



# NEWSLETTER AIFIRM

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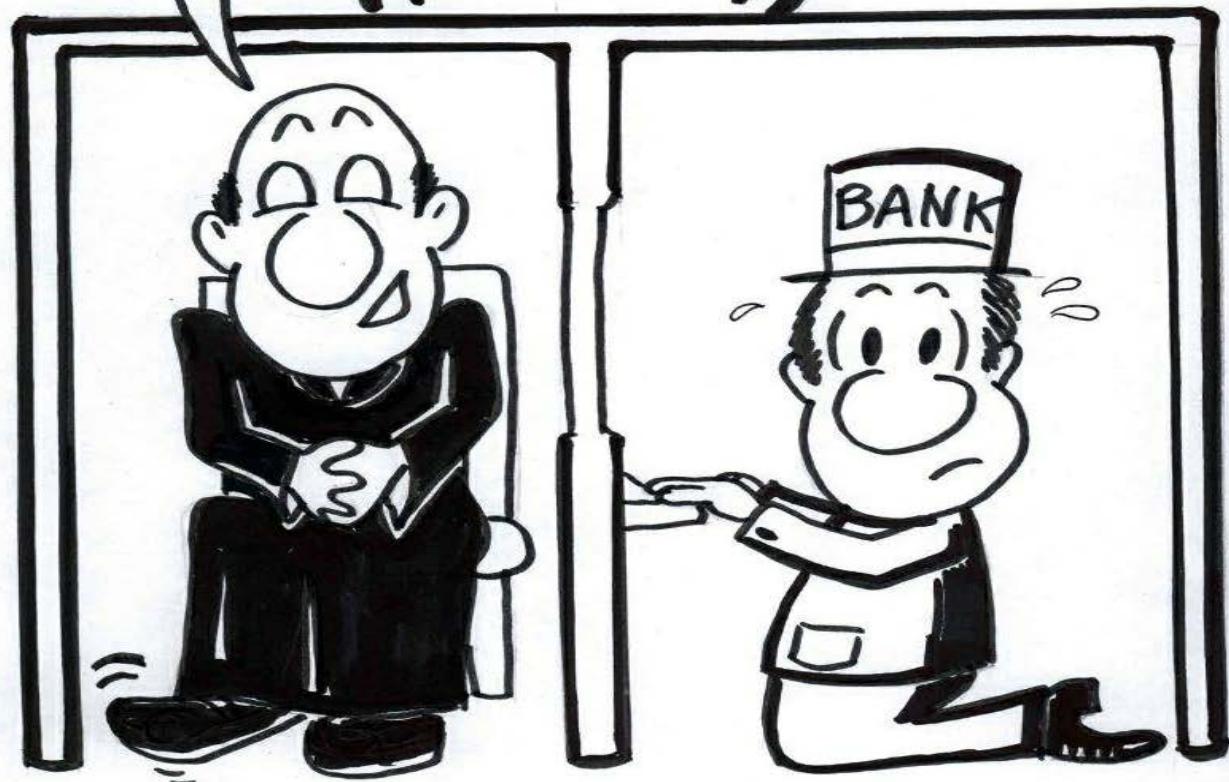
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Gli articoli che sono proposti alla rivista per la pubblicazione sono sottoposti in forma anonima a due successivi livelli di referaggio.

Il primo livello di referaggio (di ammissibilità) viene effettuato sull’articolo dai membri del Comitato di Direzione che ne valutano la congiuntà ai temi trattati dalla rivista.

Il secondo livello di referaggio (di pubblicabilità) viene effettuato sull’articolo da due referee scelti all’interno del Comitato di Direzione o all’esterno tra accademici, ricercatori, esperti della materia, che ne valutano il contenuto e forma.

