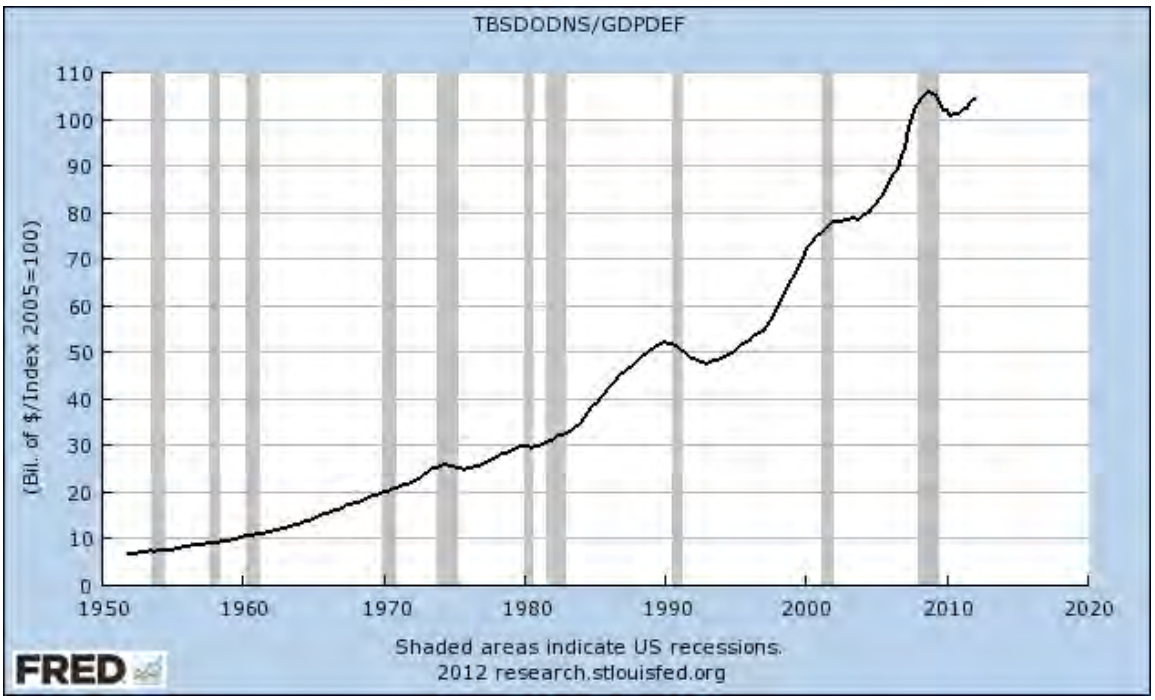
Source: Prime rate spliced together broadly as in Kashyap, Stein and Hanson (2010), with 1949-1993 being the Prime Rate as reported by the Federal Reserve Board; 1928-1948 being "Bank Rate on Business Loans, 19 Cities" and 1920-1927 being "Rate on Customer Loans, Leading Cities". Base effect from switching sources smoothed by adjusting pre 1949 data by the average variation between sets in overlapping years. 3 month T-bill series from Federal Reserve Board with pre 1931 rates for "US Treasury notes and certificates", again with the base effect adjusted. Data are annual averages. Recession dates as defined by the National Bureau of Economic Research.

It is immediately apparent that an increase in this "financial friction" usually occurs at the very start of a recession. Looking to the accompanying data for the actual amounts of business lending going on, the sudden hike in premiums normally goes hand in hand with a restriction in lending and comes after a period of sustained and rapid credit growth. The muted credit creation then continues for some time after thereafter.

21 Hanson, Kashyap, and Stein (2010)

The chart below shows business debt in the US in real (inflation adjusted) terms.

Chart 5: US total business sector debt outstanding, domestic non-financial sectors, real terms



Source: Federal Reserve Bank of St. Louis

This would seem to indicate the causality as a restriction in supply of credit then increasing the cost of borrowing and causing recession, rather than the recession reducing loan demand amid stable supply. In the latter case, we would have expected the cost of borrowing to have first fallen.

