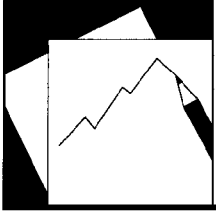


# Working Paper

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INTERNATIONAL MONETARY FUND



# IMF Working Paper

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## Fixing the Fixings: What Road to a More Representative Money Market Benchmark?

*V. Brousseau, A. Chailloux, A. Durré*

## **IMF Working Paper**

European Department

### **Fixing the Fixings: What Road to a More Representative Money Market Benchmark?**

**Prepared by V. Brousseau, A. Chailloux, A. Durré**

Authorized for distribution by Craig Beaumont

May 2013

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### **Abstract**

Interest rate derivatives on major currencies, with notional outstanding amounts adding up to hundreds of trillions, are mostly indexed on Libor and Euribor benchmarks, as are hundreds of billions in loans to enterprises, mortgages and other retail loans to the real economy. Yet, the prevailing role of these benchmarks appears to be more a legacy from history rather than reflecting today's structure of banks' funding. Building on earlier work (Brousseau, Chailloux, Durré, 2009), this paper discusses various options to move towards a new benchmarking system in the money market. It proposes a more ambitious benchmark design that would consist of a trade-weighted index that would systematically pool all short-term wholesale funding operations of banks per tenor.

JEL Classification Numbers: G10, G15, E43.

Keywords: Libor, Euribor, fixings, Unsecured Money Market, and Benchmarking System.

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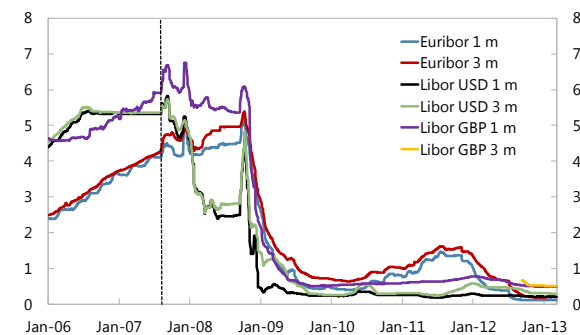
## I. INTRODUCTION <sup>1</sup>

The London interbank offered rate (Libor) and Euro interbank offered rate (Euribor) are key benchmarks for global financial markets and they behaved similarly until recently (Figures 1 and 2). Following a suspicion of the manipulation of Libor rates, Martin Wheatley, Managing Director of the Financial Service Authority (FSA), was commissioned by the Chancellor of the Exchequer in the United Kingdom to report on the following issues:<sup>2</sup>

- (i) necessary reforms to the current framework for setting and managing the Libor;
- (ii) the adequacy and scope of sanctions to appropriately handle Libor manipulation; and
- (iii) whether analysis of the failings of Libor has implications for other global benchmarks.

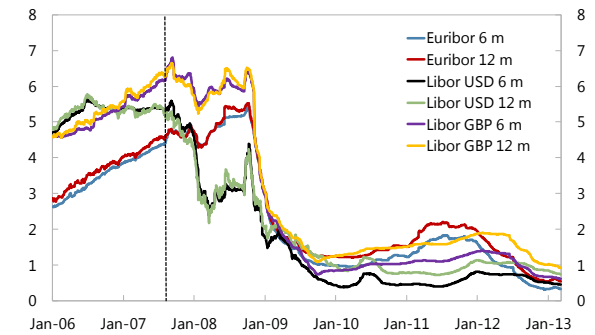
This led to an initial discussion paper (the so-called Wheatley Review of Libor) aimed at generating reaction and discussion with major actors. A similar process has taken place in Europe since the concerns on the Libor could apply to a large extent to the Euribor.<sup>3</sup> Similarly, the International Organisation of Securities Commissions (IOSCO), the European Banking Authority (EBA) and the European Securities and Markets Authority (ESMA) have also launched public consultations on money market reference issues.<sup>4</sup>

**Figure 1: Libor and Euribor Fixings for Short-term Maturities**  
(Percent)



Source: Bloomberg.

**Figure 2: Libor and Euribor Fixings for Medium-term Maturities**  
(Percent)



Source: Bloomberg.

<sup>1</sup> Special thanks (with no implications) to C. Beaumont, A. Bhatia, M. Sing, V. Le Lesle, D. Delort, F. Smets, J. Kiff and M. Segoviano for their helpful comments and suggestions. This paper is dedicated to the memory of Jean-François Borgy who worked tirelessly to build and promote efficient euro money market and bond indices.

<sup>2</sup> Wheatley's investigation began after the alleged misconduct by traders at global banks, most notably Barclays PLC, relating to the manipulation of the Libor. This report is available at the following website: [http://www.hm-treasury.gov.uk/d/condoc\\_wheatley\\_review.pdf](http://www.hm-treasury.gov.uk/d/condoc_wheatley_review.pdf)

<sup>3</sup> On 5 September 2012 the European Commission released for public consultation a working document entitled "A Possible Framework for the Regulation of the Production and Use of Indices serving as Benchmarks in Financial and other Contracts", in order to assess whether further regulation in the production and governance of benchmarks is necessary. The response of the ECB to this consultation can be found at: <http://www.ecb.int/pub/pdf/other/ecconsultation-regulationofindices-eurosystemreplyen.pdf>.

<sup>4</sup> In both consultations at the European level the European Central Bank (ECB) was also consulted and released an opinion. See the following documentation related to IOSCO at: <http://www.ecb.int/pub/pdf/other/pubcon201302onfinancialbenchmarksen.pdf>; and to EBA/ESMA at: <http://www.ecb.int/pub/pdf/other/pubcon201302ontheprinciplesforbenchmarksettingprocessesintheueen.pdf>

Libor is the most frequently used benchmark for interest rates globally, referenced in variable rate transactions with a notional outstanding value of at least \$300 trillion. Euribor plays a similarly important role. For example, exchange-traded interest rate derivatives data published by Euronext show that the total notional amount of the three-month Euribor offered rate futures contracts traded on the London International Financial Futures and options Exchange (LIFFE) in 2011 was €242 trillion and the total notional amount of the Euribor offered rate options on futures was €126 trillion.<sup>5</sup> The importance of the accuracy of these fixings goes well beyond the money market as these references represent a key input on the pricing of financial instruments with longer-term maturities, including for retail banking activity.<sup>6</sup>

Industry experts disagree as to whether the Libor should be reformed or replaced. Practical challenges and risks of disruption to financial markets suggest that replacing Libor and the likes would only be justified if the Libor appeared severely compromised, could not be adequately improved by reforms, and if a new, suitable benchmark could replace it.

