A new framework for funds transfer pricing

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1.INTRODUCTION[1]

In the wake of the financial crisis, one of the biggest failures observed in the financial system refers to the poor evaluation of the exposure to liquidity risk as well as to its pricing. The ideal funding environment preceding the turmoil (where liquidity was plentiful and cheap) led many banks to overlook liquidity and funding implications of deals, thereby encouraging an increase in leverage as well as an excessive maturity transformation to make record profits. In hindsight liquidity revealed itself as a scarce, expensive and strategic resource that requires to be effectively allocated and managed and its cost charged to different business units, products and counterparties accordingly.

According to the extraordinarly changes registered in the financial landscape, marked by more and more competitive markets where funding is available only for shorter periods and at a higher price, liquidity pricing frameworks in banks became an essential tool to measure the risk-adjusted profitability at a more granular level while addressing the impact of liquidity risk and other ALM risks on a financial firms' balance sheet structure, segregating them from operations. Failures to adequately apply liquidity transfer pricing processes, both on- and off- balance sheet, generated risks, due to the misalignment of the risk-taking incentives at individual level and consolidated one, leading to a wrong allocation of capital resource within the business units.

However, the growing importance of liquidity pricing largely derives not only from market events. More recently, worldwide regulators have been increasingly focused on pricing liquidity. The regulatory initiatives[2] will pose challenges for banks to overhaul their existing funds transfer pricing (FTP) frameworks and to incorporate formally liquidity risks. As a result banks, especially the largest, cross-border and more sophisticated ones, are revising and reshaping their approaches to meet regulatory expectations as well as to take into account the multi-dimensionality of liquidity risk as well as its interconnections with the organizational structure, the balance-sheet items, etc. This process is underway and still not completed.

In such a perspective, after an introduction on the theoretical frameworks for FTP, the paper reviews some of the methodologies for pricing liquidity, implemented by cross-border banking institutions, pointing out their intrinsic weaknesses. In the light of empirical evidences that covers the period starting just before the crisis to nowadays, we analyze the evolution of the main different FTP components showing the most significant results from a macro and a micro-perspective as well. Some potential areas of improvements and challenges will be highlighted. Finally, we describe a few benefits achievable through the adoption of a FTP approach.

[1] *The opinions expressed in this paper do not necessarily correspond to those of Bank of Italy. All errors remain the responsibility of the authors. Despite this paper is the result of a research jointly carried on by the authors, sections 5 and 6 can be attributed to Alessandro Conciarelli, sections 4 and 5 can be attributed to Pasquale La Ganga, while sections 1 and 3 has been written by Pasqualina Porretta.*

[2] *The regulatory initiatives include guidelines for developing an effective allocation mechanism to ensure funding and liquidity costs and benefits are transparently allocated to the respective business functions, customers and products and the introduction of specific global quantitative minimum standards for liquidity, introduced for the first time in the new regulatory framework known as Basel 3. For futher details see par. 2.2.*

2.LIQUIDITY PRICING: A BACKGROUND

During the years before the "financial tsunami", the banking industry experienced a period of "great moderation" characterized by narrow spreads, low volatility and low levels of risk adversion that led to an increasing competition from both commercial (or traditional) and investment banks. Over the years, the remarkable reduction in profits coming from the traditional intermediation activity pushed some institutions to adopt innovative and more sophisticated intermediation models and financial engineering techniques in order to develop and price more complex financial products, such as synthetic securitization, to increase profits[3]. The wide de-intermediation process experienced, exposed banks - independently from their support or "sponsorship" of these vehicles - to high reputational and diverse shapes of liquidity risk.

Due to the abundance of liquidity in the market at cheap rates many financial institutions and supervisory authorities overrelied on overnight and short-term securitised financing transactions and, at the same time, did not foresee the implications and the impacts of the "shadow banking system" on each intermediary and the banking industry as a whole. The maturity mismatches in banks' balance sheets were fully consistent with the assumption of liquid, efficient and continuous markets. Most financial players increased their reliance on short-term wholesale funding. They became more reliant on interbank borrowing and did not fully appreciate the risks emebedded in the sale of marketable securities for funding. The steady replacement of credit exposures in the bank balance-sheet with financial securities and liquidity lines increased the percentage of long-term and illiquid assets, not duration-matched with the funding sources. As a consequence, maturity mismatch, innate in the role played by banks in the financial system, went far away from former acceptable levels maing them vulnerable to acute liquidity risk.

2.1
Liquidity risk, the invisible risk

All these developments occurred without any robust methodological measurement framework. Before the crisis, liquidity risk management was mainly based on the measurement and control of funding risk related to maturity mismatching whereas market liquidity risk and other types of liquidity risk, such as market and contingent ones, played only a marginal role. As a result, the actual market cost of funding brings to an excessive growth of no-value generating activity.

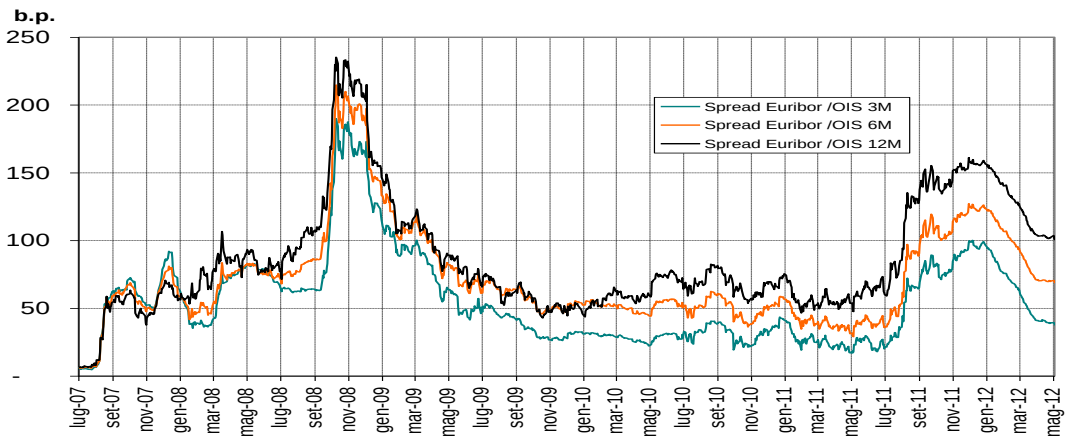
[3] *The traditional banking activity (i.e. funding investments in long-term assets using short-term liabilities) based on a low degree of maturity transformation has been increasingly replaced by a new intermediation process (i.e. OTD or Originate To Distribute) grounded on the possibility for banks to securitize and sell assets to other financial intermediaries and vehicles (e.g. SIV, conduits) financed on a roll-over basis.*

The collapses of Northern Rock and Bear Stearns (both of them were well-capitalized and made profits in the quarter before) proved that profitability and capital were no defence against liquidity risk, largely seen before that period as an "invisible risk".

Financial markets, "fallen into the oblivion" in a context of cheap and wide wholesale liquidity, sudden awoke after the Lehman's default which led the costs of various types of liquidity risks to be an essential element to live through the crisis[4]. The cost of liquidity – usually expressed by the spread between the Euribor rate and the Overnight Indexed Swap rate (or OIS) over different tenors - has skyrocketed (see fig. 1)[5].

Chart 1

Bank funding costs



Source: own elaboration on Bloomberg data

The monetary market crisis rapidly spreads to all the other segments of the financial market causing a generalized increase in all risk factors. The growing difficulties in accessing funding channels have emphasized serious weaknesses in the measurement methodologies and frameworks for estimating the funds transfer prices adopted by the cross-border banking groups[6].

[4] *Since September 2008, the default of Lehman's caused the complete drying up of the interbank market, due to a lack in market's confidence about the ability of the banking system to cope with widespread and prolonged unsteadiness.*

[5] *Empirical evidences show OIS reflects market expectations on future monetary policy whereas Euribor the conditions for unsecured funding. Since September 2008, the default of Lehman's caused the complete drying up of the interbank market, due to a lack in market's confidence about the ability of the banking system to cope with widespread and prolonged unsteadiness.*

[6] *Their metrics were not able to kept pace with all the sudden changes in the economic and financial landscape: in an environment of record low interest rates, the liquidity premium became a dominant factor in pricing loans and deposits. Back at a time when many market channels (e.g. interbank market, ABS market, CDs, CPs, etc.) were frozen, banks correctly placed an high value on stable long-term funding (such as retail deposits) as emphasized by higher and higher liquidity premiums in their internal pricing. However the mechanism for calculating these premiums,*

Even if several systemically important financial institutions (SIFIs) claimed to have a well functioning FTP process, most frameworks exihibited some deficiencies. They were: poor data quality, insufficient updating frequency and granularity liquidity risk is assessed and charged, partial anchorage or responsivenss to actual market movements, weaknesses in cost and debt funding calculation, unsatisfactory governance structure supporting it as well as insufficient risk culture, lack of transparency and incoherent application to various business lines, products and customers (sometimes fostered by organizational and business complexities originating from operating and control systems, often "fragmented"), lack of a forward-looking management view to incentivise particular business activities[7] or discourage some abuses (potential to "game" or exploit the FTP structure), inability to incorporate off-balance sheet risk[8] and main evidences coming out from the behavioural models and stress tests application, lack of adequate technology to perform FTP calculation and attribution/allocation[9].

All these aspects still represent areas targeted for improvements. Such shortcomings determined distortions in the evaluation of risk-adjusted profitability, led to a growing trend in financial leverage. Their awareness has encouraged a substantial review of bank pricing systems for transferring liquidity, in order to make FTP more crucial in the liquidity management process by the banking industry as well as the supervisory authorities.

2.2
Regulatory developments

The fragilities mentioned before explain why FTP methods are becoming increasingly attractive within the global regulatory landscape. The initiatives put forward the Basel Committee on Banking Supervision (BCBS), CEBS, SSG, and other regulatory authorities testify a renewed interest in this topic (see tab.1).

simply taking the wholesale cost of term funding and directly incorporating that cost into their internal pricing, revealed itself rough for many institutions.