PROPOSED MECHANISM

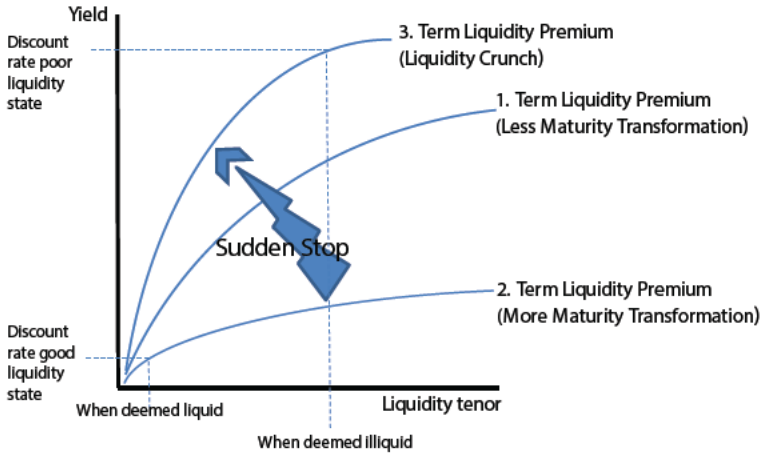
Our line of thought seems consistent with the evidence, then: after long period of increasing production, the financial machine for manufacturing new term liquidity becomes overstretched and breaks, causing a dramatic shortage in supply of, and a high price for, that term liquidity. CEIOPS analysis and the ECB data indicate that term liquidity supply plays a major role. US business lending and prime lending spreads somewhat crudely restate the established notion that financial bubbles underlie business cycles and that these arise from a restriction in bank lending.

There has recently been a focus on a possible negative interaction between "market liquidity risk" and "funding liquidity risk" at times of stress as an explanation of the financial crisis[22]. Market liquidity risk is the risk that the bank may not be able to easily liquidate a security without materially affecting its price and selling below fair value. Funding liquidity risk is the mis-calibration of maturity transformation as covered in this paper. The argument broadly runs that an initial shock, such as a hit to speculator capital, causes some liquidation of marketable securities, pushing down the price. This then causes counterparties to require an offsetting increase in the amount posted for collateralised borrowing (such as repo) and higher haircuts on the collateral value itself. The increased collateral requirements and bigger haircuts are to allow for both the actual fall in value of that collateral and for the increased possibility of further falls due to greater uncertainty and volatility. This increases speculators' funding requirements, forcing more sales and pushing down the price of the assets further, reducing the net worth of the banks or shadow banks holding the securities and causing wide spread concerns about balance sheet insolvency. This disrupts funding more widely and forces yet more asset sales in a self-reinforcing, negative spiral.

22 Gorton and Metrick (2009); Brunnermeier and Pedersen (2009); Shleifer and Vishny (2011) amongst others

In terms of our analysis, the observed behavior of increased margins for collateralised borrowing and apparent fire sale prices are symptoms of both a change in the maturity profile of the assets themselves and a shift higher in the curve for the term liquidity premium. Being less liquid, the assets should be correctly valued at a longer, more expensive tenor on a curve that has itself ratcheted up in response to the overall withdrawal of term funding capacity. This does increase the discount rate for the assets and so lowers their value[23], but the impact of this on the capital position of the banks is not key to our argument of a collapse in liquidity[24]. The correct modeling to lengthen the liquidity tenor of the asset puts more demand on the longer end of the liquidity curve, forcing it higher. Simultaneously, the asset class becoming less liquid implies the banks are less able to use that asset class as a tool to meet that increased demand for term liquidity. Hence the liquidity crunch.

Figure 6: Sudden stop



The initial shock that breaks a liquidity manufacturing machine running at full-pelt could come from many sources. It might be a relatively small hit to capital; increased volatility raising margins and/or a bigger impact of information asymmetries. It might also be a change in previously observed behaviour of deposit stickiness increasing liquidity uncertainty and encouraging liquidity hording. Liquidity or capital concerns could cause a shift in the rollover propensity / availability of funding / tenors available in commercial paper; certificates of deposit; money markets and debt instruments[25]. Critically, though, the effect is the same if regulatory change impacts banks' ability to manufacture liquidity through, for example, restricting the holding of other banks term assets as standby liquidity.

LIQUIDITY RISK OR CREDIT RISK?