In this context, this paper reviews the ongoing debate and offers an alternative approach to fix this problem. The paper is organized as follows. Section II briefly reviews the current problems with the fixings and the available literature analyzing the developments in the related unsecured money market segments. Section III outlines the range of recommendations offered by various parties in the ongoing debate, noting technical considerations on the feasibility and desirability of each proposal, and proposes an alternative approach. Section IV presents conclusions.

## **II. BACKGROUND AND REVIEW OF THE LITERATURE**

### **A. A Paradigm Shift**

The offered rate benchmarks were set up during the 1980's at a time when the financial system was bank centric and when wholesale unsecured interbank operations were the main refinancing channel of banks beyond deposits from their customers. At that time, both bond markets and the fund management industry were still in their infancy, in particular in Europe. Offered rate benchmarks provided a good indicator of banks' short-term wholesale funding costs in this context, in particular for banks that specialized in capital market operations and

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<sup>5</sup> According to the latest data available from the BIS, at the end of 2011 the notional amount outstanding of OTC interest rate derivatives (forward rate agreements (FRAs), swaps and options) was \$504 trillion. Of this total, the largest share by currency was recorded for the notional amounts referenced to euro interest rates (\$184 trillion, of which \$143 trillion related to interest rate swaps, \$17 trillion to FRAs and \$23 trillion to interest rate options), exceeding the amounts referenced to US dollar rates (\$161 trillion).

<sup>6</sup> For instance, on average almost 60% of the total loans to the non-financial sector in the euro area at the end of March 2012 had floating rates (BIS Statistics). While the available statistics do not provide details about which benchmark rate underlies which derivative instrument, Euribor offered rate is known to be the most widely used reference rate. Although lower (but also growing over time), the share of loans to households based on floating rates reached 40% over the same period.

had a limited deposit base. Interbank offered rate benchmarks provided an objective reference for pricing lending instruments. Syndicated loans and other variable rate big-ticket loans to large corporations were priced in terms of the Libor rate in a context where the wholesale funding of money market funds on medium-term maturities stood as a concrete and feasible hedging channel.<sup>7</sup>

The next twenty years saw a revolution in the money market ecosystem akin to a paradigm shift. While money markets and interbank markets were de facto synonyms, the process of financial deregulation that accelerated during the 1990's generated a multiplication of the types of market players participating in the money market. Foreign central banks, institutional investors, corporations, loosely regulated non-bank financial institutions (including hedge funds, off-balance structures and shadow-banking investment vehicles), became increasingly important players. Banks were no longer alone: "money market" did not mean "interbank market" anymore. The influence of interbank offered rate references actually peaked at the same time as a deep phenomenon of disintermediation started to undermine turnover in the traditional interbank unsecured market (in terms of pricing reference for cash loans, but first and foremost as reference for short-term interest rate derivatives, either exchange traded or over-the-counter). The mainstreaming of the fund management industry, the advent of repo operations and the entry of new players (e.g., pension funds, insurance companies), significantly altered the distribution of liquidity in the interbank market and its functioning.

This fragmentation of players in the money market generated the emergence of new funding channels that stood as appealing alternatives to standard unsecured funding for banks in the context of a changing regulatory environment. Customer deposits left the banks "*en masse*" towards money market funds so banks had to increasingly to borrow funds using CD issuance or repo operations. The shift of the deposit base towards non-banking entities also changed one of the fundamental underpinnings of the interbank offered rate system. A substantial fraction of banks ceased to be permanent net lenders and started to operate from the interbank offered borrowing side of the market.<sup>8</sup> This move of banks from the net lending to net borrowing position also resulted from changes to the prudential framework under the Basel regulations imposing significant capital charges on unsecured lending operations – but no capital requirement on unsecured interbank offered borrowing operations. This asymmetric treatment of unsecured lending operations for regulatory capital requirements incentivized money center banks to use the unsecured money market only for borrowing operations, while channelling their wholesale lending operations towards less regulatory capital intensive channels (e.g. repo). This bias eventually contributed to the hollowing out

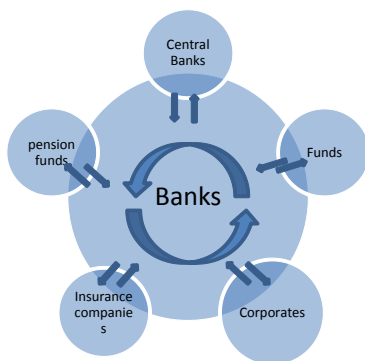
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<sup>7</sup> For an anecdotal account of the history of the Libor see *Business Insider*, [A Greek Banker on the Early Days of the Libor](#), August 2012. For a primer on the Libor fixing set-up and recent issues, see ["What is Libor?" Finance and Development, December 2012](#), International Monetary Fund.

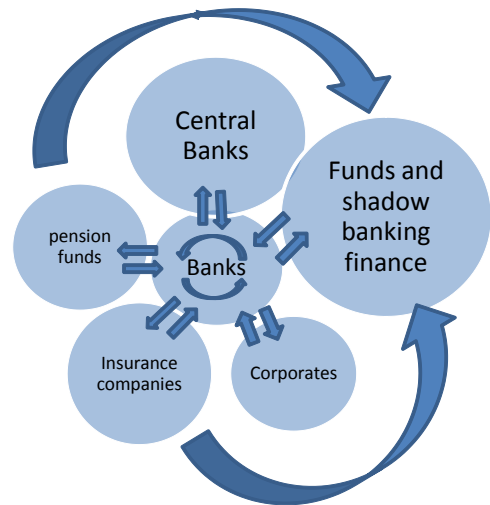
<sup>8</sup> With the exception of universal banks running large branch networks for which the retail deposit base lived through the disintermediation process.

the unsecured interbank market. The loss of this natural net lending position, coupled with the emergence of all these sub-segments where banks lost the role of dominant players, created new challenges to the setting of the interbank offered rates but also incentives for new business opportunities outside the traditional banking system.

### *The Money Market: 1980–1999*



### *2000 to present*



In this multipolar money market space the offered rate references, while becoming increasingly less representative of banks' wholesale funding costs, gained considerable weight as pricing anchors for short-term derivative contracts.