[7] *The indiscriminate and unprecedented increase in the amount of assets, financed with forms of wholesale funding in the short run, the increasing cost of the liquidity, has rendered unavoidable the adoption of drastic de-leveraging plans (either qualitative and quantitative) and de-risking processes by many international and cross-border banking groups, leading to an increase of market liquidity risk. In this circumstance, banks have realized that their off-balance sheet contingent liquidity exposures had not been priced adequately into their internal models.*

[8] *Most frameworks adopted by SIFIs were designated to price exclusively interest rate risk, therefore did not fully capture the optionalities implied in their balance sheet structure as well as fail to internalize the cost of the (explicit or implicit) "option for liquidity" embedded in financial contracts (from retail loans to derivative transactions) thorugh the application of add-ons.*

[9] *The low level of quantitative details employed to build a number of curves used for the pricing of different instruments and the lack of data to develop behavioral models for retail deposits but also for stress tests (higher haircuts and longer time-to-sell) in the internal funds transfer pricing do not highlight the hidden liquidity risks and consequently discouraged a less volatile fund raising (ie. retail deposits).*

Table 1

Recent regulatory provisions on liquidity pricing

Feb 2008	BCBS	*Liquidity risk management and supervisory challenges*
Sept 2008	BCBS	*Principles for sound liquidity risk management and supervision*
Mar 2008	SSG	*Observation on risk management practices during the recent market turbolences*
Jun 2008	CEBS	*Second part of CEBS's technical advice to the European Commission on liquidity risk management*
Dec 2009	BCBS	*International framework for liquidity risk measurement, standards and monitoring - consultative document*
Dec 2009	CEBS	*CEBS Guidelines on Liquidity buffers*
May 2009	ECB	*EU banks' funding structures and policies*
Oct 2009	FSA	*Strengthening liquidity standard including feedback on CP08/13, CP09/14*
Oct 2009	SSG	*Risk Management Lessons from the Global Banking Crisis of 2008*
Feb 2010	EU Comm.	*Consultation regarding further possible change to the Capital Requirement Directive*
Mar 2010	CEBS	*Consultation paper on CEBS's Guidelines on Liquidity Cost Benefit Allocation (CP36)*

Source: Own elaboration

They seek to address, broadly, banks' poor liquidity risk management approaches, providing some core principles and guidances for the adoption of best practices in developing an effective allocation mechanism, where the FTP play a pivot role. They look for to encouraging banks to accurately quantifying liquidity costs, benefits and risks and fully incorporate them in their FTP mechanism in order to strengthen the resilience of the financial institutions and system as well[10]. The regulatory changes published by the Basel Committee (known as "Basel 3"), mainly based on two new internationally harmonized measures of liquidity risk exposure[11], will have the potential for far-reaching implications. The FTP system will be charged with a new task in addressing a proper bank's risk-taking process which must be coeherently with business policies, in order to avoid mispricing phenomena. The reform could drive banks to revise their business strategies, including product design/mix and pricing, risk transfer strategies, and cost reductions[12]. Focusing on the transition dynamics concerning liquidity, it could create an increase in the amount (and implied costs) of medium-long term funding needs due to both an higher holding of liquid assets to meet the liquidity rule's threshold on the short-term (1 month)

[10] *See Principle 4 of BCBS (2008).*

[11] *With reference to liquidity risk the BCBS has introduced two new complementary liquidity requirements – a short-term requirement called the Liquidity Coverage Ratio (LCR) and a long-term requirement called the Net Stable Funding Ratio (NSFR). The LCR ensures that banks have adequate funding liquidity to survive one month of stressed funding conditions (significant downgrade of the institution's public credit rating, a partial loss of deposits, a loss of unsecured wholesale funding, a significant increase in secured funding haircuts, increases in derivative collateral calls and substantial calls on contractual and non contractual off-balance sheet exposures, including committed credit and liquidity facilities). The NSFR addresses the mismatches between the maturity of a bank's assets and that of its liabilities and it is intended to promote longer-term structural funding of banks' balance sheets, off-balance sheet exposures and capital markets activities. In addition, supervisors may require an individual institution to adopt more stringent standards or parameters to reflect its liquidity risk profile and the supervisor's assessment of the institution's compliance with the Committee's sound principles.*

[12] *Banks may respond to regulatory tightening by passing on additional funding costs to their (retail) customers, by raising lending rates.*

and to replace short-term funding in a structural perspective (1 year)[13]. In order to achieve such a reshuffling of on balance-sheet items, lending spreads almost certainly will enlarge and, at the same time, banks will obviously need to ramp up their holdings of securities (mainly treasuries) in order to comply with the liquidity ratios incurring in higher opportunity costs.

In this respect, worldwide regulators underscored the economic cost of meeting the new requirements (due to a higher demand for structural liquidity) and the need banks attribute them to the business lines, which pose challenges for existing FTP frameworks.

2.3
Areas for targeted improvements

The financial world already begun to change in response to the catastrophic events of the last few years[14] as well as the regulatory propulsion. Along with the supervisors' initiatives, liquidity risk management, thus liquidity pricing, has become more important in the banking industry. The inadequate liquidity risk measurement and the poor LTP practices increased the cash flow needs linked to the build-up of illiquid instruments in the balance sheet, therefore former liquidity buffer revealed not to be able to absorb contingent liquidity needs.

FTP approaches should limit opportunistic behaviours that prevent the overall profitability being maximized and, at the same time, expose unconsciously to risks at the level of group. Transfer pricing system should be consistent with the framework of governance, the agreed risk tolerance for liquidity. Risk management in its decision-making process consequently have to implement features such as gap limits, concentration limits, liquidity buffer and other quantitative measures, that must be approved by the management body in its supervisory function. However, at present very few firms have in place an internal charging mechanisms for liquidity risk, as defined in the Basel guidance. This will require banks to enhance significantly their funds transfer pricing frameworks and associated reporting and management information systems. FTP results need to be linked with the budgeting and planning processes. The higher volatility we observed in the money market interest rate level determine a movement towards approaches more sensitive to market changes (particularly for shorter-term funding costs).

Only recently there was an increase in the sensibility towards liquidity pricing in banks' FTP systems, indeed nowadays most frameworks include more realistic pricing criteria. From a methodological point of view, many SIFIs, already equipped long since of mechanisms for internal pricing liquidity, have undertaken challenging improvements in order to: 1) better incorporate some liquidity risk features (among which maturity mismatch liquidity risk, market

[13] *It's expected greater competition for retail deposits as a share of overall funding, but also banks may look to lock in long-term funding through debt markets. Moreover short-term wholesale funding mechanisms may become less appealing under Basel III.*

[14] *For instance, leverage levels drop dramatically and capital ratios grow significantly.*

liquidity risk and contingent risk) in their evaluation procedures of business lines, products and counterparties profitability[15]; 2) limit opportunistic behaviours that prevent the overall profitability being maximized and, at the same time, expose unconsciously to risks at the level of group[16] and, last but not least, 3) only recently banks are beginning to translate in their FTP systems the main evidences regarding the liquidity of assets included in their liquidity buffer coming out from stress tests (in terms of greater haircuts and time-to-sell) and behavioural models application aiming at stimulating the less volatile forms of funding (for example, the retail deposits).

3.
FUNDS TRANSFER PRICING METHODS: A REVIEW

FTP can be defined as an internal mechanism which allocates the costs of gathering funds to the products or areas that use the funds raised. It should be designed in a way that charges the cost of funding to businesses that use it and credits the benefits of funding to businesses that provide it[17]. This must encompass both on-and off-balance sheet activities, as well as potential funding needs related to actions that might be taken to preserve the institution's reputation.

In this way banks who implemented an effective FTP can understand both where and how they make money, as well as the potential risks involved in their business and hence they can measure, analyze and increase their profitability[18]. The mechanism should be designed to ensure that the end-users inside the bank can understand and use the output to facilitate decisions that will ultimately impact the financial situation of the institution as a whole.

FTP contributed significantly (especially for SIFIs) in business units' performance analyses, taking into account factors within their control (e.g. credit quality, pricing and product strategy). Through the centralization of interest rate and liquidity risks managing within a unit (Treasury is

[15] *The identification of the most appropriate metrics for pricing the internal transfer of funds, represents a significant challenge for banking groups (particularly for cross-border ones) in terms of ensuring consistency between risk-taking on the part of individual business units (or financial institutions) and liquidity risk overall generated (at stand alone basis or consolidate view). See par. 4.*

[16] *In many banking groups and financial intermediaries the FTP mechanisms did not correctly estimate the liquidity costs (and benefits), because of several reasons among which the distortions deriving from cross-selling policies between different bank products, the insufficient granularity level of the multiple pricing curves constructed for various types of assets and liabilities.*

[17] *Born as a powerful management accounting tool for profitability analysis, FTP refers to the pricing of internal transactions and charges between divisions of the same firm and it does not result in a transfer of cash, rather, it is an accounting entry that ultimately nets to zero from a group-wide perspective.*

[18] *According to Levey (2008), an effective FTP analysis contributes to improve pricing quality identiing high or poor-performing products, segments, to evaluate alternative investment and funding improving the planning process and the strategic allocation of resources and to incorporate information into rewards systems*

often considered as the bank's unit best-suited to manage this type of risk[19]), FTP allows the business units to focus on those factors directly controlled without regarding for funding and interest rates issues.

The framework should be coherent with governance, risk appetite, business model and chosen strategies of the institutions. It should have a proper governance structure supporting it. The mechanism should involve key professionals, i.e. the Chief Risk Officer, the Chief Financial Officer, and other units responsible for the bank liquidity management, including senior management and the ALCO, which should monitor changes in funding costs, measure their impact on the operations and profitability of business lines and define the frequency of the internal transfer price update.
In the light of its role as the major interface between the commercial side and the financial side of a bank whose objectives are often conflicting. Any malfunctioning or inconsistency in the system will interfere with commercial and financial management, and will create a gap between the global policies and operations of the bank.

3.1
Defining transfer prices

Each FTP system relies on transfer prices. They can be identified as the economic fair value of a transaction or, equally, the theoretical spread[20] that funds-using/funds-generating business units, activity segmentations (business lines, products and customers) should hypothetically pay to/receive from market counterparties to mitigate exposure to financial risks generated by daily business activities in a risk-neutral rate world. Internal and external transfer prices should be generated in a transparent and consistent manner and should not be applied at too "high" or too "low" level to guide coherently to the various business units.

3.2
Alternative methods for transfer pricing

The first step towards the implementation of a FTP process regards the choise of a method. Academic literature tells very little about appropriate techniques. The proposed methodologies,

[19] *Treasury is pivotal in the FTP process since its connections with the capital markets - providing market-based FTP rates - but also for its significant use of aggregated FTP information in asset/liability management.*

[20] *Defined as the difference between interest rate and a transfer price is the interest margin, which allows to calculate the internal interest profit on a transaction.*

available with different level of accurateness and complexity, differ in calculation's methodology and in the granularity of assets and liabilities contributions to interest rate margin. The approaches can be mainly grouped in two main class:

- (*Single or Multiple) Pooled approach*, which provides the pooling of funds in only one pool or more according to clearly defined criteria;
- *Matched Maturity approach* that requires an "internal market" (ALM desk) that aggregates all the transactions and assigns a transfer price to each one of these.

3.2.1
Single Pool Method

The *Single Pool Method* (SPM) is easy to implement although it can provide misleading information about the true source of a unit's profitability[21]. It is focused on the concept that there is one "pool" of funds where all transactions are uniformly allocated: the providers of funds add to the pool, and the users take from it. This approach assumes that: 1) all assets and liabilities have the same average maturity, 2) liabilities are treated as a single source of funds for all assets, 3) only a single transfer rate is assigned to loans and deposits thus the funding rate and the earning rate are equal. There's no difference in pricing between products that differ for re-pricing dates, maturity characteristics and risk profiles. This methodology implicitly charges profit and loss arising from interest rate risk exposure to the business unit.

The transfer price is calculated through two alternative methodologies: the *Single Pool Average Method* and the *Single Pool Marginal Method*[22]. Regardless of the rate type (average or marginal) used, this technique highlights several critical issues linked to a single rate value that limit its use to commercial and small-medium size (by asset) banks. Primarily it fails to consider the existence of a sloped yield curve, any maturity or embedded risk. Therefore, it makes impossible to create efficient managerial incentives to attract deposits without simultaneously providing disincentives to sell loans. Furthermore, the method doesn't take into account the historical interest rates prevailing at the time of transaction origination. Finally, interest rate risk is not separated from credit risk and thus it cannot be completely transferred giving line-of-business managers incentives to operate in a way that is not optimal from a bank-wide point of view (single-rate FTP system encouraged managers of fund-generating businesses to avoid long maturity deposits, since the spread between such deposits and the pool rate was substantially less or even negative compared to that on short-term deposits).