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Maurizio Vallino

**Vignettista:** Silvano Gaggero

#### Proprietà, Redazione e Segreteria:

Associazione Italiana Financial Industry Risk Managers (AIFIRM), Via Sile 18, 20139 Milano

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Tel. 389 6946315

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**Le opinioni espresse negli articoli impegnano unicamente la responsabilità dei rispettivi autori**

**SPEDIZIONE IN ABBONAMENTO POSTALE AI SOCI AIFIRM RESIDENTI IN ITALIA, IN REGOLA CON L'ISCRIZIONE**



## EDITORIALE

Cari lettori,

interessi in territorio zero, otto anni di crisi economica, nuove e importanti commissioni passive per la DGS e la BRRD, maggiori requisiti di capitale da parte della BCE....

Non è difficile condividere che il sistema bancario italiano ed europeo stia attraversando il momento più difficile dal dopoguerra e che le richieste di maggiore capitalizzazione da parte della BCE siano coerenti con l'attuale instabilità e l'obiettivo di salvaguardare sia i risparmiatori sia le finanze degli stati.

Tali richieste di maggior capitale e più elevati oneri commissionali, pur corrette e nella direzione di dare nuova robustezza al sistema bancario europeo, cadono in una fase congiunturale già di per sé molto difficile.

Le aziende di credito poco redditizie a causa della fase economica, o comunque molto meno profittevoli rispetto al passato, faticano infatti, sia ad attrarre nuovi investitori, sia a generare il reddito necessario per autofinanziare una più elevata patrimonializzazione.

La sfida del settore è quella di ritrovare nuova redditività, coerentemente con la necessità di remunerare le addizionali porzioni di capitale richieste dalla Vigilanza europea.

Per tale aspetto gli amministratori solitamente fanno leva sulle funzioni commerciali della banca ma è opinione di chi scrive che gli strumenti di risk management possano avere un ruolo centrale nella creazione del valore.

Nuova redditività per le banche può pervenire dal miglioramento dell'efficienza allocativa con l'introduzione nel modello organizzativo di poteri delegati che prevedano spread differenziati in funzione del rischio del cliente per tutte le operazioni di impiego.

In un contesto recessivo fortemente influenzato dalla dinamica degli accantonamenti, adottare un sistema di deleghe basato su un approccio *pricing risk adjusted* può contribuire a:

- riportare in positivo la contribuzione dei clienti con rating peggiore intervenendo laddove lo spread percepito non remunera i fattori produttivi (rischio credito, capitale e liquidità);
- usare la leva del pricing per generare ritorni economici positivi su tutti i clienti (anche i peggiori);
- rimodulare i poteri delegati rendendoli coerenti con il rating e il relativo costo di accantonamento;
- rendere coerente a tale approccio l'attribuzione degli obiettivi alla Rete.

Il risk management e i suoi strumenti si candidano per ruoli che vanno oltre il controllo ex post, per fornire metriche e metodologie per la gestione anche commerciale delle banche.

Maurizio Vallino

## **Risposta di Prometeia alla consultazione “Interest Rate Risk in the Banking Book” del Basel Committee on Banking Supervision**

di Andrea Partesotti e Alina Preger (Prometeia)

### **ABSTRACT**

Uno degli effetti della crisi finanziaria è stata la massiccia risposta regolamentare che ha portato ad una profonda revisione della normativa prudenziale. Come noto, un focus importante ha riguardato il tema della liquidità, con l'introduzione dei due nuovi ratio LCR e NSFR, ma molto è stato fatto anche per un ulteriore rafforzamento del capitale, sia in termini di “qualità” che di “quantità”.

Il rischio di tasso di interesse è stato sino ad oggi mantenuto tra i cosiddetti “rischi di secondo pilastro” (Pillar 2), per i quali non è previsto un requisito di capitale minimo, ma a fronte dei quali le banche definiscono i propri presidi interni, che includono naturalmente anche il capitale. Tali presidi si basano su metodologie interne eterogenee, che riflettono approcci gestionali molto differenti. La principale motivazione per il mancato riconoscimento del rischio di tasso tra quelli di “primo pilastro” (Pillar 1) non è imputabile all'assenza di materialità, piuttosto è storicamente legata alla difficoltà di convergere, nel dialogo tra operatori di settore e regolatori, su un approccio di misurazione condiviso.