Short-term interest rates are referenced in many financial contracts, and this mostly through interest rates fixing procedures. Fixings should be understood in the present context as snapshots of a given price or rate elaborated by some trustworthy entity. The specific procedures used to produce these fixings may vary, but should be clear and transparent. Examples of interest rate fixing procedure are of course the interbank offered rate fixings, usually referred to as “declarative fixings” (like the Libor, the Tibor or the Euribor) but also the Euro OverNight Index Average (EONIA), a famous example of the “actually-traded” family of money market references.

Because variable (or floating) interest rates are referenced in a wide variety of financial contracts, effective fixings of interest rates are essential to the functioning of interest rates markets. Yet the importance of these fixings goes well beyond their use as reference in these various contracts. Fixings of short-term money market rates, and derivatives indexed on those fixings, convey information about future (or “forward”) interest rates. This forward rate information content is the primary input to the pricing relationships that underpin the entire universe of fixed-income instruments and assets, including, but not limited to, bonds of all type issued by governments, corporates and supranational entities. The pricing of interest rate instruments using the chain of forward rates generated by money market fixings and the

related derivatives produces internally consistent pricing. This pricing consistency is an obligation for the whole industry, as the primary requirement for market-makers is to avoid being arbitrated by their peers. This non-arbitrage condition has led the whole industry to adopt internally consistent pricing mechanisms, and underpinned the global dominance of Libor-based products and their fixings for the hedging and trading of short-term interest rate products.

Because interest rates on various instruments (exchange-traded future, forward rate agreement, swaptions, basis swaps) are interlinked through a web of arbitrage relationships the derivative instrument aiming at hedging a particular interest rate risk need not be indexed on exactly that interest rate (“proxy-hedging”). The primary criterion of choice is that the link between the hedged variable and the underlying rate of the hedging derivative (the “basis”) be predictable; subject to that condition, another essential condition is a sufficient liquidity of the considered derivative instrument itself. For example, French government bond securities (OATs) can be hedged with Bund future contracts, despite the existence of a derivative on the OATs themselves. Proxy-hedging is a widespread practice for market-making operations on cash and derivatives fixed income instruments. In the same vein, market-makers of EONIA swaps hedge their exposures with Euribor swap rates, which are more liquid, and their customers occasionally choose to manufacture their own hedge on the basis of Euribor swap rates rather than buying a more exact hedge from the EONIA swap market maker. Market liquidity and predictable relationships among rates are what is truly needed.

The explosion of interbank rate-indexed derivatives trading (Figure 7), and the intensive use of proxy-hedging, inflated considerably the exposures of short-term derivative books. This created significantly increased challenges for the fixing of the indices. In fact, daily changes of some few basis points could generate very substantial profit and loss swings for short-term derivative trading units. These conditions shifted the center of gravity of money market fixing from Treasuries to derivative desks, and fixing contributions, rather than reflecting actual trading conditions on a generally subdued market for term unsecured money market loans, started to be made under the forceful influence of short-term derivative trading units.

## **B. Towards the Thin End of the Wedge?**

By broadening substantially the channels of wholesale funding to segments carrying different types of credit risk and different pricing determinants, while continuing to use predominantly interbank offered rate references to index banking assets, banks created large risks of divergence between the output of the Libor fixing process and the actual cost of banks wholesale funding, that translated into large asset-liability risks.<sup>9</sup> These risks were however

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<sup>9</sup> The widespread nature of these risks was evidenced by the rapid development of derivative contracts designed to help managing these risks, i.e. basis swaps like the London interbank offered rate (Libor)-Overnight Indexed Swap (OIS). Unfortunately the trading of these instruments failed to provide adequate hedging opportunities when they were most needed, like in 2008.

long concealed in the late 1990's and 2000's by the generalized narrowing of credit spreads. Ample liquidity conditions cushioned the interest rate and credit cycle and the subsequent limited movements of spreads reduced the risks of a substantial wedge between banks actual wholesale funding costs and the published interbank offered rate references.

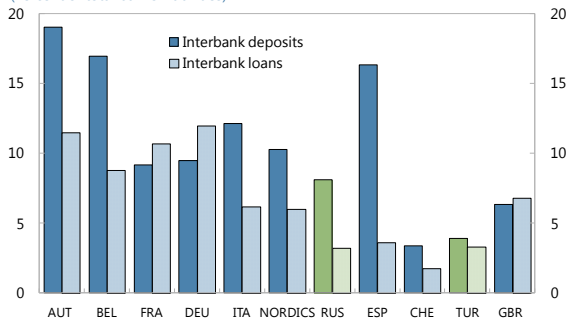
This wedge is now seen in a post-crisis environment as the “elephant in the room” by money market practitioners. In the absence of a genuinely active market for term unsecured lending operations, banks have to heuristically gauge the rate at which these operations would take place, whilst knowing that their actual cost of wholesale funding results from the complex combination of their repo market access, the quality of their collateral, their access to the foreign exchange swap market, and a number of other variables. The existence of this wedge is, in itself, an existential threat to a proper functioning of the interbank offered rate references. Since the value of the interbank fixings arises from their use as a basis to price credit to the real economy, it is also of utmost importance to central banks that they properly reflect market conditions and cannot be subject to distortions which would ultimately impair the transmission of their monetary policy stance to the economy (for a detailed overview of the crucial importance of money market references for the conduct and transmission of monetary policy, see “*Towards Better Reference Rate Practices: A Central Bank Perspective*”, the [report](#) of the BIS Working Group on money market references, March 2013).

### C. Facts and Figures

Although the cash and derivatives segments of the money market are mostly over-the-counter (OTC), reducing considerably the quantitative information available on transactions prices and volumes, various indicators support the view that unsecured wholesale funding channels for banks have gradually dried-up, precisely at a time when the benchmarking role of the Libor and Euribor through activity in the derivatives segment had soared, and when wholesale funding in general (including repo operations and short-term security issuance) increased dramatically.