Clearly, credit risk must play a role in restricting bank lending. Reverting to the methodology in section (iii), a bank's funding structure supports liquidity risk whilst its capital supports credit risk. So does the evidence indicate that the banks' shaky funding structures caused the restriction in lending, or that actual or potential erosion of the capital "pivot" caused banks to pull in their horns?

Ivashina and Scharfstein (2009) analyse the collapse in large bank loans during the crisis: a fall of 79% in Q4 2008 relative to the peak of the credit boom in Q2 2007. The loans in their data source are almost all syndicated loans, which makes a useful proxy for term lending: syndicated loans tend to be longer tenor financing due to the time and cost of the syndication process (and are therefore appropriate for corporate restructuring and other commitments that tie-up funds for an extended period). Their evidence is that banks with a more stable funding structure, as defined by a higher level of customer deposits, cut this long term lending by much

23 The increased uncertainty will also raise the margin required to cover unexpected loss, further shifting up the overall curve for the term cost of funds. Again, the impact of this on capital is not pivotal to our reasoning.

24 This is useful for the European slant of our analysis. The fall in price below fair value of assets held on a mark to market basis does pressure regulatory capital. The fall in price of those held on a banking book / designated Available for Sale does not. So the argument of the impact of the crisis being primarily linked to capital constraints carries less well for Europe, where the banking system dominates, than for the US, where securities issuance dominates.

25 Paulson (2010) comments on the haircuts imposed on senior debt holders in the failure of Washington Mutual thus: "In retrospect, I see that, in the middle of the panic, this was a mistake….clipping senior debt holders only added to the uncertainty of debt holders in other institutions, adding to the market's uncertainty about government action. Banks were even less willing to lend to one another."

less. Cornet et al. (2010) find that most of the reduction in bank credit creation at the height of the crisis can be explained by liquidity risk exposure. Schwartz (2010) looks at the blow out in short date bank funding costs, given by one and three month Euro LIBOR, from short date interest rate expectations. She attempts to split this spread into a market liquidity component and a credit component and finds more than half related to liquidity. She attributes this much more significant role for liquidity than most earlier studies to assessing liquidity costs as including compensation for liquidity risk- the possibility liquidity will worsen in future just when the investor wants to sell, rather than just liquidity as a transaction cost. This might indicate that the CEIOPS proxy, at less than half of the term unsecured bond spread, is in the right ballpark but an underestimate.

The evidence that capital constraints were a major determinant of the sudden stop in bank lending can be sketchy. Milne (2009) points out that total US sub-prime residential mortgage lending, both securitised and remaining on-balance sheet, peaked pre-crisis at about USD 1.2 trillion, representing only 1.5% of global banking assets. He argues that total loan losses on this were "far too small" to explain the scale of the crisis. Hanson, Kashyap and Stein (2011) plot capital ratios for U.S. commercial banks against two proxies of bank loan spread. They find no apparent correlation, though they also warn of the crudeness of the data. Haldane (2012) finds that capital adequacy based on risk weighed assets was a poor indicator of the likelihood of bank failure during the crisis. Under conditions of uncertainty, the best indicator was the bank's liquidity position. He does not dwell on this result, though, in a speech focused on whether financial regulation has become too complex overall. The CEIOPS analysis shows the blow out in spreads during the crisis even when stripped of credit risk, which also challenges the assumption that liquidity spreads are simply a function of asymmetric information, or the risk that the buyer is acquiring a lemon. Finally, the view of the crisis as being explained by lax lending and capital arbitrage is just not very satisfactory in explaining why and how banks innovated in liquidity manufacture and maturity transformation ahead of the crisis.

It is difficult to fully relegate capital constraints to a supporting role, though. The above trawl of recent literature is far from a comprehensive overview. It also does not rule out banks having cut lending in the expectation of declining loan quality and so acting in advance to protect their capital strength. And there is some evidence of this from the ECB bank lending survey, which shows credit standards tightening from mid-2007 to the end of 2008.

Overall, then, it seems reasonable to conclude that liquidity constraints were clearly a very significant factor in the crisis and that the collapse in term lending capacity occurred as banks' ability to interact with each other to manufacture liquidity was broken. This did not require a capital constraint or concerns over balance sheet insolvency to happen.