Il rischio di tasso di interesse del banking book (IRRBB) per sua natura mal si presta ad una rappresentazione standardizzata, essendo fortemente condizionato dai comportamenti della clientela –retail in particolare – molto eterogenei tra mercati e aree geografiche diversi. Per misurarlo, infatti, un ruolo cruciale è giocato dai modelli comportamentali interni alla banca.

### **La proposta del Comitato di Basilea**

In questo contesto si inserisce la recente proposta del Comitato di Basilea che – a completamento del lavoro di rafforzamento del quadro regolamentare di questi anni – intende riaprire il confronto sul rischio di tasso di interesse, con l'obiettivo di rafforzare il presidio patrimoniale delle banche, favorire la trasparenza e la comparabilità, e limitare l'arbitraggio regolamentare tra Banking e Trading Book.

Inoltre, il particolare contesto di mercato, con tassi di interesse al minimo storico, e la contestuale presa di posizione rispetto alla term structure da parte delle banche per sostenere il margine, ha generato una comprensibile attenzione anche da parte dei regolatori sui possibili impatti di un rialzo dei tassi.

La consultazione di Basilea propone in effetti due opzioni. La prima introduce un framework di Pillar 1, la seconda manterrebbe invece un contesto di Pillar 2 “rafforzato”. In entrambi i casi la proposta si caratterizza per l'introduzione di un nuovo modello standard.

### **La posizione di Prometeia**

Prometeia, unica tra le società di consulenza bancaria in Italia, ha risposto alle sollecitazioni del Comitato di Basilea esprimendo in materia la propria posizione.

Con riferimento alla metodologia proposta, trattandosi di un modello standard, vengono comprensibilmente introdotte alcune semplificazioni suscettibili di critica e/o affinamento. Tuttavia, rispetto al disegno complessivo, ci sembra che il modello proposto abbia tre limiti metodologici rilevanti, rispetto ai quali auspichiamo che il Comitato di Basilea possa introdurre dei correttivi e sui quali abbiamo incentrato la nostra risposta:

- vincoli fortemente penalizzanti della maturity comportamentale dei Non Maturing Deposits, che porterebbero ad una rappresentazione di questa poste non adeguata in termini di stabilità e stickiness, riducendo la duration media della raccolta;
- inclusione della componente di credit spread – significativa soprattutto per gli attivi – nel calcolo dell'EV sensitivity. Questo, all'opposto, condurrebbe a un incremento della duration degli asset;
- mancato riconoscimento delle strategie di investimento dell'equity, che, analogamente, non consentirebbe di riconoscere gli effetti di riduzione del rischio di tasso in termini di volatilità degli earnings.

Secondo noi l'effetto complessivo di questi elementi condurrebbe ad una errata valutazione della posizione di rischio di tasso della banca, certamente non desiderabile.

## Possibili implicazioni

Le implicazioni possono essere diverse, dipendendo dalla struttura di Balance Sheet delle singole banche. Assumendo che le banche oggi partano da una posizione di rischio allineata al proprio risk-appetite, possiamo immaginare che applicare un simile modello regolamentare le indurrebbe a riequilibrare la propria posizione di rischio, riducendo la duration degli attivi e/o incrementando quella della raccolta.

Effetto potenzialmente duplice e non auspicabile: da un lato, la sottostima del rischio effettivamente sostenuto dalle banche a fronte del rischio di tasso di interesse; dall'altro, la riduzione del margine da trasformazione delle scadenze, proprio in una fase storica di forte pressione sulla redditività delle banche in genere e sul margine di interesse in particolare.