[21] *It is suitable only for a small bank with a traditional business model and with a stable and undiversified sources of funds used to finance its loans.*

[22] *The single pool average method uses as transfer price, the average rate for funds included in the same pool; the single pool marginal method is based on a pool transfer price, the funding marginal rate, applied to different types of products depending on their maturity.*

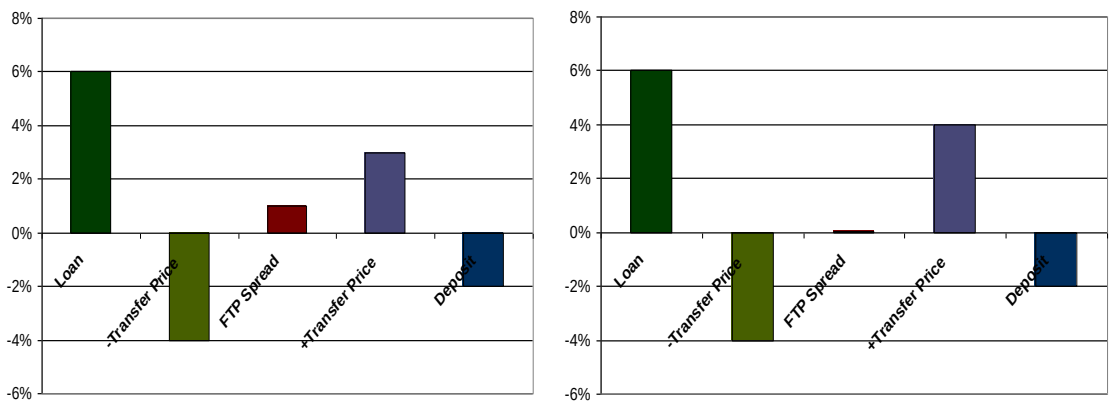
3.2.2
Multiple Pool Method

The *Multiple Pool Method* (MPM) is an extension of "single pool" rate transfer pricing technique. Following this method, the balance sheet is split into pools of assets and liabilities sorted by different criteria (e.g. maturity features, rate and yield, embedded risk or credit factors). The MPM assumes at least two pools: one for users and one for providers[23]. It eliminates the distortions of the SPM because assets and liabilities with similar maturity or repricing characteristics are matched and the resulting mismatches managed (e.g. totally or partially hedged) by a central unit, which is the Treasury unit (that acts as a clearing house) which is responsible for isolating the effects of funding choices. Here below a graphic example (see fig. 2) of the double-pool method.

Under MPM a whole set of rates is needed: one for each pool. These transfer prices can be derived internally calculating average interest rates on assets and liabilities in each pool and subsequent changes in the level of market interest rates will not result in varying contribution value[24], or based on market prices that should reflect market rates on instruments such as interbank loans or interest rate derivatives[25].

Chart 2

FTP approaches: the Single Pool Method and the MultiplePool Method



Source: Kugiel (2009)

[23] *Each pool covers a single part of the maturity spectrum, and their number of span depends on individual bank balance sheet term structure.*

[24] *However, this approach lacks objectivity, and doesn't encourage correct business decisions.*

[25] *The bank must establish a set of transfer rates in the form of a yield curve that most accurately reflects its market cost of funds. Most banks use the LIBOR/Swap curve,since it is built on instruments they most actively trade in.*

The multiple-pool approach is successfully used in many large banks, where there are several providers and users of funds and a dynamic funding portfolio, though it has a lot of disadvantages[26]: profitability of products is influenced by changes in market interest rates; historical interest rates prevailing at the time of the contract are not regarded; the method is not suitable for long term fixed rate transactions; interest rate risk is not separated from credit risk; managerial results are approximated with little accurateness; increased disparity between managerial and accounting interest in the FTP portfolio.

3.2.3
Matched Maturity Marginal Funds Transfer Pricing

The *Matched Maturirty Marginal Funds Transfer Pricing* (MMFTP) is a more precise method than those based on a funding pool concept. The approach (sometimes known as "*coterminus method"*) is basically based on an opportunity principle: funds transfer prices should represent the alternative opportunity rate for the bank's sources or uses of funds and vary according to re-pricing terms or other attributes. It is a gap approach where each balance sheet item (e.g. loan, deposit), except equity, is linked to a marked-based pricing benchmark with the same characteristics (i.e. cash-flow pattern, invested capital, amortization schedule, and so on). The core characteristic of the *MMFTP* is the assignment of individual transfer prices; however all transfer prices are based on rates prevailing at the moment of transaction origination.

The basic idea is that a centralized unit, often the Treasury unit or the ALM department, serves as a conduit for all the institution's funds using current market (average or marginal) funding costs[27]. Under this 'double-way road' system, each business unit is treated like a full matched-book: liabilities-raising units are expected to sell, funds raised, at appropriate transfer price (at or below market rates) to the Treasury, whereas asset deploying units buy the funds required to support their assets (at or above market rates) from the Treasury. The *MMFTP* generates many benefits to the business decision making process not achievable without a true matched-maturity FTP process. This method offers significant advantages such as: 1) the business units are more willing to accept the FTP system when prices are determined in a transparent manner on a rational basis and are consistently applied throughout the organization; 2) accurate measurement of the marginal spread for each product/transaction; 3) separates credit risk and interest rate risk because the spread earned is clearly attributable to different types of risk; 4) identifies correctly the income related to interest rate mismatching; 5) each product spread is independent from all other products and fixed at time of transaction.

In a nutshell, this approach allows a detailed analysis of the business units'

[26] *As underlined by Shih A., Crandon D., Wofford S. (2000.)*

[27] *Each account is matched to a market driven index (e.g. treasury yield curve, swap curve, Euribor or Libor-based curve, etc.).*

contribution to total profits of the subsidiaries, customers, product*s*; however it is costly to implement. Unlike the *Multiple Pool Method,* it requires an internal market that aggregates all the individual transactions and assigns a transfer price to each of them;, moreover it needs robust policies, computation mechanism and detailed transaction databases and sufficient funds to build costly IT systems. Even if the type of system adopt would depend on the human capital and technological resources available, as well as the desired objectives to be achieved through transfer pricing, the matched maturity has become the preferred approach to FTP because transfer prices are more transparent rational methods to evaluate business units.

3.3
FTP rate-setting process: base funding curves and adjustments

Determining the FTP rates is necessary to select the appropriate base FTP rates across the yield curve to represent market available rates. In turn, selecting an internal pricing yield curve is a critical aspect since it determines how to measure the different contributions of business units to net interest rate margin: if an institution sets the benchmark cost of funding lower, it will increase the measured profitability of loans and descrease the profit contribution of deposits. Derived from market rates[28], the yield curve represents the opportunity cost of funds[29] for products with similar financial characteristics. It is usually set daily to incorporate changing market conditions and to preclude business units from obtaining cheaper funds than actual market conditions[30].

- To estimate the actual cost of funding, banks adjust the base curve to derive the adjusted FTP rate curve: to this aim, additional spreads are added to the reference rates using the actual spreads for unsecured funding at different maturities. They reflect both institution-specific credit risks and market access premiums and are generally derived from estimated new issuance spreads for the institution (see fig. 3).

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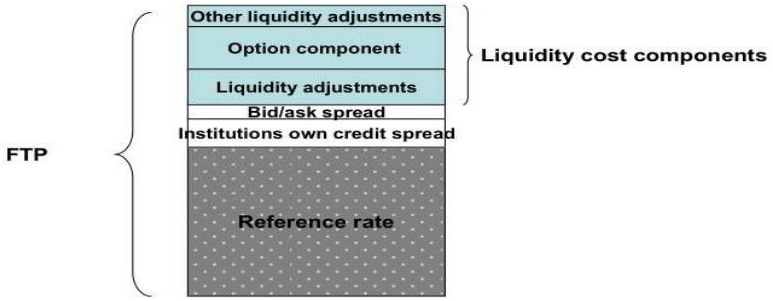
[28] *Generally, the benchmark is fixed by the market: many institutions use swap curve, which is constructed from a combination of Euribor/Libor rates for floating rate and short-term transactions (up to one year), and the swap curve for fixed rate and medium or long-term transactions (more than one year).*

[29] *In general terms, how much the institution would pay for the required funding or how much the institution would receive from its funding.*

[30] *There is a trade-off between the business requirements (which need stability of conditions) and financial requirements (which requires frequent transfer price updates).*

Chart 3

Base curve and adjustment



Source: CEBS (2010)

The common adjustments are related to:

- *credit risk and residual spread*[31] reflects the fact that the bank cannot get funding at the pure market rates. This spread depends on the creditworthiness of a bank and on general market conditions and it's usually measured through the bank's CDS spread;
- *funding liquidity spread or premium* that reflects costs/benefits of managing liquidity in the market. It is usually made to provide explicit revenue/credit to the bank's treasury department for "brokering" funds to providers and users;
- *liquidity adjustments* are introduced for instruments that may have liquidity premium than swap rates. The premium may be estimated by observing rate differentials between the organization's wholesale funding curve and the swap curve (or a risk free rate). All these items, referred as "liquidity cost components", include a full remuneration of the optionality risk[32] embedded in some bank's products as well as country risk.

In this perspective the cost of unsecured funds i^{FTP} applied to a fixed rate transaction is:

$$i^{FTP} = i^{IRS} + s^{CDS_i} + \varepsilon$$

where i^{IRS} represents the interbank or swap rate quoted on the market, s^{CDS_i} is the CDS spread for bank *i* quoted on the secondary market and ε indicates other adjustments to take into

[31] *Other adjustments can also be made, although they are not common in practice, to reflect country risk premium due to inconvertibility, nationalization, political violence risks, specific retail network fees for raising certain deposits, different tax treatments (country risk premium and tax adjustment). OECD fiscal principles on Transfer Pricing require that cross border transactions must be priced according to "arm's length principle".*

[32] *These adjustments should reflect the "cost" of providing the customer an option or "right" to pay off a loan or redeem a deposit at no charge before the contractual maturity date. As shown by La Ganga, Vento (2008), any banks typically apply option pricing theory or replicating portfolio (option spread/premium) to reflect it.*

account other types of risks (e.g. *country risk*, *optionality risk*, and so on)[33]. The final step for measuring the profitability of each bank's funding/investing sources is represented by the selection of the point along the adjusted FTP curve that best reflects the price of the instrument transferred and than the computation of the difference between the rate of funding/investing and the FTP ones.

4.
INCORPORATING LIQUIDITY RISK WITHIN THE FTP METHOD

The recent crisis has demonstrated that the liquidity risk create by financial products, services and capital markets activities have not been adequately assessed by banks[34].

4.1
A new challenge: how to price different dimensions of liquidity risk

From a liquidity pricing perspective, liquidity risks are usually distinguished into three main cost types: 1) maturity mismatch or funding liquidity costs, 2) market liquidity costs and 3) contingent liquidity costs.