(v) A CONFUSED REGULATORY RESPONSE

Having identified maturity transformation as key to banking instability and business cycles, the kneejerk reaction has been to want to ban it, or to otherwise restrict or disincentivise it. Our model in section (iv) indicates what happens if banks simply don't stretch their balance sheets: success in clamping down on maturity transformation pegs term liquidity premiums at their elevated, liquidity crunch state, with a significant impact on the real economy. In the longer term, the higher premiums simply incentivise maturity transformation in the unregulated sector. More immediately, frustrated by the resultant lack of term lending by the financial sector, central banks have resorted to providing the term funding themselves. A less confused response would be to repair banks' ability to manufacture term liquidity.

BAN IT; RESTRICT IT; TAX IT

Although fairly unfashionable until recently, it is an old notion that the financial system tends to build unstable funding structures, which then cause recession.

Henry Simons (1948), writing in the aftermath of the Great Depression, viewed the boom times development of short term borrowing to finance long term obligations on a large scale as "perverse flexibility in the total turnover (quantity and velocity) of effective money". This makes the economy vulnerable to a change in business earnings as it "precipitates hopeless efforts at liquidation during depressions".

Laurence Kotlikoff (2010), writing after the onset of the current crisis, titles his book "Jimmy Stewart is Dead" in reference the virtuous manager who staves off a run on his bank in the Christmas film ***It's a Wonderful Life***. Contrary to the happy outcome at the movies, Kotlikoff describes banks borrowing short to lend long as "gambling with other people's money" and as "a system that works for them, even if it doesn't work for the country".

Having identified maturity transformation as key to business cycles and banking instability, the reaction of Simons, Kotlikoff and others is to want to ban it. Narrow Banking / 100% Reserve Banking / Limited Purpose Banking has banks putting 100% of contractually short term deposits into reserves, such that there is certainty that all the money is there if everyone asks for it back at the same moment. Milton Friedman (1969) endorses this as an ideal, but also reasons that maturity transformation "simultaneously lowers the cost of capital to borrowers and raises the effective rate of return on capital to lenders- thereby fostering a higher level of capital formation than would otherwise occur." Minsky is also slightly less extreme with a call to "lean against" the use of "speculative" and "Ponzi" finance.

The current regulatory reform agenda follows more Minsky's line, with curtailing maturity transformation a direct objective of liquidity side of the Basel III reforms. Further restriction of the system's ability to undertake maturity transformation may occur as a side effect of other regulations and as the agenda moves to shadow banking. Finally, there remains the question of whether this all goes far enough: the IMF considers the liquidity standards under Basel III essentially microprudential, at the level of the firm, and that more needs to be done to develop macroprudential tools, to measure and mitigate systemic liquidity risk. Recent academic work makes further proposals for managing systemic liquidity risk. Brief details and examples of this agenda and its impact on maturity transformation are given below:

BASEL III: Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR). The LCR is aimed at ensuring banks have a sufficient Liquid Asset Buffer to cover net liquidity outflows over a 30 day period of stress. It was to become binding for EU banks from Jan 2015. The NSFR is aimed at ensuring that banks have the structural funding to cover their term assets, requiring that funding expected to be sticky for a year covers assets that may remain on the books for over a year. The intent was for it to become binding from 2018.

In October 2012 European Banking Authority (EBA) Banking Stakeholder Group[26] calculated that the shortfall in qualifying holdings of the EU banks stood at EUR

26 Calculations based on impact studies by the EBA spring 2012 and by CEBS Dec 2010 and published in the Banking Stakeholder Group's position paper "Liquidity Rules: Dangers Ahead" Oct 2012. Shortfalls only for those banks surveyed (potential underestimate total shortfall) and based on sum of shortfalls for banks below 12005 (potential overestimate total shortfall).

1.15 trillion in mid-2011, up in absolute terms from EUR 1 trillion at end 2009. The shortfall for the NSFR stood at EUR 1.93 trillion.