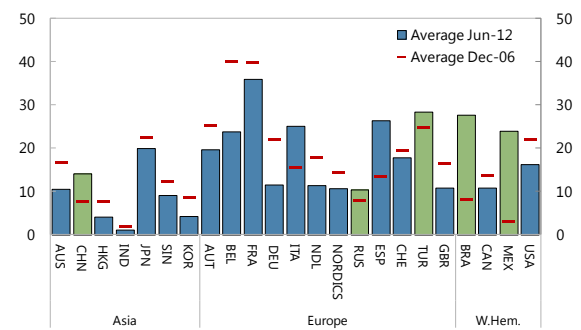
This observation is confirmed by the data provided by banks' balance sheet and surveys. Figure 3 shows that interbank unsecured operations (all maturities included) represented only 15–20% at most—namely in Austria and Belgium—of banks' balance sheet (in the second quarter of 2012) with less than 10% for Germany, France and the United Kingdom (both deposits and loans). At the same time, total short-term wholesale borrowing by banks was significantly higher in Asia, Europe and North America over the same period, reaching even 40% of banks' balance sheet in France (Figure 4).

**Figure 3: Wholesale Interbank Unsecured Operations**  
(Percent of total banks' liabilities)



Source: SNL Financial.

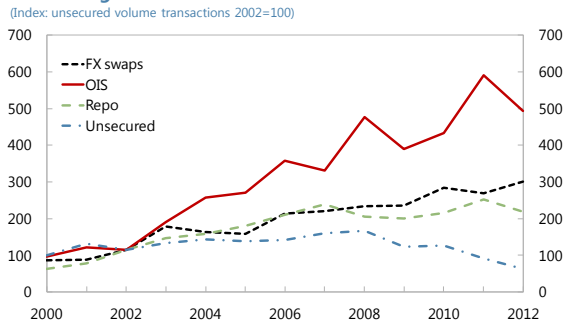
**Figure 4: Short-term Wholesale Borrowing**  
(Percent of total banks' liabilities)



Source: SNL Financial.

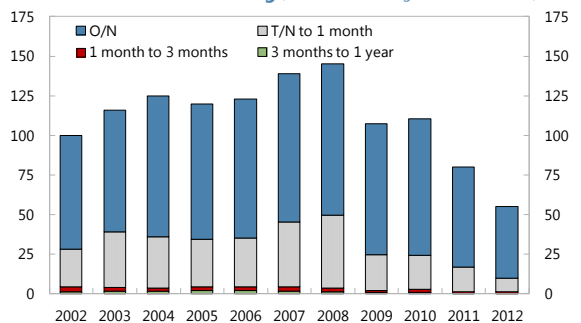
In the specific case of the euro area money market, for which more detailed information are publicly available, Figure 5 shows that the daily turnover in the unsecured segment has declined between 2002 and 2012 while the turnover on secured operations (repo), initially well below unsecured operations, was multiplied by a factor of 4. This chart also goes to show that other funding channels and short-term market segments (FX swaps, EONIA swap trading), unlike unsecured term borrowing operations, have experienced a massive expansion over the last 10 years. In addition, maturity breakdown data (Figure 6) show that 96% of the unsecured borrowing operations daily turnover comes from transactions with a maturity less than one month (in particular 70% for the sole overnight segment), maturities that are not used for the calculations of Libor-type fixings.

**Figure 5: Average Daily Turnover in Various Euro Area Money Market Segments**  
(Index: unsecured volume transactions 2002=100)



Source: ECB (2012).

**Figure 6: Maturity Breakdown for Average Daily Turnover in Euro Area Unsecured Lending** (Index, cash lending volume 2002=100)



Source: ECB (2012).

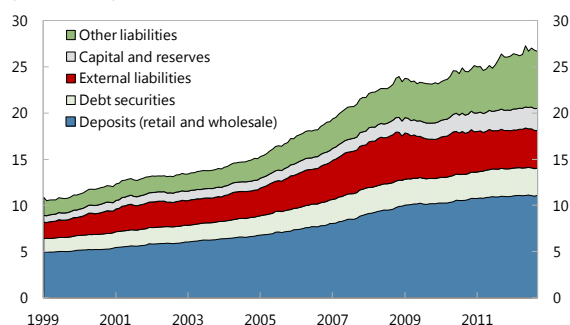
The increasing importance of wholesale funding for banks is also seen in the breakdown of liabilities of monetary and financial institutions (MFIs). Figure 7 provides for instance this breakdown for MFIs in the euro area (outstanding amounts at the end of the period in EUR billions, excluding the Eurosystem)<sup>10</sup>. Although anecdotal evidence also suggests similar patterns in other advanced banking systems. Similarly, the importance of Libor-type fixings based on the unsecured money markets—due to their benchmark role in the derivatives markets—is also supported by evidence reported by Figure 8 and Table 1. It appears indeed

<sup>10</sup> Further details and explanations can be found at:

[http://www.ecb.int/stats/money/aggregates/bsheets/html/outstanding\\_amounts\\_2013-02.en.html](http://www.ecb.int/stats/money/aggregates/bsheets/html/outstanding_amounts_2013-02.en.html).

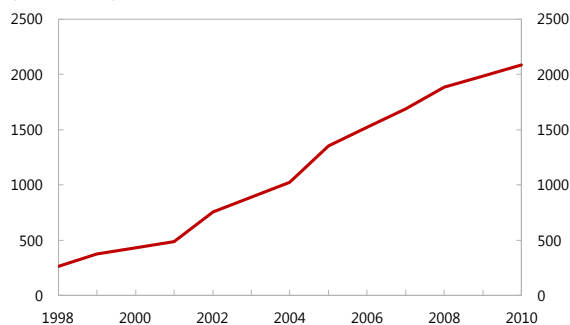
that the OTC derivatives daily turnover as calculated for the BIS Triennial Survey on derivatives (and composed for most part of Libor and Euribor-index Interest Rate Swaps) has almost tripled in ten years. With a daily turnover for OTC derivatives of around 2 trillion USD equivalent in 2010 (Figure 6), swap operations amounted to two thirds (Table 1) according to last available BIS data.

**Figure 7: Euro Area MFIs Total Liabilities**  
(Billions of euro)



Source: SDW.

**Figure 8: Interest Rate Derivatives Daily Turnover**  
(Billions of USD)



Source: BIS Survey.

**Table 1: Global OTC Interest Derivatives Market Turnover by Instrument 1/**  
(average daily turnover in April, in billions of USD)

Instrument	1998	2001	2004	2007	2010
Interest rate instruments 2/	265	489	1,025	1,686	2,083
FRAs	74	129	233	258	601
Swaps	155	331	621	1,210	1,275
Options and other products	36	29	171	217	208
Memo:					
Turnover at April 2010 exchange rates 4/	310	640	1,085	1,680	2,083
Exchange-traded derivatives 5/	1,381	2,188	4,524	6,099	8,142

Source: Bank for International Settlements.