4.1.1
Maturity mismatch or funding liquidity cost

Maturity mismatch or funding liquidity costs appear in case a bank has funding shortage or needs to renew it at worst economic conditions than current market ones. Among different

[33] *However, there is no single agreed methodology for calculating internal prices. All systems include some direct funding cost. The approaches range from taking a risk free curve and adding relevant credit default swap spreads, to an approach that deconstructs the funding cost into a risk free rate, a liquidity premium specific to the maturity and a liquidity premium specific to the institution. The majority also try to incorporate some indirect costs. For instance, one institution require each division to generate its own stress test to determine their funding requirements in contingency mode including possible use of undrawn commitments.*

[34] *They are commonly view by risk managers, supervisors and industry experts as critical exposures embedded in banks' provision of maturity transformation services to their customers.*

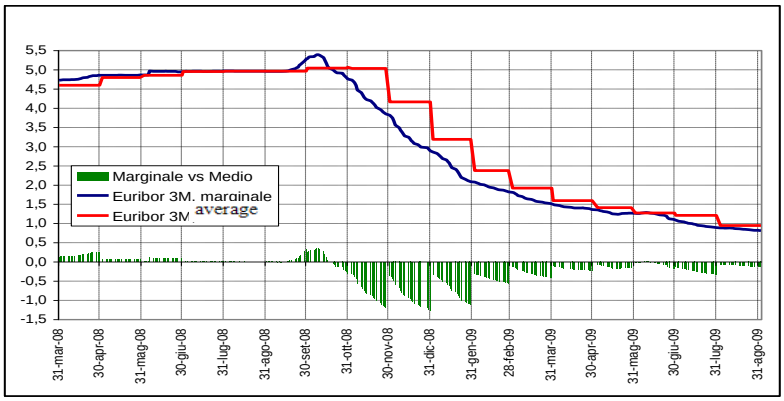
techniques adopted to reflect this kind of liquidity risk in their FTP frameworks[35], many groups have opted for using the marginal cost of funding applied to the various types of products depending on their expiration or on "cash-flow matched-funds basis" in order to represent, more correctly, from an economic point of view, costs and benefits implied in different funding sources. As an example, if we consider a mortgage with three years duration, variable rate and quarterly interest payment frequency the FTP would have to be equivalent to the sum of the quarterly base rate costs (e.g. Euribor rate), indicative of the re-pricing risk implied in the interest rate term structure movements, the spread between interbank financing rates between 3 years and 3 months, as additional financial remuneration for maturity mismatch liquidity risk and, finally, a liquidity premium linked to idiosyncratic factors that allows to make the financing cost equal to the difference between the three years inter-bank financing rate and the three years (effective or estimated) market rate paid by a financial institution.

According to such approach, the internal transfer rate utilized upon origination of a product or a transaction should be the one derived from the FTP curve corresponding to the maturity of the transaction or, in the case of amortizing assets or non-maturity products, blended marginal rates consistent with their estimated effective cash flow profiles. This approach is considered to be the best practice. It reflects the effective market conditions (extremely volatile after the Lehman's collapse) better than alternative technical methods focused on the use of a single interest rate, calculated as an average (simple or moving) of two or more than two different rates (i.e. single rate blended curve)[36].

Using average funding costs, on the one hand, allow to reflect historical rates in the FTP processes and to provide a relatively simple methodology but, on the other hand, do not appropriately reflect the actual market costs of funds and market risk perceptions especially when internal price updating is sporadic (see fig. 4). Carrying forward such misallocations the ongoing profitability assessments of the business resulted for some banks in the inability to identify, on a risk-adjusted basis, poorly performing assets.

Chart 4

Lag between marginal rates and average rates



35 See. par. 4.

36 The blended term or pool transfer rate is a weighted transfer price with the cash-flows associated with the existing (or new) business.

Source: own elaboration on Bloomberg data

4.1.2
Market liquidity cost

Market liquidity costs are generated from the difficulties to promptly sell an asset, also after the application of an haircut, to its fair value without an unfavorable and remarkable price impact, because of insufficient depth of the market where such asset is traded.

At this stage the measurement of the above mentioned costs, carried out by the vast majority of SIFIs, is based on the `cost of carry' implicit in the maintenance of the securities included in the liquidity buffer. This spread, expressed as a liquidity premium, is charged or granted to the business units or to assets and liabilities. For example, the securities included in the liquidity buffer are priced taking into consideration their underlying liquidity (sometimes expressed in terms of bid-ask spread).

There is a wide range of techniques that liquidity risk managers are investigating to better price market liquidity risks caming from business lines or trading desks. As regard SIFIs, they began to reflect more adequately this cost in their FTP systems on a group wide basis given these three elements:

- the application of greater haircuts to marketable assets (e.g. stressed haircut) than those commonly defined by market operators;
- the use of prolonged holding/liquidation periods hypothesis for some specific asset classes;
- the FTP's policy review to discipline the allocation of specific marginal internal transfer rates to the part of assets not guaranteed or to the entire portfolio in coherence with their liquidity degree.

4.1.3
Contingent liquidity cost

Those types of costs are connected to the unexpected cash flows that could arise due to contingent events (as an example an increase in the withdrawal rate by depositors due to reputational problems regarding a banking group). As regards banks more oriented towards an OTD model, the off-balance sheet exposures to SIV and the opportunity cost for holding a liquidity buffer, were not correctly reflected in FTP mechanisms before the financial crisis.

Broadly speaking for products with an indeterminate maturity, such as retail sight deposits, better practice involves to assign a "liquidity charge", based on the behavioral maturity of the portfolio, rather than the residual maturity of individual loans. Some of the SIFIs apply behavioral modelling techniques and stress tests to assess the repayment characteristics of cash flows stemming from these types of products[37].

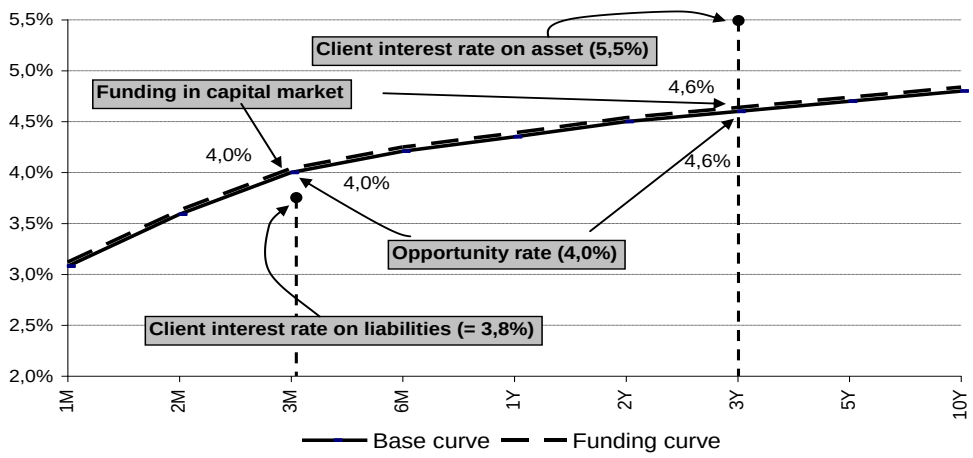
4.2
Practical application of matched-funds method

As we stressed in the paragraphs before, the funds transfer price is an interest rate representing the value of funds to the bank. In the past, banks came to view funding as essentially free, and funding liquidity risk as basically zero[38]: the internal transfer rates were *de facto* coincident with the swap rates (considered a risk free rate) so the price of liquidity was judged close to zero (see chart. 5).

Chart 5

"Zero" cost of funds approach

Sales asset result		Maturity transformation		Funding result	
interest income	+5.5%	opport. rate asset (3Y)	+4.6%	interest rate expense	-3.8%
opportunity rate (3Y)	-4.6%	opport. rate liabil. (3M)	-4,0%	opportunity rate (3M)	+4.0%
Contribution asset margin	**+0.9%**	**Maturity transformation return**	**+0.6%**	**Contribution margin liability**	**+0.2%**



[37] *However, in a few banks, behavioral models applied to determine their stickiness are not coherent with a internal transfer pricing environment. They are not useful from an internal transfer pricing purpose since they assume that the current account of non-maturing assets or liabilities is not influenced by interest rate applied to customers.*

[38] *As a result, no charge were attributed to some assets for the cost of using funding liquidity, and conversely no credit attributed to some liabilities for the benefit of providing funding liquidity.*

Source: Kleffman (2008)

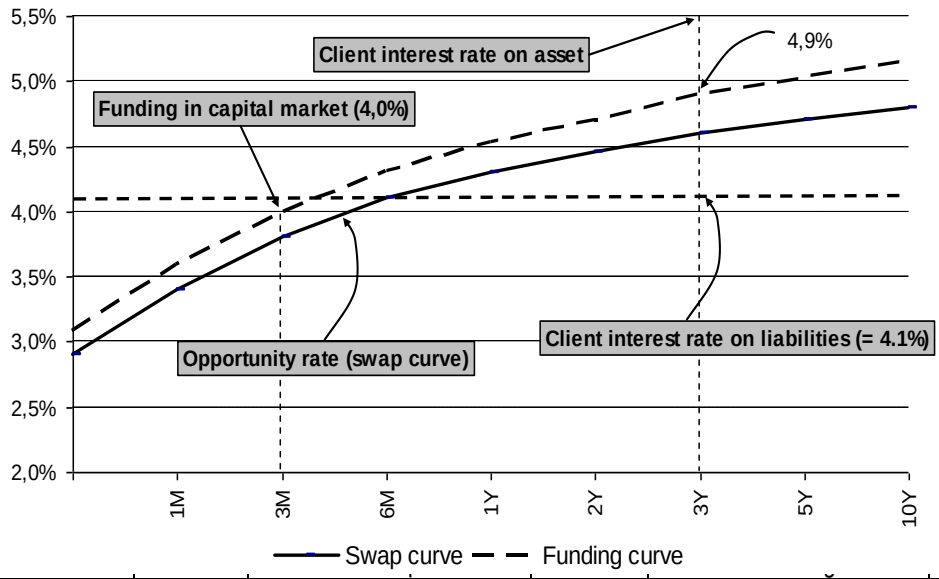
This relationship of equivalence determined an underestimation of other risks, because the return coming from the maturity transformation performed by banks does not decompose interest and liquidity effects since just only one risk free curve in the FTP mechanism was used. Without a transfer pricing system, net funds users would receive credit for interest income without being charged for the full amount of the associated interest expenses, while net funds providers would be charged with interest expense without being credited for the full amount of associated interest income. To illustrate this point, let us start with an example using traditional transfer pricing, and then show how *maturity-matched-funds-transfer pricing* (MMFTP) can be introduced to bring transparency to the risk and profitability analysis. Assume that a commercial bank raise funds in the form of 3-months deposit at the cost of 3,8%, and than invest in a 3-year fixed rate loans yielding 5,5%.

Some banks were aware of the need to charge users and credit providers of liquidity and employed a pooled approach for liquidity transfer pricing. In the graph below (see fig. 6), the comsumption and the supply of liquidity is charged or discharged by accounting funding costs. Net interest margin generated by lending and funding units is allocated by assigning transfer rates, not derived from an opportunity or benchmark curve (e.g. swap curve) or looking at the funding curve in the capital market. The rates we take into account are the client interest rate on asset and liabilities (respectively 5,5% and 4,1%).

Using just one risk free curve in the MMFTP, performed for assets and liabilities at the time of their origination, is not possible to attribute profitability separately and appropriately to loans and deposits, because it's not possible to decompose interest and liquidity effects.