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## Prometeia's response to BCBS Consultative Document on Interest rate risk in the banking book (June 2015)

### Main Remarks on the proposed standardised metric for measurement of IRRBB

As a premise, we understand the attempt of the BCBS to promote comparability and transparency for IRRBB across different banks and jurisdictions, by means of a standardised and simplified approach. At the same time, we are convinced that a common concern for a standardised model is that, given the peculiarities of banking products and customers' behaviour in different countries, especially in the retail market, standardisation is not suitable for IRRBB.

This is of course a general argument in favour of a pillar 2 approach. However, we fear that also in the proposed pillar 2 framework there could still be scope for the so-called "fallback" model in the Regulator's intention.

Starting from this premise, we would like to contribute to the discussion by addressing two main issues of the proposed standardised simplified model, which in our opinion represents a potential source of mismeasurement. The first one has to do with the technical specification of slotting in the time buckets the notional repricing cash flows, **including the spread component of interest cash flows**. The second one relates to the choice of very restrictive **constraints to the modelling of NMDs**, especially those received from retail customers.

As we will subsequently explain, mistreating of these two issues might have the unintended consequence of producing a measure of EV sensitivity not consistent with the measure of NII sensitivity, and may ultimately be incorrect. We observe that NII sensitivity can be broadly backtested against realised NII results and has shown, for instance mainly in Italy but not only, a long history of positive correlation to market rate movements (i.e. when market rates go up, the NII increases reaching a new "equilibrium" at a higher level). This is also the common opinion among practitioners. Consistently, we should expect that a bank which structurally benefits from a raise in interest rates in terms of NII (i.e. has a positive NII sensitivity), should show a positive EV sensitivity (economic value gains) under the same scenario.

Based on various analyses that we have carried out with our clients, our understanding is that models of NII and EV sensitivity should not lead to diverging measures of interest rate risk, provided that a consistent set of assumptions can be guaranteed.

### Spread component of interest cash flows

The instructions for allocating notional repricing cash flows in time buckets require slotting all coupon cash flows, including the spread component (when material).

Taking into account coupon cash flows is of course necessary in order to calculate the present value of any balance sheet item and is related to PV (or EV) sensitivity. Nonetheless we believe that a clear distinction should be made about the different risk drivers underlying the interest coupons of the banking book position when measuring interest rate risk. In fact, the EV sensitivity arising from a stream of credit spreads or commercial margins should not be ascribed to interest rate risk.

We will try to clarify our point by means of some examples.

Let's consider a commercial bank lending a floating rate bullet loan to a customer, with 10-year maturity, priced at Euribor 3m plus 250bps and funding it with a 3-year, floating rate bullet liability, priced at Euribor 3m plus 100bps.

Alternatively, we can consider another example, where the bank lends at a fixed rate, pricing at the 10-year swap rate plus 250bps, and then hedging the position by entering into a 10-year interest rate swap.

In both cases, the bank is not holding any open position in terms of interest rate risk, be it repricing risk, basis risk or any other dimension of interest rate risk. Nonetheless, applying the methodology prescribed in the simplified approach would highlight in both cases an open interest rate risk position: we would observe a duration of the loan significantly longer than the duration of the liability in the first case<sup>1</sup>, and a partial hedging of the swap in the second one.

The paradox would be that, in order to completely eliminate such risk position (in terms of EV sensitivity, under the simplified model), it would be necessary in the first example to fund the floating loan with a liability that has a longer repricing time (i.e. duration), while in the second example it would need an "extra hedge", pay fixed and receive floating, to cover the spread component of the loan (which is obviously unrealistic). The ultimate result would be to introduce a mismatch in the repricing profile of the bank, i.e. an open interest rate risk position, while pursuing a strategy to minimise internal capital for this risk.

In addition, we would like to point out that the spread component, especially for lending, is the *gross* income expected to remunerate other specific risk drivers, i.e. credit risk, and/or to cover operating costs. This means that representing in time buckets only the coupon *inflows* (the revenue) would fail to recognise the associated *outflows*, or costs, represented by expected losses and operational costs<sup>2</sup>.