Notes:

1/ Adjusted for local and cross-border inter-dealer double counting (i.e. 'net-net' basis).

2/ Single currency interest rate contracts only.

3/ The category 'other interest rate products' covers highly leveraged transactions and/or trades whose notional amount is variable and where a decomposition into individual plain vanilla components was impractical or impossible.

4/ Non-USD legs of foreign currency transactions were converted into original currency amounts at average exchange rates for April of each survey year and then reconverted to USD amounts at average April 2010 exchange rates.

5/ Sources: FOW TRADEdata; Futures Industry Association; various futures and option exchanges.

Reported monthly data were converted into daily averages of 20.5 days in 1998, 19.5 days in 2001, 20.5 in 2004, 20 in 2007 and 20 in 2010.

#### D. Recent Literature on Money Market Fixings

Although the literature on the information content of the interbank offered rate (BOR) fixings is sparse, the few available results concerning its possible mispricing are quite mixed. Recent papers have focused mostly on the evolution of the spread between the BOR and Overnight Indexed Swap (OIS) rates as a stress indicator without questioning the genuine information content of this spread.<sup>11</sup> In particular, few studies have looked into the broader question of the existence of a possible gap between fixings levels and actual wholesale unsecured funding costs of banks.

Gyntelberg and Wooldridge (2008) analyze the detailed modalities of money market fixings. They highlight the potential biases related to participants' strategic behaviour, but conclude that fixings have worked well in a context of market dislocation, and that the dispersion within the dataset exploited to determine the references is a consequence of market turmoil rather than being a symptom of a flawed fixing process. They argue that the safeguards against risks of gaming of the index (principally, the trimming of the extremes) work well in this context. In the same vein, Michaud and Upper (2008), after studying the drivers of Libor rate movements during the turmoil suggest that central banks' operations are instrumental in the cooling-off of the Libor/OIS spread.

Our earlier research (Brousseau *et al.*, 2009) took a different path and focused instead on the pricing dynamics of the fixings pre- and post-Lehman. It came to the conclusion that *"something deeply unusual happened on Euribor offered rate fixings in the post-Lehman period"* taking the form of a deterministic trend for which there is no obvious economic explanation, unless reflecting a *"...coordination between individual fixing contributors..."*, with this *"converging pricing among prime banks not entirely reflecting market conditions, hence making the fixing entirely virtual"*. To the best of our knowledge, this paper is the only study providing statistical and econometric evidence of the new "virtual" character of the fixing and evidence of possible manipulation. The conclusion that *"the expected arbitrage between both segments of the money market (namely BOR and OIS) stopped working after September 2008"*, results from three elements, each of which is supported by empirical evidence:

- First, a strong bi-directional relationship between the 3-month deposit interest rate and the 3-month swap index (namely the 3-month deposit interest rate does Granger-Cause the 3-month EONIA swap (OIS) and vice-versa) is observed before the crisis and during the crisis prior to the collapse of the company Lehman Brothers Ltd.
- Second, a substantial break in the previous statistical relationship is observed in the crisis sample post-Lehman in the sense that the deposit interest rate no longer

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<sup>11</sup> See in particular Chailloux *et al.* (2008), McAndrews *et al.* (2008), Taylor and Williams (2009), Christensen *et al.* (2009), Kwan (2009) and Aït-Sahalia *et al.* (2010).

Granger causes the OIS rate, while the OIS continues to Granger cause the deposit interest rate. In addition to the breakdown observed in the relationship between the 3-month deposit rate and the 3-month OIS, the paper provides econometric evidence that the deposit rate displays an observable linear pattern (characterised by the presence of a deterministic trend).

- Third, the paper highlights that the empirical distribution of daily returns of the Euribor fixing diverges significantly from the empirical distribution of the OIS from September 2008 while matching it very closely beforehand. It is shown that this difference in distributions could be produced by pure randomness with only an extremely low probability, allowing to rule out pure chance as an explanation.

These empirical findings, highlighting issues in the process of setting the declarative money market fixings, laid the ground for a reflection on the integrity of the fixing framework. The view adopted in this paper is that the benchmark status of any interest rate reference should be based solely on its representativeness, i.e., its capacity to reflect fairly trading conditions in the underlying market but also to represent a reliable and informative pricing anchor to peripheral markets. The features of an ideal money market benchmark are being intensely debated in various fora. We will summarize (in III.) the key elements featured in the current policy debate and review the reform proposals made so far.

### **E. Is Fecit Cui Prodest?**

Recent anecdotal evidence of abuses is also raising questions that highlight the paradoxical nature of this issue. Fixing manipulations that may benefit the profit and loss of one trading unit (e.g. short-term Interest Rate Swaps) may have otherwise impacted negatively the overall balance sheet of the considered institution. Certain banks within the fixing panel may, given their asset-liability management practices and the structure of their balance sheet, have a structural bias in the fixing process. Universal banks, given the net long liquidity position stemming from their network deposit gathering, should seek higher fixings. Merchant banks with greater presence in capital market and investment banking, likely to run a structurally short liquidity positions, should conversely be keen on achieving lower fixings. The additional layer of complexity created by the availability of hedging instruments like basis swaps or swaptions contributes to blur the stakes further. One would think that this diversity of bias within the panel should create a naturally balancing process that, together with the reputational risks at stake in case of manipulation attempts, would suffice to self-regulate this process. Such self-regulation, as anticipated by some in the literature (see for instance the discussion in Michaud and Upper (2008)) may not always prevail in some circumstances as highlighted by recent developments.

### **III. APPROACHES TO A MORE REPRESENTATIVE BENCHMARKING SYSTEM IN THE MONEY MARKET**

The set of investigations that are currently taking place in various jurisdictions (mainly led by the UK, US, Euro-area, Swiss and Japanese authorities), by looking into evidence of manipulation of Libor, Euribor and Tibor fixings, leads inevitably to question the future of the current definition of these benchmarks. In this respect, various proposals have been made in order to improve their representativeness. The purpose of this section is thus to offer an overview of the main proposals that are currently debated or could be envisaged, starting from quick-fixes to a full overhaul of the system. In addition to the options being considered by policy makers in the Libor and Euribor jurisdictions, we propose a deeper reform option in section D. Whatever the option chosen for the future, it is important to underline that it should receive the full support of the financial industry in order to make the change effective.