Chart 6

FTP accounting funding costs



interest inc					me +0,6%
opportunity rate	-4.6%	opport. rate (3Y)	-4.6%	Contribution margin liabil.	+0,8%
Liquidity spread	-0,3%	Liquidity spread	+0,3%		

Contribution asset margin	**+0,6%**	**Contribution liabilities margin**	**+0,8%**	**Net interest income**	**+1,4%**

Source: Kleffman (2008)

From this point of view, the inaccurate appraisal of the liquidity costs cause relevant distortions in the measurement of risk-adjusted performance. These circumstances lead to misallocations of liquidity to products, business lines and customers because of opportunistic behaviours from the divisions (at the expense of the entire group) that often took advantage of arbitrage opportunities due to the gap between funding or investment opportunities offered in the market and the internal transfer pricing conditions set on a group-wide basis[39].

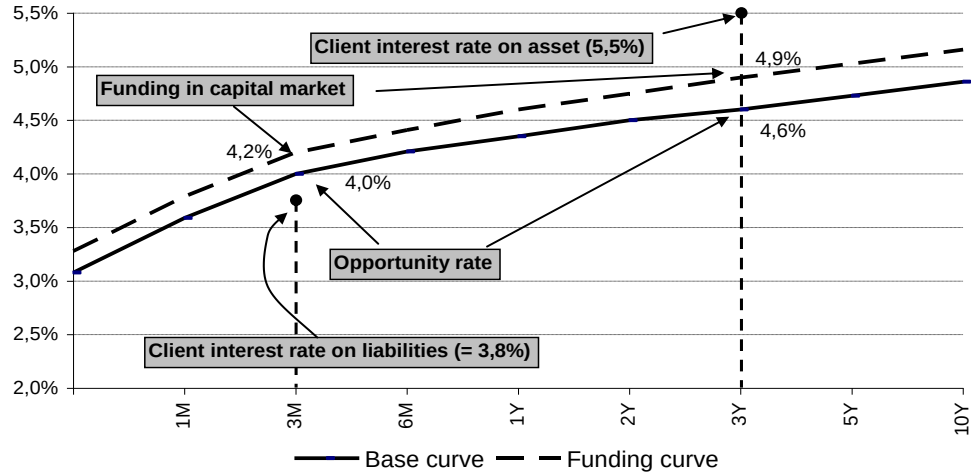
A matched-maturity marginal cost of funds approach to liquidity transfer pricing is the current best practice for calculating the actual market cost of funding. The dummy loans and deposits are entered in the accounting system as if they were real trades with an external counterparty. The spread above the reference rate is the rate that values the internal swap transaction at par. This approach computes the portion of the cost that is attributable to liquidity. The spread, derived from the difference between the swap curve and the funding cost in capital markets is usually referred as a term liquidity premium. The resulting situation is that the lending unit has a real 3 year asset and a shadow matching liability; the lending unit has a real 3 months liability and a shadow asset of the same maturity. In the same way the treasury unit has a shadow asset and liability which have the same interest rate features of the loan and deposit, but without credit risk. By matching the real assets and liabilities with shadow liabilities and assets of the same maturity, the business units (deposit customer unit and loan customer unit) are hedged, and changes in interest rates will only affect the profitability of treasury unit or ALM desk. Every business unit within the bank with this FTP system will be accountable for only the revenues generated and risks managed under its direct responsibility.

Chart 7

Extended FTP including liquidity costs

[39] *The spread between the loans and deposits should cover, by the way, the interest rate risk due to the mismatch between the 12-months funding and 3-year lending and the related liquidity costs (in addition to other types of costs: administrative costs, the credit loss on the loan, etc.). If rates rise from 3,8% to 4%, the bank will find itself with a net interest rate margin reduced to only 60 basis points (instead of 80 basis points), which would not be sufficient to cover expenses.*

Sales asset result	Maturity transformation	Funding result



interest income	+5,5%	**Interest rate risk premium**		**Term liquidity premium**		interest rate expense	-3,8%
Opportunity rate (3Y)	-4,6%	opport. rate asset (3Y)	+4,6%	**liquidity spread (3M)**	**-0,2%**	**liquidity spread (3M)**	**+0,2%**
liquidity spread (3Y)	**-0,3%**	opport. rate liabil. (3M)	-4,0%	**liquidity spread (3Y)**	**+0,3%**	opport. rate liabil. (3M)	+4,0%
Contribution asset margin	**+0,6%**	**Interest maturity transform.**	**+0,6%**	**Liquidity maturity transform.**	**+0,1%**	**Contribution margin liability**	**+0,4%**

Source: Kleffman (2008)

Taking into account liquidity costs lead to an alternative assessment of the contribution of the different business units to interst rate margin. Consider funding with 3-months deposits at 3,8% and lending for 3 months in the interbank market at the current available rate, e.g. 4,2% (4,0% opportunity rate Euribor + 0,2% liquidity spread for 3 months). Therefore the contribution of the funding unit is 0,4%. Then to fund the loans at 5,5%, borrow money for 3 years in the capital markets set at the current available 3-years rate, e.g. 4.9%, that is the rate it would cost the treasury unit or ALM desk (that act as a clearing house) to borrow the money in the interbank market for 3 years at a fixed rate (4,6% opportunity rate IRS + 0,3% liq. spread for 3 years). Thus the contribution of the lending unit is 0,6%. The Treasury is responsible for managing interest rate and liquidity transformation from 3 months to 3 years equal respectively to 0,6 and 0,1%. This is illustrated in fig. 7.

5. EMPIRICAL EVIDENCE FROM A TWOFOLD PERSPECTIVE: THE ITALIAN CASE

We perform an empirical analysis (from July 2007 to August 2011) for the top 3 Italian banks, in order to evidence the increasing importance of liquidity risk in a FTP framework[40]. The evolution of the different FTP components, from a macro-perspective, shows how they can be used to interpret the various phases of the financial crisis; while, from a micro-perspective, the differences in the results coming from various FTP decompositions calls for a tight coherence between FTP system and the business model to generate solid and consistent profits and not only "accounting" ones, that could turn into losses in the long run.

5.1
Responsiveness of FTP during the crisis from a macro-perspective

To evaluate the underlying trend of different FTP components such as risk free rate, liquidity premium and credit premium - which include also a component due to liquidity issues of the OTC market - we applying the following decomposition formula that express the yield spread (*z-credit)* on a senior unsecured bond as:

$$s^{CDS_i} = y - i^{REPO} + \varepsilon_{IL} \qquad \textit{with: } \varepsilon_{IL} \text{ è una componente residuale}$$

$$s^{CDS_i} = z_credit + i^{Euribor} - i^{REPO} + \varepsilon_{IL} \qquad \textit{with: } swap \Rightarrow y = z_credit + i^{Euribor}$$

$$s^{CDS_i} = z_credit + (i^{Euribor} - i^{OIS}) - Si^{UNSEC-SEC} + \varepsilon_{IL} \qquad \textit{with: } i^{REPO} = i^{OIS} + Si^{UNSEC-SEC}$$

where: s^{CDS_i} represents the 5 years CDS of banks included in the sample; *y* is equal to the yield to maturity (5 years) of the bonds issued by banks included in the sample; $i^{REPO} = i^{OIS} + Si^{UNSEC-SEC}$ is the rate for repo transactions; $(i^{Euribor} - i^{OIS})$ represents the difference between Euribor rate and OIS rate; (*z-credit*) is the spreaqd over Euribors of *y*; ε_{IL} is a residual component related either to the liquidity of the OTC Italian bond market and to the systemic risk embedded in the CDS quotes.

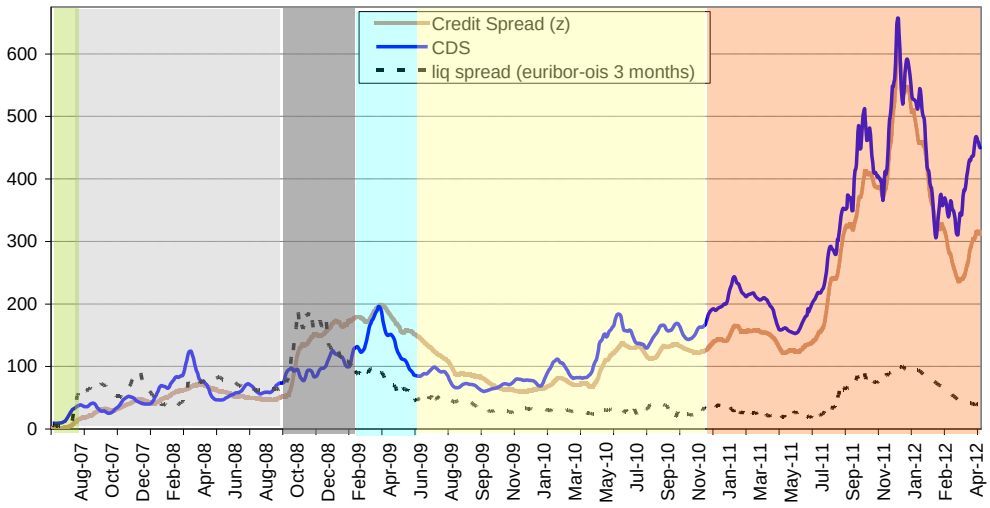
[40] *The bond sample is formed of senior unsecured bonds with an average maturity of 5 years with fixed or floating rates, a bullet redemption, without embedded optionality. The yields to maturity are from Bloomberg and refer to secondary market quotes (OTC), instead spreads are calculated as 10 days averages of daily end-of-day data.*

Broadly speaking, empirical evidence clearly shows how[41]:

- before the crisis, the spreads on credit risk (CDS) and on liquidity risks (Euribor-OIS) were few basis points, respectively 10 and 5 b.p. Thus setting the FTP benchmark curve with the swap curve without any adjustment was a good proxy for not sophisticated banks; instead, for SIFIs, if included it would have reduced to some extent the profitability of some structured credit deals;
- the crisis can be divided into two sub-periods. During the first part we experienced the development of liquidity risk since not collateralized lending *de facto* disappeared, with Euribor-OIS spread widened dramatically and Italian banks not deeply involved in the sub-prime market (grey area chart 8); in the second part, we saw credit risk taking the main part expecially after the Greek crisis and in particular during the second half of 2011 when Italian and Spanish financial systems with Italian banking sector deeply involved (orange area chart 8) with spreads above 600 p.b. The two LTRO contribute to reduce liquidity strains and spread halved in the first two months of 2012, but the recent re-emergence of the Grrek crisis caused a sharp increase in the CDS more than in the credit spread;
- between those two main periods Italian banks pass through a short lived East Europe crisis (sky-blue area fig. 8) and a period of marked recovery following the bottoming out of finacial markets (yellow area fig. 8);

Chart 8

Evolution of interbank, CDS and bond spreads for the 3 largest Italian banks



[41] *See Annex 1 for a more comprehensive analysis.*

Source: own elaboration on Bloomberg data

A more in-depth analysis can be carried out considering the difference between credit spread on bond and the related CDS, called "*basis*"[42]. The analysis we performed includes CDS spreads (s^{CDS_i}) as well as the costs related to a cash-derivative relation[43]:

$$s^{CDS_i} + cc = y - i^{REPO} + \varepsilon_L$$

$$s^{CDS_i} = z_credit + i^{Euribor} - i^{REPO} + cc + \varepsilon_L$$

$$s^{CDS_i} = z_credit + Se^{UNSEC-SEC} + (i^{Euribor} - i^{BUND}) + \varepsilon_L$$

If there is a difference between the expressions of the equation there is a Net Basis so that:

Net Basis = CDS - carry collateral + repo unsec-sec - z-credit

where all the elements are the same as mentioned before, and *carry collateral* represents the cost for securing the structure and we proxy the component of *carry collateral* with the difference between swap and Bund rates.