In response to widespread concerns about the impact on lending as banks struggled to meet the new regulations, the Basel committee published revised standards for the LCR in January 2013, watering down the original proposals and giving banks until 2019 to fully comply. Though this eased the immediate pressure, the regulations are still restrictive rather than supportive of banks' ability to manufacture term liquidity using the tools listed in section (iv). Under the LCR, short dated money market borrowing is assumed to run off at 100%. Senior debt does not have any value as standby liquidity. Asset backed securities are haircut (25%) and restricted to a class that comprises a small portion of standby liquidity (along with equities and some corporate bonds, not more than 15%). Even higher rated corporate bonds and covered bonds are restricted in amount (not more than 40%); haircut (15%) and eligibility (AA- or CRD compliance, respectively). Repo's not backed by eligible assets are assumed to fully run off. For the NSFR, with minor exceptions, any marketable securities of more than one year maturity which do not qualify for inclusion in the liquid asset buffer require funding for more than one year maturity. The NSFR may thus be next for further "calibration".

What is missing, though, is the courage to reappraise the overall approach. Making bad regulation less bad does not make it good, in that it does not actively seek to minimize term liquidity premiums.[o]

Side Effects: As an example, the European Commission, in putting meat on the bone of the FSB's Key Attributes of Effective Resolution Regimes for Financial Institutions (Oct 2011), published the EU Framework for Bank Recovery and Resolution (June 2012). This encompasses the provision for the bail-in of unsecured, uninsured creditors. The framework proposes including senior debt of a month or more at issue for potential write down or conversion to equity. This is a much shorter period than the one year at issue proposed by the UK's Independent Commission on Banking. The framework thus encourages very short date, interbank money market lending at the expense of longer date lending or marketable security issuance. This in itself disrupts some maturity transformation. But it is also exactly these sub-one month interbank borrowings that are included at 100% in the run-off factor for the Basel III LCR, which pretty much fully negates the use of these funds for customer lending.

Shadow Banking: At the behest of the G20 leaders, the FSB has been leading the work to strengthen the oversight and regulation of shadow banking. Its consultative document published 18 November 2012 updates the work in progress with final recommendations due in September 2013. Whilst noting that shadow banking can provide a "valuable alternative" to banks, the report proposes a targeted approach to apply oversight and regulation where "bank-like risks to financial stability (longer term credit extension based on short term funding and leverage)" are identified. Specific to the EU, the 14 August 2012 draft report to the European Parliament Committee on Economic and Monetary Affairs on Shadow Banking "notes further that the financial interdependence between the banking sector and shadow banking entities is currently excessive".

Further proposals: The IMF Global Financial Stability Report (April 2011) presents the following table

Table 8: Selected regulatory proposals for managing systemic liquidity risk

Author	Goodhart (2009)	Perotti and Suarez (2009)	Brunner-mier and others (2009)	Acharya and others (2010)	Cai and Illing (2009); Farhi, Gol-sov, and Tsyvinski (2009)	Valderrama (2010)
Proposal	Liquidity insurance: charge break-even insurance premium (collected including good times), monitor risk and sanction on excessive risk taking.	Mandatory liquid-ity insurance by taxing short term wholesale funding.	Capital charge for maturity mismatch.	Impose incentive-compatible tax (paid including good times) to access government guarantee (including for loan guarantees and liquidity facilities).	Minimum invest-ment in liquid assets or reserve requirements.	Manda-tory haircut for repo collater-als.

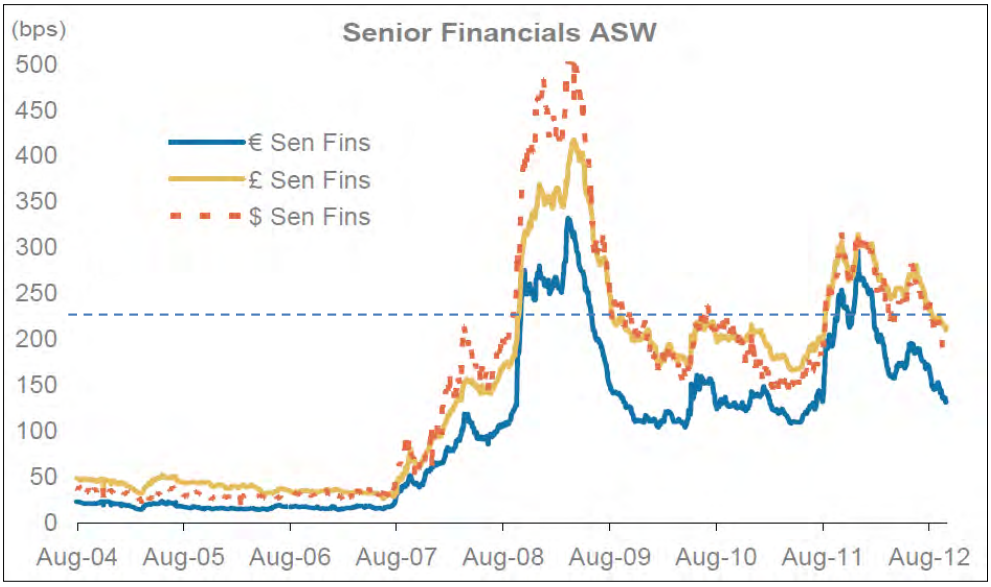
The upshot of the regulatory agenda exactly mirrors our proposed mechanism through which a liquidity crunch is created: there is an increased requirement for banks to raise term liquidity whilst the tools they use to do so are simultaneously taken away.