#### **A. The Quickest Options**

The most immediate solution would be to reform interbank offered rate fixings without amending their essential features. The Libor and Euribor would continue to be set using the key features of current fixing procedures (declarative approach, no reference to actually traded volumes, trimming of extreme quotes...). A key advantage of this approach would be to minimize the legal complexities emanating from changing the reference interest rate benchmark in financial contracts (“continuity risk”).

This is the main approach taken in official reports like the Wheatley report, which prescribes reforms that are limited enough in scope to be implemented quickly. The proposed changes aim at reforming the governance of the index and the accountability of panel banks, at introducing refinements in the calculation process, and at discontinuing the publication of some relatively unused tenors and currencies. The report expresses some support for incorporating transaction-based data in the calculation process, without specifying how this might be done.

Views among practitioners on including transaction-based data seem mixed. For instance, most participants in the Euribor European Stakeholders workshop of 12 October 2012 agreed that a transactions-based calculation might not be adapted to the Euribor offered rate index.<sup>12</sup> Overall the incremental and limited changes approach is likely to be favored by the banking community over more sweeping changes to the fixing process, given the sizeable litigation risks posed by the redenomination of contracts amounting to trillions of euros and dollars.

The main issue with this approach, in particular when it comes to maintaining the declarative approach and the unsecured interbank operations scope of the fixing, is that it is based on an

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<sup>12</sup> The Euribor European Stakeholders workshop of 12 October 2012, held in Brussels, gathered representatives from the Euribor panel banks, the European Institutions, stakeholders Associations and Euribor Steering Committee Members. A summary of its conclusions can be found at [the Euribor Banking Federation website](#).

assumption of revival of the wholesale unsecured market funding channel for bank. As noted by V. Le Lesle (IMF, 2012), the odds for a resumption of the unsecured segment of the funding market, be it on the short end or the long end of the curve, are dim given the regulatory environment, and the pressure from various types of debtors to increase the seniority of their claims.

### **B. Going Trade-Weighted on Unsecured Interbank Operations?**

Another option would be to shift in favor of transaction-based benchmarks, in contrast with the traditional “declarative” nature of Libor-type fixing procedures. In theory, this could increase the reliability, representativeness and integrity (using real transaction data should impede manipulation) of the new benchmark, and the Eonia and Fed Fund effective swap markets are two practical examples of the success of a trade-weighted reference.

However, the practical feasibility of such a new methodology needs to be carefully studied in order to allow the new benchmark to be credible and widely employed as reference rate. An efficient transaction-based benchmark would demand two absolute pre-requisites: first, a calculation based on real transactions would prove reliable only if markets are sufficiently liquid (i.e. enough underlying transactions). An insufficient transaction volume on key tenors would cast some doubt on the relevance of the reference. Second, the wholesale unsecured segment of the money market would still have to be representative of the general wholesale funding conditions for financial institutions. This would not only help avoiding discontinuity in reference pricing but also reinforce the benchmark value of this reference rates in this segment going forward. For this reason market participants, when not squarely opposed to it, envisage a greater recourse to trade-weighted references mostly in a context where the information provided by underlying transactions would be complemented by some “expert judgment” (or model input) that would be used in the production of the reference.<sup>13</sup> The high uncertainty prevailing about banks’ funding channels in the post-crisis environment (Le Lesle, 2012) will probably make these two conditions difficult to meet. A full restoration of wholesale unsecured markets trading in the post-crisis environment could make this solution appropriate. Any other outcome would create a discontinuity in pricing that would weaken its benchmark role.<sup>14</sup>

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<sup>13</sup> This approach of “hybrid reference”, combining some features of declarative (survey-based) indices, and some features of the trade-weighted references, is for instance mentioned in [Blackrock’s contribution to the IOSCO public consultation](#).

<sup>14</sup> A concrete case of the challenges attached to the migration to a fully-trade weighted index is illustrated by the decision taken recently in Australia to base money market references on the Australian Dollar on actual trades, see [AFMA update on the BBSW, March 27](#).

### **C. Jumping the Libor Cliff into the OIS Liquidity Pool – A View from Short-Term Derivatives Markets**

Beyond the general but difficult to substantiate presumption that – prior to monetary authorities’ intervention – these fixings might have been maintained artificially high and too slow to adjust downward following the compelling measures taken by central banks to ease liquidity tensions, stands the issue of the extremely high dispersion of quotes that was noticed throughout the turmoil. Funding conditions should in principle be somewhat homogeneous among the group of prime banks contributing to the fixing. Although it could be argued that higher dispersion in quotes among surveyed banks and more volatile term spreads should be expected in crisis periods due to the prevailing uncertainties, the key issue remains whether these crisis phenomena are also reflecting more major distortions in the market dynamics. It cannot be ruled out that the near-absence of underlying market activity, creating a complex environment for contributing banks to quote accurate prices, also generated an environment prone to largely heuristic practices for fixing contributions. Regrettably it also opened up the scope for abuses, fostered by the disproportionate economic stakes created by trillions of dollars of notional exposure on short-term derivatives.

In this regard, it could be argued that the abovementioned reform proposals prescribed in recent reports commissioned on money market fixing issues suffer from a somewhat narrow focus. These reports indeed outlined essentially a set of quick-fixes while paying limited attention to the deeper flaws of the system.<sup>15</sup> The improvements in the field of governance, transparency and accountability prescribed to amend the Libor offered rate fixing process are certainly commendable and desirable. Yet they miss the point of the fundamental weaknesses of this process, i.e., the increasing economic irrelevance of the fixing as a manageable reference for the cost of banks wholesale unsecured funding (and wholesale funding generally). By contrast, the approach adopted in these official reports assumes that the drawbacks of the declarative offered rates benchmark system emanate essentially from a weak operational set-up (tarnishing an otherwise fundamentally sound framework). From our view, increasing banks’ accountability, systematizing audit trails, and working towards removing any scope for coordinated and deliberate fraud, while necessary, is not however sufficient to restore the integrity and economic relevance of the money market fixings. Rather than just focusing on how overly casual fixing modalities and weak governance might have been conducive to abuses we contend that more fundamental changes are needed. Some more radical changes are actually put forward in the BIS report (BIS, 2013), in particular with respect to the leading role that central banks and public sector authorities should play going forward in case of market failure, given the obvious presence of large externalities to

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<sup>15</sup> In a pre-crisis survey carried out among a panel of euro-area Treasurers in 2007, the ACI Financial Market association asked the following question: “It has been widely reported that London interbank offered rate fixings do not reflect actual prevailing market rates for cash, do you agree?” The surveyed treasurers replied. “Agree” at 39 percent; “Strongly agree” at 43 percent whereas only 16 and 2 percent respectively disagreed and strongly disagreed.

the financial system. Yet, no answer is put forward here with respect to the challenge posed by the irremediable decline of wholesale unsecured funding operations.