As a matter of fact this component capture the differential related to counterparty credit risk in the CDS market, when the correlation between market participants increases and collateral needs rise.

In the first part of the crisis, the evolution of the net basis was negative and related to the liquidity/systemic issues, this trend improved with Lehman's bankruptcy (blue area in fig. 9).

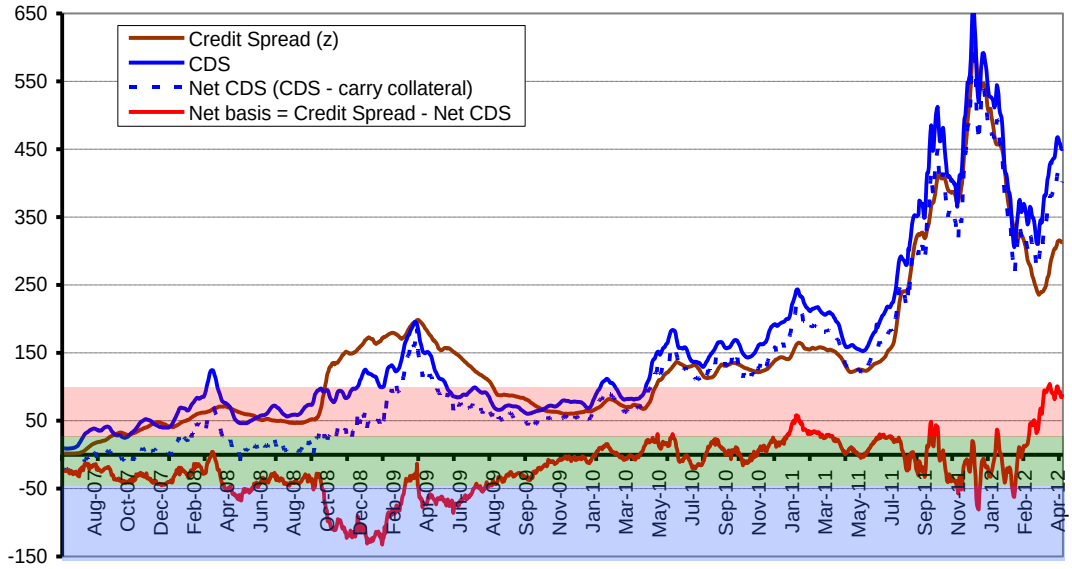
The improvement of liquidity conditions during the first half of 2009 let the basis converge toward zero. The financial markets found a new equilibrium in a environment where many spreads where no more close to zero as before the beginning of the crisis, evidencing higher risk aversion and premium. The sovereign debt crisis led to a shift towards credit risk issues but remained within a range of 30 b.p. above or below the zero (green area in fig.9) with a mean reverting trend that evidence how market forces corrected the excessive differences between cash and derivative markets.

[42] *Fluctuations in the basis give rise to arbitrage trading opportunities between the two forms of the securetiest.*

[43] *The cash-derivative relation refers to the arbitrage strategy between the bond and the CDS associated to the same issue/reference entity. The strategy consists for the cash side in "naked" selling (buying) of the bond, that needs a repo (reverse repo) contract for settlement, and for the derivative side consists in selling (buying) a CDS, that needs some sort of collateralization in order to reduce counterparty credit risk.*

Chart 9

Net basis analysis



Source: own elaboration on Bloomberg data

The spike experienced by the basis during the first month of 2011 is related to the developments of the Irish crisis and the possibility of a bail-in of senior bank bonds that caused a contagion effects in other European countries (red area in FIG. 9). During the first quarter of 2011 the net basis pull back towards zero because the new capital inection in most Italian banks. The excalation of the sovereign crisis which stated in the second quarter of the 2011 caused the net basis to go negative with credit spread and CDS above 600 b.p. reflecting an increase in the systemic and liquidity risks. The two LTRO of the ECB allow the reduction of those risks (the spreads halved in the first two months of 2012) and the net basis return to zero. The new strains for the sovereign crisis lead to a largely positive basis evidencing both a overtshooting in the CDS market and illiquidity in the bond market. The described evolution confirm that to assess correctly the credit risk of a bond we must analyze both cash and derivative markets as well as to consider the issues related to CDS collateral and to the secondary market liquidity for bonds to detect growing source of tensions and where they are located (liquidity risk, systemic risk, idiosyncratic credit risk).

5.2
P&L attribution from a micro-perspective

Empirical evidence put into light another element worth of attention from a micro-perspective: the different conclusions, and therefore risks/rewards attribution, coming from different decomposition methods of an FTP rate. The first method we apply refers to a simple decomposition of the FTP rate which takes into account:

1. *Risk free rate* = EONIA 5 years
2. *Liq premium* = swap 5 years – EONIA 5 years
3. *Credit risk premium* = CDS 5 years

The evolution of the different components is shown in Chart 10 A.

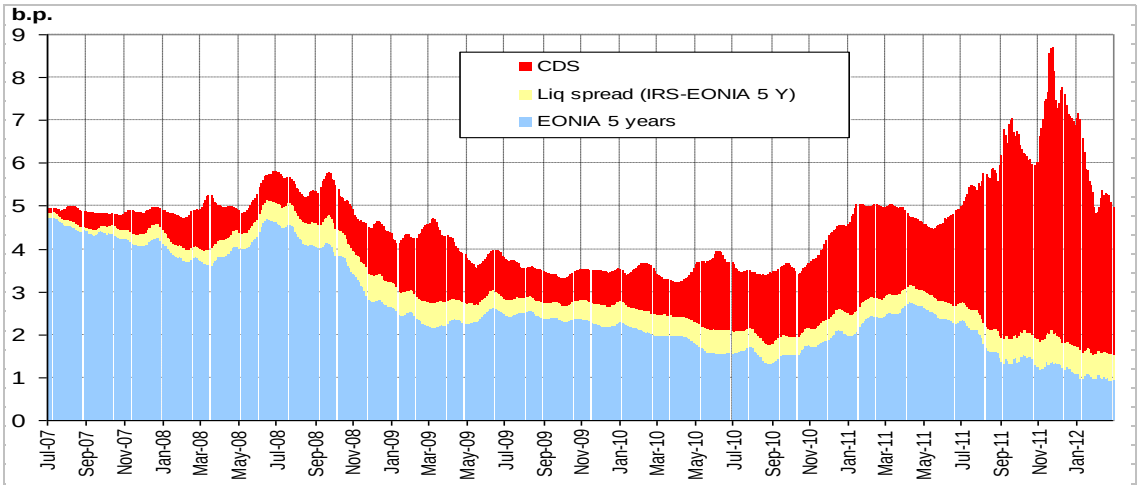
The second technique refers to and extended decomposition of the FTP rate[44] considers:

1. *Risk free rate* = EONIA 6 months
2. *Short term liq premium* = (*Euribor – OIS 3 months)*[45]
3. *Maturity transformation liquidity premium* = (*Euribor – OIS (12 – 3 months))*
4. *Maturity transformation interest rates = IRS 5 years - EONIA 6 months*
5. *Credit risk premium* = average 5 years top-3 Italian banks CDS

The evolution of the different components is shown in Chart 10 B.

Chart 10.A

Evolution of transfer prices with a simplified approach for top-3 Italian banks

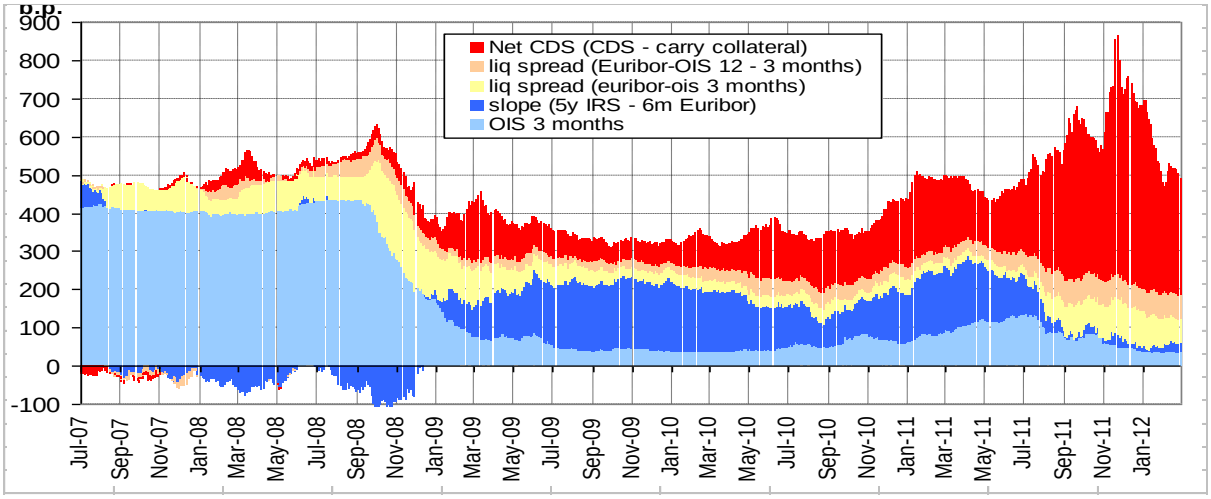


[44] *See par. 5.*

[45] *We consider the difference between 12 and 3 months Euribor-OIS to highlight the liquidity transformation component.*

Chart 10.B

Evolution of transfer prices with an extended approach for top-3 Italian banks



CDS, premia and rates refer to 5 years maturity and are expressed as 10 days averages

Source: own elaboration on Bloomberg data

The discrepancy in the two methods is mainly referred to two components:

1. the decomposition of the risk free rate: short term rate and slope of the curve in the second FTP rate instead of a unique long term rate as in the first FTP rate;

2. the analysis of the liquidity premium through a decomposition of a short term liquidity premium and an assessment of a spread for long term liquidity premium in the second FTP rate instead of a measure of long term liquidity premium as in the first FTP rate.

The differences, as shown in Charts 10 A and 10 B, are evident in the attribution of liquidity risk premia during Lehman crisis, which brought a spike in the first FTP rate near 8%, due to a liquidity premium above 2%, while, in the simplified method, the rate remained below 6%, since liquidity premium where only 0,5%. Moreover the second methodology highlights how a wide part of the long term risk free rate can be referred to the slope of the curve. This kind of risk should be managed by the treasury department through swaps.

Thus the simplified FTP approach is more appropriate for banks with business models where maturity transformation is limited, so that funding and assets maturities are matched. The extended method of FTP is more suited for banks with sophisticated business models that widely exploit “maturity transformation” and are able to attribute and manage all the risks coming from their activity. This straightforward example underlines the extreme value to align the FTP process to the business model since sophisticated banks need to adopt a sophisticated approach to correctly identify where the risks and rewards implied in the business process are. Only doing so, every unit that bears a risk can also manages it; otherwise the same unit and the bank as a whole can incur in the misalignment of incentives which were one of the roots of the current financial crisis as described in par 2.