The difference between EV measures including or excluding the spread component in our experience may range from 3% to 6% of regulatory capital for a 200bp parallel shock (of course figures depend on the Balance Sheet structure of the bank).

Finally, although risk management purposes should prevail on the accounting treatment and constraints, we observe that excluding the spread component is also consistent with the current approach adopted for hedge accounting in the definition of the hedged item and the calculation of its changing fair value (net of spread, to consider only the hedged risk, i.e. interest rate risk).

## Modelling of Non Maturity Deposit

The proposed Time Series Approach allows the use of internal estimates for modelling NMDs, but is subject to cap and floors in the parameters<sup>3</sup>. The bottom line is that it leads to a constraint in terms of total average duration of no longer than 1.8 years for transactional retail deposits and even shorter for the remaining categories.

We are aware that a great deal has been written and discussed on this topic, along with plenty of empirical evidence of the stability and stickiness of this source of funding. It is also our belief, given the analysis that we have carried out in the last two decades when modelling these positions for many financial institutions in the EMEA region and based on our evidence, overall average duration for retail NMDs may range up to 3 or 4 years (including more volatile and short duration components).

The impact on EV measures of the proposed constraints compared to the unconstrained use of internal models could be quite significant. Case studies performed on Italian banks show differences of up to more than 10% of regulatory capital for a 200bp parallel shock (subject to the particularities of each bank).

Furthermore, it should not be ignored that a distribution capped at 6 years, regardless of the final average duration, would keep from recognising the natural hedge in a longer time bucket for fixed rate loans, leading to a distortive measure especially when performing non-parallel shocks analysis.

<sup>1</sup> The impact of the credit spread component on the overall duration of a floating rate loan is actually significant: for example, a 6 month floating loan, 15-year maturity, with 250bps spread would be treated as having a duration of approximately 1.3 years, as compared to the 6 month duration of the pure base rate component.

<sup>2</sup> The inconsistency is most evident for the credit risk component of the spread when a risk free interest rate curve is then used for discounting.

<sup>3</sup> Caps on the stable part and to the maximum and average maturity of the core component; floors on the pass-through rate.

## Implications for EV measures

The two issues discussed above – constraints on NMD's modelling and the inclusion of the spread component – individually taken into account would lead to a significant mismeasurement of EV sensitivity. Furthermore, considering them together would lead to the unpleasant consequence of an inconsistent measure of EV sensitivity with the evidence of NII measures. The contradiction between NII and EV measures – a bank gaining money in terms of NII while losing it in terms of EV, under the same scenario, and vice versa - is counterintuitive and difficult to explain.

In fact, we can observe a long series of evidence showing that, in Italy as well as in many other banks in EMEA, a period of rising interest rates has brought on average higher interest margins for banks, and vice versa. This evidence is consistent with an overall ALM position of banks where assets – on average, but *structurally*<sup>4</sup> – reprice more quickly than liabilities, or in other words, where the financial duration of assets is shorter than the financial duration of liabilities.

In this situation, we would expect that models for measuring interest rate risk should provide consistent information given that assets reprice more quickly than liabilities. NII sensitivity should be positive with respect to a rise of interest rates, which is in fact a common finding. Consequently, the measure of EV sensitivity should provide the same type of information, which is to say, in the case of rising interest rates EV should increase (or at least should not be completely diverging as it would be with the proposed metric).

Instead, when relevant constraints and/or assumptions are imposed to the metric used for calculating EV sensitivity, especially when affecting cash flows in longer time buckets, the outcome could be significantly distorted. In fact, all else equal, the slotting of spread components would lead to erroneously measuring a longer duration for portfolios of long term loans; while at the same time, constraining the maximum maturity and duration of NMDs would lead to a shorter duration for liabilities.