In this context, one alternative solution would be to substitute to interbank offered rates fixings a fixing based on OIS (Overnight Indexed Swaps) trading. Many believe that this transition, while challenging in some respects, could be technically feasible.<sup>16</sup>

During the twenty years that preceded the crisis, interbank offered rate derivatives instruments essentially offered a way to trade and hedge short-term instrument rates: that was their point and purpose. The fact that those fixings incorporated, by construction, prime bank credit risk turned out to be historical accident. In those times prime bank credit risk was small and stable, and hence did not hamper the use of the interbank offered rate fixing for the aforementioned purpose. Today, the same role could be played by OIS fixings (given the absence of prime bank credit risk in Eonia swap prices). In an ideal world, the role of Euribor fixings would be played by the Eonia swap index, and the role of Libor indexes by London-based OIS indices (Sonia swap fixings for GBP and Fed Fund effective swap fixing for USD). This solution, that would provide the banking system with a quasi-banking risk free reference to index cash and derivatives transactions, has many merits that were highlighted in the BIS (2013) Working Group report on market references.

Currently however, capital market liquidity for interest rates derivatives is concentrated on Libor-type linked derivatives. A switch would require a substantial degree of organization and of cooperation between lawmakers, derivative final users and the financial industry in the various jurisdictions. The discontinuation of the publication of interbank offered rate indices could only succeed if orchestrated carefully through the phasing-in of industry-wide contractual templates and rules governing the conversion of interbank offered rate-indexed derivatives contracts to OIS based ones. In particular, the switch should be coordinated through time and the spreads involved in that switch (or margin adjustments) be fixed by a central authority for all swap maturities and swap frequencies. The occurrence of NPV adjustments to be paid by parties to derivative contracts could probably not be avoided.

However daunting, the idea of a switch to an OIS-based framework emerged from some practical and operational adjustments that were implemented in the realm of short-term derivative pricing and settlement. In the middle of 2010, a market consensus was reached regarding the correct way to cope with the explosion of the Euribor/OIS spread volatility. This consensus resulted in changes to market practices concerning pricing, hedging, risk management and margin call computations and options quotation for short-term derivatives. New cash flow discounting practices using the OIS curve (after years of using zero-coupon curve calculated from the Euribor swap curves) are in the course of becoming a dominant pricing and valuation methodology. That change has important consequences, in particular

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<sup>16</sup> See the [European Banking Federation website](#) for a technical description of the EONIA swap fixings.

for the pricing modalities of collateral posted to secure the exposures of OTC derivative clearing houses, in the context of the rapidly spreading market standard of collateralizing OTC interest rates derivative exposures.

On June 17, 2010, the London Clearing House communicated that it would start to use the OIS curves to discount their interest rate swap (i.e. Libor and Euribor) portfolios. They justified that change by the observation that an increasing proportion of trades were priced on the OIS curves, and this after conducting extensive consultations with market participants. On August 11, 2010, the broker ICAP communicated that it would modify its pricing methodology and consequently the way they would publish pricing information on swaptions (standardised options on Libor swaps). That move was not limited to, but also involved, a change of the discounting yield curve from the Euribor swap yield curve to the OIS yield curve.

This new methodology is becoming a market standard, and this in spite of: (i) a greater complexity of the pricing algorithms, (ii) new procedure prone to potential programming errors affecting front offices, middle offices and back offices, and (iii) a more complex process involving two different yield curves, playing two different roles, one being utilized for discounting and being the OIS curve, the other utilized in another manner, referred to as to the ‘forwarding curve’, and being the Libor/Euribor swap curve.<sup>17</sup>

This evolution has required, and probably encouraged an extension of maturity spectrum of the Eonia swaps, as visible on the quotation pages of the major brokers. That spectrum increased steadily since the beginning of the crisis. In 2007, Eonia swaps longer than 10-year were absent. Progressively, brokers integrated longer maturities. ICAP reached the 50-year tenor on 15 August 2012, having been preceded for more than a year by some fellow brokers, e.g. Tullett. These moves demonstrate the value that market participants attribute to a pricing based on the OIS curve. The efforts made by major market-makers player in terms of staff training, information technology adjustments, and of communication with customers and market participants should not be under-estimated. They are also revealing of the fact that a switch to a benchmark curve deemed more effective are actually favored by a large segment of the industry. The implementation of that switch requires nonetheless an explicit coordination among major market participants that is essential.

#### **D. Towards a Full Overhaul: A Total Cash Pool Index (TCPI) Benchmark**

Recent contributions to the money market fixings reform debate did not feature the proposal of a trade-weighted index that would systematically pool all the short-term wholesale funding operations of banks. This type of benchmark reference would be holistic and not be centered

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<sup>17</sup> For a technical description of the separation of the two roles of the yield curves see Bianchetti M. (2009), Two Curves, One Price: Pricing & Hedging Interest Rate Derivatives Decoupling Forwarding and Discounting Yield Curves, <http://arxiv.org/abs/0905.2770>.

on the specific nature of underlying funding instruments. In this approach the reference rate would represent the cost of the overall funding mix for wholesale operations below one year. For instance it would, for a given tenor, aggregate all the short-term borrowing operations of money center banks, and calculate one single trade-weighted average rate that would encompass unsecured interbank borrowing, issuance of CDs, general collateral repo operations and also security lending, cross-currency funding operations through foreign exchange swaps. In a nutshell any wholesale borrowing transaction involving a cash leg bearing interest would be pooled within a corresponding maturity bucket to calculate this synthetic index.

This approach would have the merit of addressing the problem of scarcity of trading on any particular given segment of the money market, and give a general sense of the overall funding cost of banks. It would also have the merit of creating a reference that would represent fairly banks' wholesale short term liability base. From a customer protection objective this broad reference would reinforce transparency and give solid insurance to indexed debtors that interest rates on their debt is set on a reference that is not prone to manipulation or fudging (manipulation would prove impossible because of the very large underlying instrument pool and the use of actually traded data), but also fair (i.e. in line with banks' true wholesale borrowing costs). The second point of fairness could be beneficial to debtors and contribute to narrower margins. Aside from the problem of outright fraud this approach would increase transparency, something that would directly impact pricing modalities and hence affordability of the cost of credit for Libor or Euribor-indexed debtor. Indeed the uncertainty on banks' actual access to funding under the conditions set out in the Libor offered rate framework may have generated a more conservative pricing of margins above the index by contributing banks.