5.2.1

Signals through the crisis of an hypothetical FTP mechanism

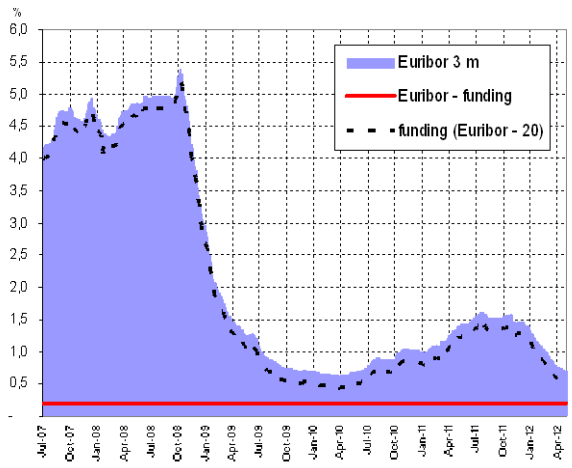
From June '07 to August '11, we assess through a FTP mechanism the value's creation[46] at current market conditions in an hypothetical bank. The business model of the bank consists in borrowing money for three months at Euribor minus 20 b.p., lending for five years at a fixed rate of IRS plus 100 b.p. and hedging interest rate risk with swaps.

The FTP provides a picture of the different contribution of the lending unit, the funding unit and the treasury department to the interest rate margin earned by the bank as a whole. The results of the value generation assessment change in relation to the sophistication of the approach used. For instance a simplified framework, which sets internal transfer rates equal to swap rates, not dealing with credit and liquidity risks, assesses the funding unit generated constantly an interest margin of 20 b.p. for all the period (Cfr. Chart 11 panel A), while the lending unit generates constantly 100 b.p. of margin (Cfr. Chart 12 panel A). On the other hand, if we are dealing with a FTP system which takes into account liquidity and credit risks, we will see that the contribution of the funding unit grows constantly from March 2009[47] (Cfr. Chart 11 panel B brown line) while the lending unit generates negative contribution at an increasing pace (Cfr. Chart 12 panel B brown line).

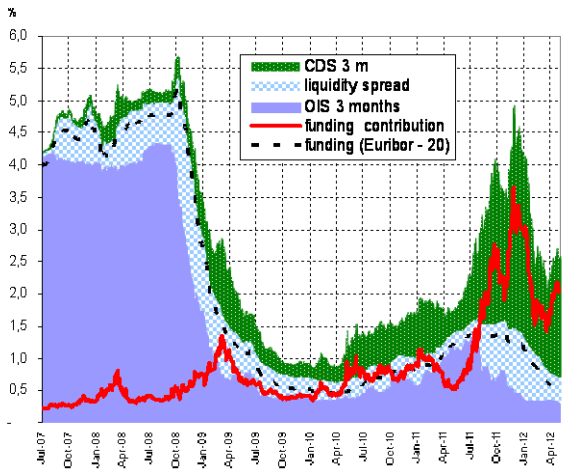
Chart 11.

Decomposition of FTP rates and margins for Funding Unit (3 months tenor)

Panel A: simplified FTP



Panel B: sophisticated FTP

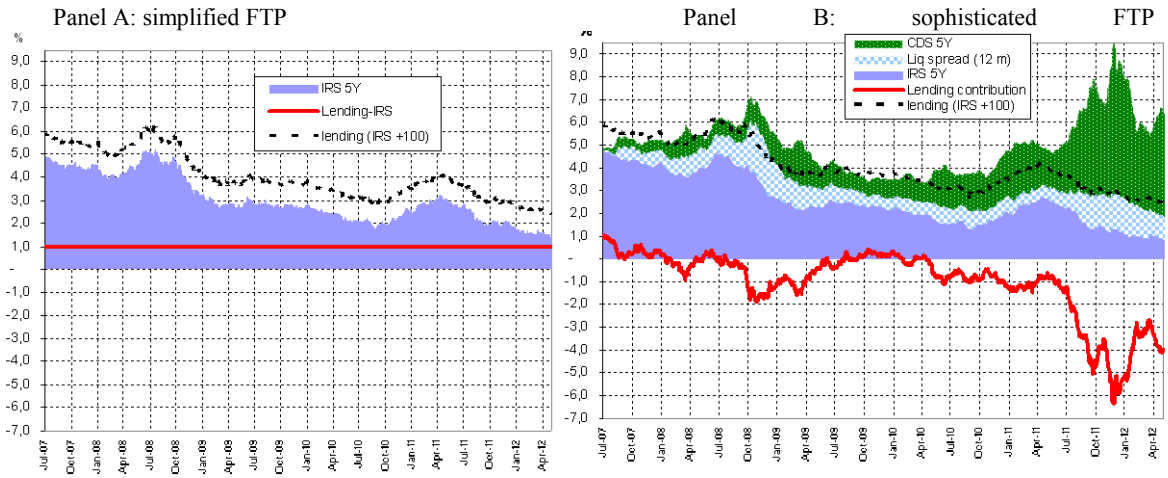


[46] *We refer to "value creation" in a broad sense since, in this case, we do not consider the remuneration of equity.*

[47] *After Lehman's default the basis was negative (CDS was lower than bond spread) and the choice to use CDS as a proxy for credit risk can lead to negative contribution of funding in that period. If we consider theeffect of the basis in the CDS (which is equal to consider z-spread), funding contribution get more stable and always positive. This example is a waring for using CDS instead of bond spread (z-spread) or if we use CDS at list it is essential to analize and take into account basis risk .*

Chart 12.

Decomposition of FTP rates and margins for Lending Unit *(5 years tenor)*



Analyzing jointly the contributions of all the units involved (lending, funding and treasury) to the net interest rate margin, it is possible to obtain a very different assessment of the value generation of each business units, giving "some colour" to the evolution of units' contributions. The sophisticated FTP framework during the period before the crisis gives broadly the same results of the simplified one, because liquidity and credit were few basis points each (between 5 and 10 b.p.).

The second FTP system during the first part of the crisis (August 2007- August 2008), as the crisis was starting to spread, highlighted the growing importance of the liquidity component in the value generation, while lending reduced its contribution to zero. On the other hand the first one would have given a stable assessment of the contribution of the two units as shown in Chart 13 by the dotted black line.

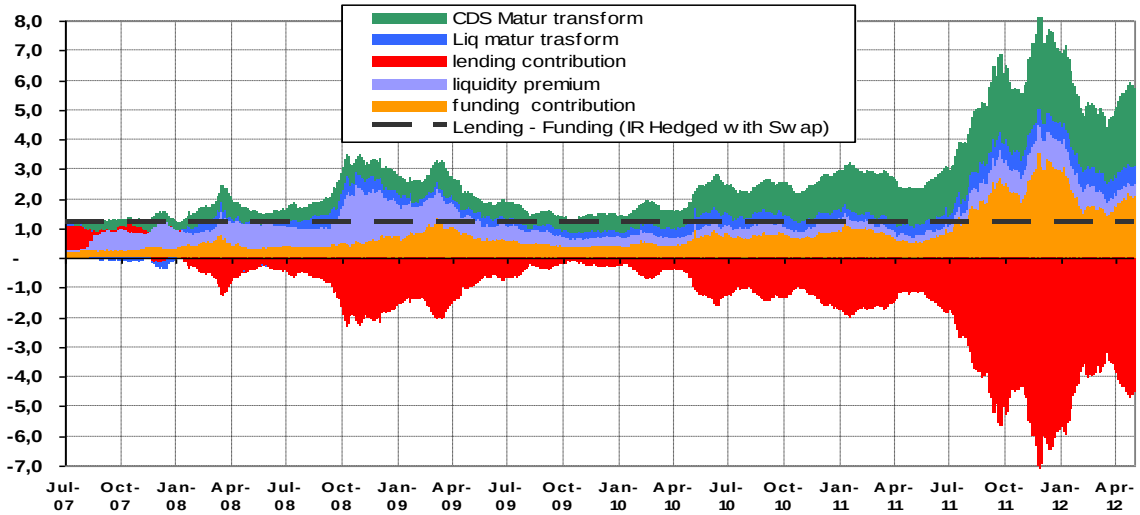
Thus in the aftermath of the crisis the second approach, as a management tool, highlighted that the conditions underling the business model were seriously challenged and therefore it needed a reshaping with a matching between funding and lending maturities, and an increase in lending spread in order to generate value from lending activity. Afterwards, the widespread of the crisis with the default of Lehman highlighted the increasing interaction of the credit risk component with the two maturity transformation components of interest and liquidity.

During the time horizon we observed, the business model generated a spread of 120 b.p. for the bank as a whole, but what changed radically were the different contributions to interest rate margin: lending unit destroyed value at an increasing pace, receiving subsidies from funding and treasury units (the latter through the maturity transformation of liquidity and credit). The indications given by the FTP is that the business model still generates margin at the cost of bearing more risks, in particular liquidity and credit risks, This trend accelerated during the recent peak of the sovereign crisis, showing that in order to ensure the value's creation and the correction of the distorsion highlighted the bank needs to: 1) increase substantially lending spread in line with current funding conditions; 2) get a more stable source of long term funding at a cheaper rate, since the risks coming from maturity mismatch increased and moreover the cost of senior unsecured bonds provide a funding no more coherent with the applied lending

spread. A possible solution could be represented by secured funding, that has a lower funding spread due to the collateral provided. On the other hand, the business can be run as is, but at the cost of liquidity and credit risks which could lead to a sudden default in case they materialize or increase further[48].

Chart 13.

Splitting of margins for Lending and Funding units with IR hedged

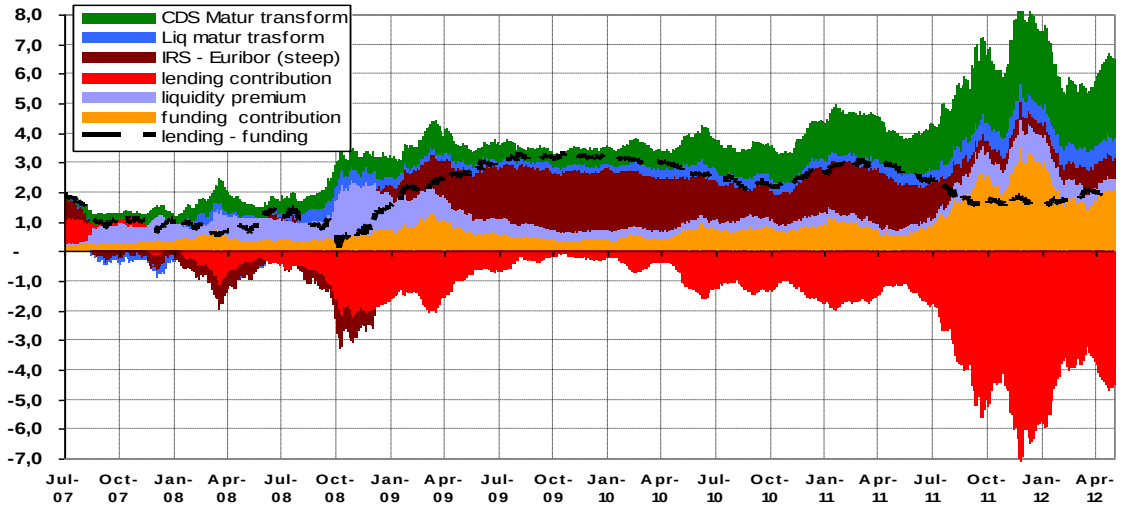


A further contribution to the analysis can come from considering the role of interest rate in the value generation of the former business model. If we do not hedge interest rate risk through swaps we can assess the contribution of interest rate risk to interest rate margin, which is represented in our example by the steepness of the risk free curve between the short term (3 month) and the medium term (5 years). The main difference with the former example regards the new contributor to interest rate margin (as evidenced in Chart 14 by the brown area) represented, as stated above, by the steepness of the yield curve which leads to a variation of interest rate margin along all the period: in this new framework interest rate margin varies from 0 to 300 b.p., unlike formerly when it was stable at 120 bp.