Ultimately, the total effect could turn out to be that NII sensitivity – given a scenario of rising interest rates – still remains *positive*, because in the short term there would be no major changes to the model and assets would keep repricing more quickly than liabilities. While on the other hand the EV sensitivity might actually result to be *negative* because of assets' longer duration and liabilities' shorter duration, eventually changing the sign of the measure, showing that in the case of interest rates rising the EV of the bank would decline.

## Equity capital investment assumptions

In addition to the above, we are aware that there is a third controversial issue that is evident when reconciling measures of NII and EV sensitivity, and it refers to the assumptions made for investment of equity capital<sup>5</sup>. It is unquestionable that investing own capital in long term duration assets will lead to a stable flow of revenue, together with a higher EV volatility of the assets themselves. In this case, there is no way to recompose the dichotomy: the ultimate risk position embedded in such a strategy depends on the point of view that the bank and the regulator are willing to adopt. If we look at the bank from a *going concern* point of view, then it would be more appropriate to assess risk in terms of NII sensitivity (there is no need to close the investment position). On the opposite side from a *gone concern* point of view, where the objective is to look at the bank in terms of liquidating value, the EV sensitivity would be the right measure.

Should the former approach prevail (*going concern*), which is the case in the everyday management of IRRBB, then it would be correct to take into account equity capital by explicit modelling (as long term funding), both in NII and EV metrics. Doing so, both models would catch the earning stabilisation effect of the investment strategy, leading once again to measures of NII and EV sensitivity consistent with one another<sup>6</sup>.

<sup>4</sup> "Structurally" means that it is not just a short term effect, but that higher interest rates lead to long-lasting higher NII for banks.

<sup>5</sup> To be more precise, we think that investment assumptions should be made with reference to free capital only, i.e. the portion of equity that directly funds interest rate bearing assets. This is also in line with recent EBA guidelines on this topic (*Guidelines on the management of interest rate risk arising from non-trading activities, EBA/GL/2015/08*).

<sup>6</sup> Please note that NII sensitivity, in our understanding, is not limited to a short-term time horizon analysis, where particular repricing dynamics might have – in the very short term – different impacts, eventually diverging with respect to the overall IRR position of the

## Other issues

In this section we would like to provide some short comments about specific features of the proposed standardised model that, in our opinion, could be made more in line with current industry practices for the measurement of interest rate risk.

### a) Behavioural modelling for prepayment options in retail loans

The proposed standard model allows banks to use their internal estimates for prepayment rates, but then set a number of fixed parameters (multipliers) to shock those prepayment rates under different scenarios. We observe that, while interest rate shocks may vary over time, depending on volatility and level of interest rates, prepayment rate multipliers are constant for each scenario. In other words, we could say that prepayment rates are intended to be *scenario* dependent, but not *shock* dependent<sup>7</sup>.

We also observe that the phenomenon of prepayment is not limited to *fixed* rate portfolios, but it is also relevant for *floating* rate loans, which for instance in Italy represent a large majority of retail loans. The impact of prepayment on floating rate loans could be significant and should, therefore, be taken into account especially in the case in which the Committee should confirm the metric based on EV including spread<sup>8</sup>.

### b) Behavioural modelling of exposures other than NMDs

We notice that behavioural models for NMDs are explicitly taken into account, although with some caveats, thus recognising the common practice for interest rate risk management of these exposures. However, there are other type of positions that are commonly managed by means of behavioural models but are treated at contractual terms in the proposed metrics. In particular we can mention non-maturity assets (NMAs) or overdraft, which can be modelled similarly to NMDs, leading to a behavioural maturity and duration different from the contractual one (which is overnight), and Term Deposits<sup>9</sup>.

Term Deposits in some jurisdictions represent an important source of funding from retail customers. Lacking an alternative, such as current or saving accounts despite their short term contractual maturity, they are subject to continuous roll-over at pricing conditions that are not (or not completely) market driven. In this case, the behavioural model allows representing them as a stable and sticky source of funding, not different from NMDs. The standard metric does not recognise so far such modelling, while considering to apply an early redemption rate (where relevant), further reducing the expected maturity of these positions and thus leading to a potential mismeasurement of interest rate risk.