The various impact studies have estimated the cost of meeting the liquidity requirements as the incremental cost of raising term liquidity from a post-crisis baseline. See, for example, Santos and Elliot (2012) who put the net impact at 0.14 bps on European bank lending rates. This is in line with the BCBS study (2010) and roughly approximates to earlier work by King (2010) at 12 bps to 24 bps for NSFR only, depending on whether synergies with meeting capital requirements are accounted for. Other estimates differ.

Coming through our analysis, though, is that the cost is not just the incremental to meet the regulations. The regulatory uncertainty is such that banks have been unable to restart term liquidity manufacture and Term Liquidity Premiums have remained at elevated levels as a result. Put simply, the baseline is wrong.

Returning to the proxy for Term Liquidity Premiums, in the five years since the financial crisis, the average spread over the swaps rate for investment grade European banks has been about 200 bps higher than before. The data covers Euro area and non-Euro area banks and, despite the more recent Euro crisis, the average spread has not been that different between the two groups. From the proxy, 80 bps of this can be attributed to an elevated Term Liquidity Premium.

Chart 6: European financials senior debt spreads



Source: Morgan Stanley

From Table 6, 82% of euro area loans are longer term, implying a 66 bps increase in total lending spreads. The European Commission most recently calculated the impact of higher spreads in their June 2012 proposed framework for recovery and resolution, using Bank of England (2010) methodology based on a Cobb-Douglas production function. Using the same method would indicate a yearly macroeconomic cost from the elevated liquidity premiums of 1% of euro area GDP, or a net present value of 38% of current year GDP.

Table 9: Calculation of yearly cost elevated term liquidity premiums using EC methodology

Senior debt spreads, median for five years to Sept 2012	200
CEIOPS proxy term liquidity premum (bps)	80
Term loans as % total loan book (private sector non financial residents, end 2011)	82%
Variation lending spreads due to term liquidity premium (bps)	66
Variation in non financial firms cost of capital (bps)	22
Yearly macroeconomic cost (%GDP)	0.94%
NPV macroeconomic costs (% GDP)	38%

All of the assessments of the impact of liquidity on GDP warn of the uncertainty of the calculations and this analysis is certainly no different. However the logic that a blow out in liquidity premiums causes much of the economic damage from a financial crisis and that these premiums have been kept in a near liquidity-crunch state raises further concern. The IMF (2009) estimates that output falls steadily below its pre-crisis trend until the third year after a banking crisis and does not recover the shortfall thereafter. This leaves output losses relative to trend at 10% after seven years. The liquidity premium data indicates ***at least five years*** of active damage this time around, leading to a much greater loss of output. As the EBA's Banking Stakeholder Group (2012) says, it is "time to raise the alarm".