[48] *An example of the liquidity risk is the strain suffered by Dexia banking group which after experiencing a substantial increase in funding spreads do not find no more funding to continue running his business.*

Chart 14.

Splitting of margins for Lending and Funding units without IR hedging



Before the crisis, the steepness of the curve added a further 50 bp. to interest rate margin which reached 200 bp., but the following flattening of the curve contributed to reduce the margin near zero. After the default of Lehman, the sharp decline of short term interest rates represented a big contributor to interest rate margin, which ranged between 200 and 300 (more than the constant 120 bp.). The worsening of the sovereign crisis caused a flattening of the curve which reduced the contribution of risk free rates to interest rates margin. What is worth noting is the role of the strategy called "playing the curve[49]" over the crisis, which, during some periods, gave a boost to profitability but in exchange for very large volatility of interest rate margin: it is up to the management to decide whether to play or not that "game" in relation to its risk appetite consistent with the indications of shareholders.

6. CONCLUDING REMARKS

There are many factors that led to the build up of the recent crisis. At the top of the list is excess liquidity arising from the poor evaluation of the exposure to liquidity risk as well as to its pricing. Developing an effective and robust liquidity pricing scheme is a new challenge for bank liquidity risk management in the light of both of the current regulatory

[49] *This expression refers to the strategy of funding at the short end while investing at the long end of the interest rate curve.*

framework and of market environment which require banks to effectively upgrade their cost/benefit allocation mechanisms starting from their FTP frameworks. Banks will have to review the profitability of their current businesses and investigate measures to maintain current returns in the new regulatory and financial landscape. In addition to profitability, banks must take into account issues regarding the scarcity of funding and capital.
As we analyzed in the paper many steps in the right directions have been taken; however more need to be done. Only doing so, FTP in bank will incentivize a correct balance sheet consumption (through a proper calculation of net interest income) and thus significantly improve bank risk-adjusted-performance. Technical and methodological refinements to FTP systems should be realized in order to address the inefficiencies emphasized by the current financial crisis. Our empirical evidences underline how the discrepancies between internal transfer prices and actual market costs of funding led to an excessive no value generating activity if all risks are not considered and hedged at deal inception; and more importantly the need for a strict coherence between the sophistication of the business model and the one of the FTP adopted. This is the only way banks have to generate solid profits and not only "accounting" ones in the short term (that will turn into losses in the long run when unexpressed risks will materialize). It is essential that banks are aware of the exposure to those risks to decide whether to hedge or not or to change accordingly their commercial policies (i.e. spreads to customers).

Despite the progresses made some of those distortions are still present as well as there are further areas of improvements. The FTP methodologies need to evolve along with other building blocks of liquidity risk management frameworks, such as stress test frameworks, behavioural models, IT system, and so on. In this perspective, banks have the great opportunity to make FTP an effective value creation tool based on a new "risk pricing paradigm".

ANNEX 1

THE EVOLUTION OF THE CRISIS FROM A FTP FRAMEWORK

Before the financial turmoil, the funding cost was very close to swap rates pointing out that the market, in the medium term, did not differentiate significantly between secured and unsecured funding (represented by the green area in FIG. A below). The two funding channels were considered equivalent in the global wholesale market because bank solvency was guaranteed from a solid growth either of asset and of earnings and, above all, by an implicit public support for large banking groups. At the beginning of the financial turmoil, from August 2007 to August 2008 (the grey area in FIG. A), credit premium increased slightly, in particular during the Bearn Stearns's collapse (3 month Euribor-OIS spread was 80 b.p. and 5 years CDS was 125 b.p.). Nevertheless, that event represented more a problem at an individual bank level (idiosyncratic) than a systemic one, because it was managed within the banking system with the public sector support.

On the other hand, the Lehman's default triggered a systemic crisis: the OTD weaknesses were deep and spread within the system. Furthrmore there were no bailout from private or public sector of a SIFI. During the fall of 2008 (dark grey area in FIG. A) liquidity was the main issue, since the coordinated intervention of public and monetary authorities - the former to bailout financial institutions (such as AIG, RBS, Lloyds, etc), the latter to guarantee liquidity - concentrated the problem on lending with "default proof" collateral. Therefore not collateralized lending *de facto* disappeared since Euribor rates skyrocketed and consequently Euribor-OIS spread widened dramatically and all bank bonds reflected this trend through a widening of spreads in comparison with securities considered risk free (such as German Treasuries).

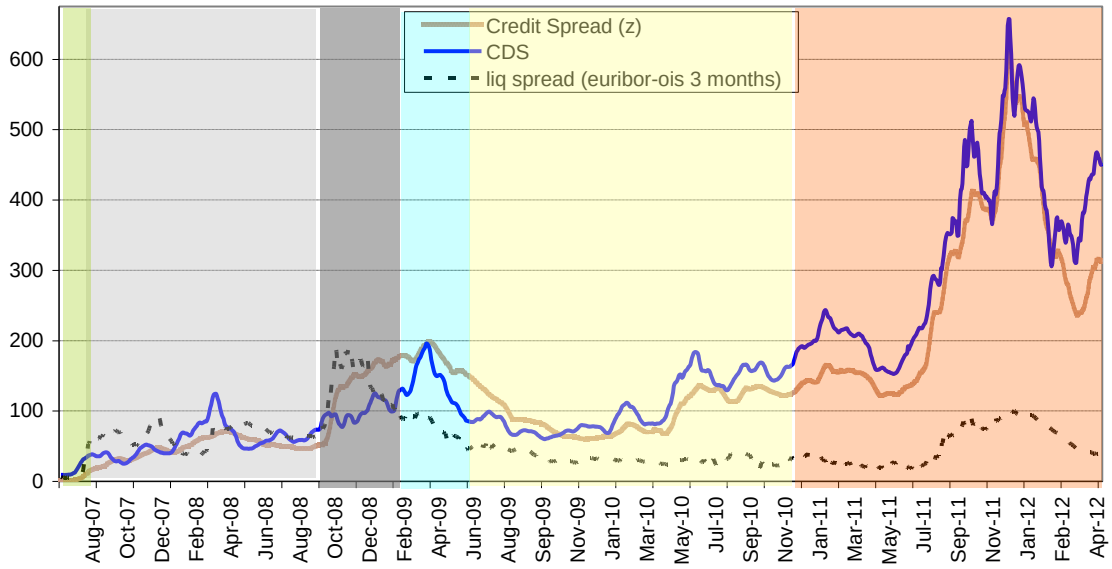
Focusing on Italian banking system, the top-3 banks CDS premia increased, but not at the same pace, evidencing the downward effect on the CDS quotes of a sudden increase of systemic risk[50] as well as a slightly expected loss increase on senior bonds because Italian banks. On average, they were not deeply involved in the sub-prime market and benefited from the public bailout's option. During the first quarter of 2009 (the light blue area in FIG. A) Italian banks heavily exposed in Eastern European countries' (EECs) went through a crisis that determined a fast increase of default risk perception, as demonstrated by CDS spreads reached cash spreads. During the following three quarters of 2009 (evidenced by the yellow area in fig. A), the strains on Eastern Europe countries got back and the expectations of an improvement in the world economy recovery of contributed to a rapid decrease in the CDS levels followed, more slowly, by a decline in bonds spread[51].

[50] *The effect of a relative reduction of CDS quote in relation to cash spread during episodes of increased systemic risk is due to the increased correlation between the default probability of the protection seller and that of the reference entity if both parts belong to the same economic sector (ie. Financial).*

[51] *The lagging behavior experienced by bonds in relation to CDS is also due to a "buy and hold" strategy of cash investors that, reducing liquidity in the secondary market, smoothed the quick movements experienced in the CDS market but also lead to high spreads levels during illiquidity and stressed periods.*

Chart A

Evolution of interbank, CDS and bond spreads for the 3 largest Italian banks



Source: own elaboration on Bloomberg data

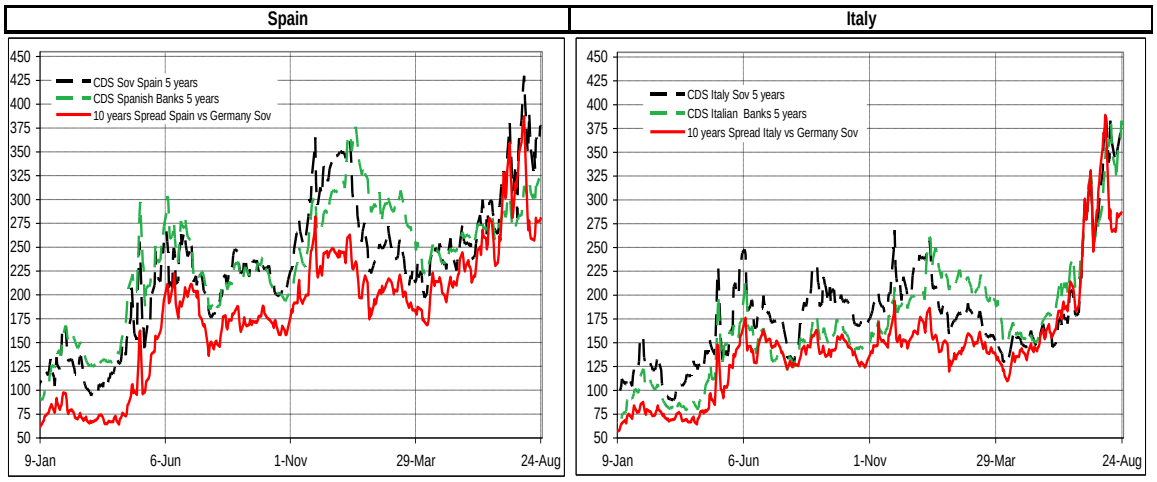
The sovereign risk became a relevant element that influenced the credit spread component of the cost of funding for banks in those countries[52]. The tight link between public and banking sectors, established starting from Lehman's collapse, became evident with the onset of the crisis materialized in the sovereign debt markets (spring 2010, orange area in FIG. A), especially in the economies such as Ireland, Portugal, Spain, Greece, Italy[53]. In the second part of 2010 we observed a positive co-movement between sovereign and banking credit risk as highlighted by a close evolution of sovereign and banking CDS for all countries (see FIG. B), even if the roots of the causes were dissimilar.

Chart B

Evolution of sovereign and banking CDS

[52] *The huge amount of new resources required to operate in a new financial environment, where all (funding, credit, market liquidity) premia were set higher, materialized a loop hole problem of sustainability in countries where bank recapitalization needs appeared huge in relation to the size of the economy or where there was limited room for public intervention.*

[53] *In the first three countries (Ireland, Portugal, Spain) the crisis spread from the private banking sector to the public, due to the huge amount of recapitalization needed by banks. This circumstance was highlighted by banks CDS abover the sovereign ones; while in the other two countries (Grecce and Italy) the tight conditions of public finances were echoed in the credit spread of the country's banking sector, underlined by sovereign CDS above banks CDS.*



Source: own elaboration on Bloomberg data

The sovereign crisis scaled to an higher level during the second half of 2011 with the spreads well above 600 p.b. and a get back of liquidity risk (Euribor-OIS spread increased near 100 b.p.). The two LTRO by the ECB reduced liquidity strains and let credit spreads to reduce by half. During the month of April the new strains in Greece of the sovereign crisis caused the CDS to rise more than the credit spread on bonds.

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