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bank over the entire time horizon. Nonetheless, regardless of the very short-term dynamics, when extending the NII analysis to a longer time horizon, the two metrics should lead to broadly consistent outcomes.

After all, measuring NII sensitivity over the long-term time horizon, and taking its present value, must lead to analogous results than using an EV approach, being the two metrics are just different ways to look at the same phenomenon.

Finally, we must underline that what is discussed here, about the comparability of NII and EV measures, refers to **static models**. We are aware that ALM frameworks often encompass dynamic B/S simulation for the measurement of earnings volatility, based on new business assumptions: new business is not relevant in terms of interest rate risk for market-priced positions, while it might be quite significant for non-interest bearing deposits (or equity). In this case, a NII dynamic model is able to catch and measure a component of interest rate risk, which is neglected when relying only on static models. On the other hand, dynamic models based on new business assumptions can be applied only to a limited time period (no more than 3 or 5 years), in order for the assumptions to be realistic: this means that dynamic simulation is not suited to measure the interest rate position of the bank over the entire time horizon.

<sup>7</sup> For example, the multiplier implicit in an internal model would be 0.84 for a +100bp parallel shock, and 0.69 for a +200bp parallel shock, while the proposed scenario multiplier is 0.75.

<sup>8</sup> In fact, excluding the spread component, a portfolio of floating rate loans would have a very short duration, equal to the average repricing time, regardless of actual or behavioral maturity of the loans.

<sup>9</sup> This issue is probably well known, since the Committee is asking banks to provide their figures for NMAs and other exposures “less or not amenable to standardization” within the QIS exercise (panel F)

### c) Non-performing assets

According to the proposed standard model, interest rate risk is measured only for interest rate sensitive assets and liabilities. It is not specified, however, what should be the treatment of non-performing assets, which have, unfortunately, reached significant volumes (as is the case for the Italian banking sector). More specifically, we observe that there are different practices in the industry for managing these exposures for interest rate risk purposes. For example, in some cases, *bad loans* are treated as fixed rate assets (non-interest bearing), amortising according to the expected recovery schedule. In other cases, they are considered just like non-interest sensitive assets, and then excluded from the analysis (they are considered to be funded by equity, thus reducing the free capital component).

On the other hand, there is another component of non-performing loans, *past due* and so-called “*unlikely to pay*” exposures, which – from an accounting point of view – maintain their contractual interest rate characteristics, although the expected cash flows could be significantly different from the contractual ones.

We believe that it could be beneficial in terms of clarity and comparability to address this topic explicitly when defining a standard framework for interest rate risk.

### d) Automatic Interest Rate Options (IRO)

The proposed standard model requires evaluating the EV sensitivity of IRO to interest rates and volatility shocks. However, the analysis is limited to *sold options* and to *bought options used to hedge a sold option*. It is not clear the reason for exclusion and the treatment of *bought options not used to hedge a sold option*. This could be for instance the case of embedded options in portfolios of floating rate loans with a *floor*. The floor is an option bought from customers and this type of product is quite common in the retail market. Neglecting to include these specific options in the analysis can lead to a mismeasurement of interest rate risk<sup>10</sup>.

Furthermore, the proposed standard model fails to evaluate the impact of automatic options on NII measures, while their impact on NII dynamic can be substantial.

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<sup>10</sup> Also in this case, the QIS exercise is collecting data for all Automatic Options.

## Monetary transmission models for bank interest rates

Laura Parisi (University of Pavia), Igor Gianfrancesco (Banco di Desio e della Brianza), Camillo Giliberto (Banca Monte dei Paschi di Siena), Paolo Giudici (University of Pavia)

### Abstract

Monetary policies, either actual or perceived, cause changes in monetary interest rates. These changes impact the economy through financial institutions, which react to changes in the monetary rates with changes in their administered rates, on both deposits and lendings.