THE PUBLIC PURSE PLUGGING THE MANUFACTURING GAP

Alarmed by anemic growth, the central banks and the state have become increasingly aggressive in stepping into term lending, both to the banks and to the real economy directly. Where this supports bank maturity transformation, as in the EUR 1 trillion of 3 year money the ECB provided to the European banks (the vast majority of which was placed back with the ECB on overnight deposits, leaving the ECB the one lending long, borrowing short), or where it supplants the banks, as in the US purchases of mortgage securities or the French plans to lend to SME's directly, it should reduce the damage. And there is tentative evidence that this is now the case. Of the three CEIOPS indicators of liquidity premiums, unsecured bank senior debt spreads minus CDS spreads narrowed dramatically between Q1 2012 and Q3 2012, though covered bond levels and debt spreads themselves remain significantly above crisis levels. However, this result has been achieved through the state purse taking direct exposure to private sector credit risk ***as standard***. Exactly the risk the liquidity regulations were designed to prevent ***in exceptional circumstances***. Further, the headline temporary nature of the interventions prevent banks from building long term business models based on this support, yet flooding them with cash also prevents the markets for long term assets from restarting[27]. This raises the risk that the state intervention is both ***as standard*** and ***without a credible way to stop.***

27 See Malherbe (2012) for a model of how high cash holdings can cause less long term assets on sale to reflect cash needs and more to reflect private information ("lemons"), impairing their role for liquidity provision.

Table 10: Public sector term liquidity provision

Liquidity Provider	Facility	Activated	Terms and collateral criteria other than government bonds
ECB	Long Term Refinancing Operation	Dec 2011	EUR 1 trillion of 3 year liquidity at 1% against very wide range of collateral including RMBS; ABS; covered bonds; corporate and bank bonds and on balance sheet mortgage, consumer and corporate loans, most subject to minimum credit rating
BoE	Extended Collateral Term Repo	Jun 2012	6 month liquidity at base + 25 bps against wide range of collateral including RMBS; ABS; covered bonds; corporate bonds and on balance sheet mortgage, consumer and corporate loans, subject to minimum credit rating
BoE	Funding For Lending	Jul 2012	GBP 68 billion of 4 year liquidity swapping eligible collateral for treasury bills for 0.25% fee if total lending increases
Federal Reserve	QE3	Sep 2012	Outright purchase of USD 40 billion Agency MBS per month until further notice
French State (50% direct, 50% CDC)	Public Investment Bank	Announced Oct 2012	EUR 42 billion of direct lending to SME sector

Quantitative easing, where the central bank injects money through the purchase of government bonds, is excluded from the table. From a bank's point of view, this simply exchanges one liquid asset, government paper, for another, reserves. This leaves the maturity structure and term lending capacity of the bank's balance sheet unchanged. In an IMF working paper, Singh and Stella (2012) find the same result when considering the pool of assets acceptable as collateral for securitised borrowing.

(vi) CONCLUSION:
THE RADICAL ALTERNATIVE: AN OLD SOLUTION FOR AN OLD PROBLEM

IMPLICATIONS

The main conclusions one can draw from this paper's line of thought cut against the grain:

- The regulatory desire to reduce the inter-connectedness of financial institutions is misplaced. On the contrary, the growth of interbank liabilities is a key mechanism in the private financial sector's ability to manufacture term liquidity to support term lending.
- Blaming low Term Liquidity Premiums for lax lending standards prior to the crisis misunderstands the difference between capital risk and liquidity risk. Poor lending, possibly through the arbitrage of risk weighted regulatory capital requirements, is just poor lending, underestimating expected loss and the capital required to cover unexpected loss.
- Speculative bubbles caused by unduly low interest rates overall should be addressed by increasing policy rates: there is no benefit to forcing a higher charge for long term lending than for short term lending. In line with Friedman's view, this just disincentives capital formation. Put another way, for the purpose of "taking away the punch bowl", it is the level of rates and not the shape of the curve that should matter.
- It is likely that allowing Term Liquidity Premiums to blow out did further impair the market value of newly illiquid assets (including already questionable loans). More effective policy action to prevent the blow out in liquidity premiums could have limited the impact.
- Conducting monetary policy through the tail of short term policy rates is less effective during a liquidity crunch, when the financial friction between short term and longer term rates increases in line with the higher liquidity premium. This effect is most relevant when short term policy rates are near zero, and cannot fall further to offset longer Term Liquidity Premiums. So just when it is most needed, the tail of short term policy rates is not really connected to the dog of longer term lending.
- From the point of view of the banks, quantitative easing exchanging government bonds for cash simply trades one liquid instrument for another, leaving the term structure of the banks' balance sheets unchanged. It is therefore ineffective in stimulating term lending capacity during a liquidity crunch.
- Quantitative easing exchanging risk assets that are or may become illiquid for cash (what Willem Buiter (2008) terms Qualitative Easing) does increase the system's term lending capacity.
- Having miscalculated the negative impact of liquidity regulation on growth, central banks are increasingly resorting to Qualitative Easing. This blunt tool exposes the public purse to private sector credit risk. The purported purpose of the liquidity regulation, in preventing the public sector underwriting private sector credit provision, has therefore not been achieved.