This approach would also have some asset-liability management merits for banks. In practice, and also because of leads and lags in banking activities, banks tend to pool funding resources rather than to earmark specific liabilities to specific assets, in particular in the context of modern centralized Treasury management practices where specific units are in charge of funding all the balance sheet activities of their bank. This index would thus have self-stabilizing features: it would encourage banks, to ensure a close match between their indexed assets and liabilities, and to diversify systematically their financing sources, an objective that is currently at the heart of regulators' agenda to promote financial stability. To be fair the dominance of Libor-type benchmarks for asset indexation actually generates large mismatch risks, that banks at times try to handle through the use of basis risk derivatives like the Euribor/OIS swaps, when they do not simply leave this gap open, creating massive risks to their balance sheets.<sup>18</sup> This type of benchmark may naturally reduce this gap.

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<sup>18</sup> As evidenced in 2008 when the basis swap spread surged from a couple of basis points to more than 300 bps suggesting a "rush to the exit" attempt to square this exposure, something that had to be done at a sheer cost.

This total cash pool index would thus be a fair representation of banks funding conditions: indeed, it would reflect the credit component of their interbank borrowing costs, would also reflect the quality of their asset base (a component of their credit standing) through the borrowing cost of their secured operations, and have a stabilizing effect by inducing a funding behavior that would reduce risks of funding mismatches. Transitional issues could be managed by a coexistence of this new index with current Libor-type references, this allowing a smooth market-driven migration to the new reference. The phasing-in of the new index would permit to gradually index newly issued or traded products (IRS, cash instruments like FRNs) on the new reference, while letting instruments indexed on the legacy reference expire gradually. This would help deal with the transition for short-dated instruments. Regarding longer-dated instruments the possible convergence of the two reference curves (likely if the new index is acknowledged by market practitioners as solid and becomes an anchor) could facilitate the migration: quasi-similar pricing curves could allow least-cost NPV adjustments of these books to the new reference, while allowing counterparts desiring to remain indexed to the legacy references to stay put.<sup>19</sup> The gradual transition to a TCPI-type index could also be facilitated by a larger recourse to OIS-related references that could serve as an interim solution.

Yet, it is fair to recognise that this approach would represent a stark departure from the current model. In that sense it would probably be seen by financial industry as cumbersome procedure entailing significant migration costs also raising issues in terms of continuity of contracts. However, these costs should really first be established and, if significant, they would be offset in the long-run by the robustness of this benchmarking framework, something that may contribute to a general narrowing of funding spreads. In addition, the public sector could contribute to ease the transition by hastening the regulatory, accounting, and other institutional changes required in the migration process (BIS, 2013). Another criticism could be related to the risks of misreporting by banks if the reporting system is seen as too complex in nature. Again, such risks could be drastically reduced if the changes are reflected from the onset in a joint effort between practitioners and banking associations to improve the transparency of the financial industry. By definition, this requires time so that this possibility should be addressed right now to be implemented in few years.

#### IV. CONCLUDING REMARKS

The reports of alleged manipulations of Libor, Tibor and Euribor benchmarks—triggering legal investigation in various jurisdictions—while troublesome and revealing of deep ethical issues that have plagued financial markets also shed light on an important reality: the

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<sup>19</sup> A smooth transition to a new indexation framework while keeping legacy indexes alive is not unprecedented. The launch of the Euro and of new OIS indices post 1998 created similar situations whereby longer-dated instruments were either re-indexed or kept on legacy indices, which are still published now while hardly ever used for new issuance 15 years after the transition to the Euro (e.g. the bond indices like the [T4M](#), [TAM](#) or [TAG](#) that were derived from the French overnight index).

observed extinction of the market segment that served as basis for the calculation of money market fixing references. Interest rate derivatives on major currencies, with notional outstanding amounts adding up to hundreds of trillions of exposure, are mostly indexed on these benchmarks, and so are hundreds of billions of loans to enterprises, mortgages and other retail loans to the real economy. Yet, the prevailing role of these benchmarks appears to be more a legacy from history rather than reflecting today's structure of banks' funding.

Furthermore, potential abuses in other currencies have also put into question the credibility of this benchmarking framework, a method based on declarative quotes provided by few surveyed financial institutions, subject to no constraints other than reputational and ethical. That issue appears valid in the general context of the financial markets and especially for the money market. In addition, the general perception of substantially damaged activity in the term unsecured segment of that market (not only attributable to the recent crisis but also, for a part, reflecting secular trends in the funding of financial institutions that emerged before the crisis) has also contributed to casting doubt on the representativeness of the benchmarks so produced. Consequently, questions have arisen on potential improvements to their calculation methodology or on their outright replacement.

After recalling the main changes that unfolded over the last twenty years in the wholesale funding of banks (impacting in turn the relative importance of the various segments of the money market), this paper discusses the technical features and implications of various options to move towards a new benchmarking system in the money market.

Numerous options are currently discussed in various fora. This paper contends that the representativeness of the new benchmarking system for banks actual wholesale funding costs should be the key parameter to distinguish the different candidates. In this regard, the currently low market activity in the term unsecured segments of the money market appears to be an important weakness of a trade-weighted reference rate, especially within the post-crisis environment. By contrast, a replacement of interbank offered rates by swap indexes based on trade-weighted overnight reference rates appears to be a more promising avenue since this instrument displayed an impeccable liquidity performance even at the climax of the crisis tensions. Beyond these basic and immediate options this paper also argues in favor of a more ambitious benchmark design that would consist of a systematic calculated pooling of all short-term wholesale funding operations of banks, which could overcome the issue of the potential shallowness of each specific sub-component of the wholesale funding market.

Any change of benchmark shall have considerable legal implications given of the outstanding amount of interbank offered rate-referenced derivative products. They are unavoidable. Beyond those implications, it is indisputable that any successful new benchmarking system will require the endorsement of the financial industry. It is therefore necessary to intensify the exchange of views with practitioners to move gradually towards a representative, relevant and lasting new benchmark reference rate in the money market.

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