POLICY RECOMMENDATIONS

My recommendations are made against a policy objective of minimising Term Liquidity Premiums, so as to maximise growth whilst avoiding a cash flow crunch, yet ensuring that losses to the public purse from any extraordinary liquidity support are minimal in the context of overall GDP gains.

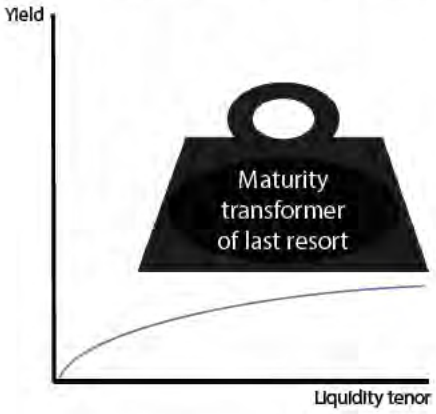
The purpose of the capital layers in a bank is to limit the risk of externalities in the financial system and the broader economy which would occur in balance sheet insolvency. The ICB (2011) finds that loss absorbing capacity of 16% of RWA would have been sufficient to cover the recent crisis losses of all banks in their sample, bar Anglo Irish. The Commission therefore recommends 17% loss absorbency

capacity, as a percentage of RWAs. The EC's recommendations on bail-in (2012) do not formally include a recommendation for loss absorbency capacity, but the accompanying FAQ suggest 10% of gross assets as sufficient to have resolved most recent bank failures, based on a scenario of an extremely severe crisis. The impact assessment calibrates this in proportion to the ICB's recommendation (11% more onerous than the ICB). The EC's proposals have the advantage that the quantity of bail-in debt and equity is linked to gross balance sheet, whilst the equity alone is linked to the risk-weighted balance sheet. This implies the price of the bail-in debt should adjust if bank under-estimates the capital required against RWA, hence disciplining the bank. But it also avoids the incentive for a bank under a gross balance sheet only measure to load up on risky assets, as these are still caught by the capital to RWA calculation.

A 10% capital to gross assets would be much like the historic regulation for banks, requiring a proportion of the balance sheet to be in equity and a proportion in subordinated debt. The developments are a higher total capital requirement than under the Basel regulations, calibrated to gross assets to prevent gaming, whilst retaining the nuance of equity linked to risk weights and with the subordinated debt cleanly loss absorbing. This regulation of capital to gross assets should also be applicable to shadow banking, which would allow the banks to downstream liquidity to fund cash flow shortfalls, without requiring the regulators to undertake the difficult and unnecessary task of identifying and restricting shadow banking maturity transformation.

With the higher capital buffer in place, Haldane's view that more regulation is not necessarily better regulation comes to the fore. The banks are forced to hold higher loss absorbency capacity, which then allows the state to provide support to maturity transformation and cash flow shortfalls protected from loss by that higher capital buffer. Ideally, this would be at a rate slightly more punitive than the recent schemes, to discourage ongoing dependence, but using a similar wide range of collateral and for similar long tenors.

Figure 7: Central banks as maturity transformer of last resort



Little is gained and much is lost by then requiring the banks to also curtail maturity transformation such that they will not to call on that support. *Whatever* the cause of the blow out in the Term Liquidity Premium, the appropriate response is ***not*** to constrain maturity transformation in a largely arbitrary manner. This only worsens the effects, requires the state to take the risk of capital loss directly and pushes out the incentive to manufacture term liquidity into the darker corners of the shadow banking sector, where it is least likely to be detected. Instead, the appropriate response is to incentivise a bank's shareholders and debt holders to better monitor a bank through revised and tougher capital standards. With these stronger capital buffers, there is no place for liquidity regulation. Rather than tweak the Basel liquidity standards, they should be junked. Other regulation should take account of incidental the damage done to the ability of banks to do their job in supporting term lending.

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