The dynamics of administered bank interest rates in response to changes in money market rates is essential to examine the impact of monetary policies on the economy. Chong et al. (2006) proposed an error correction model to study such impact, using data previous to the recent financial crisis.

In this paper we examine the validity of the model in the recent time period, characterized by very low monetary rates. The current state of close-to-zero interest rates is of particular relevance, as it has never been studied before.

Our main contribution is a novel, more parsimonious, model and a predictive performance assessment methodology, which allows to compare it with the error correction model.

We also contribute to the literature on interest rate risk modeling proposing a forward looking method to allocate on-demand deposits to non-zero time maturity bands, according to the predicted bank rates.

### 1 Introduzione

Monetary policies, such as variations in the official rate or liquidity injections, cause changes in monetary interest rates. These changes impact the economy mainly in an indirect way, through financial institutions, which react to changes in the monetary rates with changes in their administered rates, on both deposits and lendings.

The dynamics of administered bank interest rates in response to changes in money market rates is essential to examine the impact of monetary policies on the economy. This dynamics has been the subject of an extensive literature; the available studies differ, depending on the used models, the period under analysis and the geographical reference.

The relationship between market rates and administered rates is a complicated one and the evidence presented, thus far, is mixed and inconclusive. Hannan and Berger (1991), for example, examine the deposit rate setting behavior of commercial banks in the United States and find that (a) banks in more concentrated markets exhibit greater rates rigidity; (b) larger banks exhibit less rates rigidity; and (c) deposit rates are more rigid upwards than downwards. Scholnick (1996), similarly, finds that deposit rates are more rigid when they are below their equilibrium level than when they are above; his finding on lending rate adjustment, however, is mixed. Heffernan (1997) examines how the lending and deposit rates of four banks and three building societies respond to changes in the base rate set by the Bank of England and finds that (a) there is very little evidence on the asymmetric nature of adjustments in both the deposit and lending rates, (b) there is no systematic difference in the administered rate pricing dynamics of banks and building societies, and (c) the adjustment speed for deposit rates is, on average, roughly the same as that for loan rates.

More recent papers on the same issue include: Ballester et al. (2009), Chong et al. (2006), Demirguc-Kunt and Huizinga (1999), Flannery et al. (1984), Maudos et al. (2004), Maudos et al. (2009). Among them, Chong et al. (2006), who applies and extends Engle and Granger (1987) error correction model has become a reference paper, in both the academic and the professional field.

The empirical evidence contained in all the previous papers can be summarized in the following points: (a) bank rates react with a partial and delayed change to changes in the monetary rates; (b) the speed and the degree to which they follow these changes present substantial differences between the various categories of banking products and between different countries.

The previous conclusions have been obtained for a relatively stable time period, previous to the emergence of the recent financial crisis.

After 2008, however, we have witnessed substantial changes. From a macroeconomic viewpoint, monetary interest rates are now, in most developed economies, close to zero, or negative; from a microeconomic viewpoint, bank management has changed substantially, for the compression of interest margins and for the increase in regulatory capital requirements. The effects of the previous changes on the transmission of monetary policies have not been yet fully investigated. In particular, the current state of close-to-zero interest rates is of particular relevance, as it has never been studied before.

When monetary rates are close to zero, the error correction model, albeit formally elegant, does not well capture the dynamic of administered rates, which appears strongly inertial.

The need of adapting the error correction model to the current situation is very relevant, not only from a macroeconomic point of view, but also from a microeconomic bank perspective and, in particular, in the measurement of interest rate risk, and in the related asset and liability management policies.

The current regulatory framework requires that banks measure interest rate risk, and disclose it, within the calculation of the internal economic capital. This implies that the lending activity of a bank should be calibrated also on the basis of the economic capital required to cover the additional interest rate risk. Indeed, in a typical commercial bank, interest rate risk is the second risk in size, after credit risk.

There is a limited scientific literature on interest rate risk modeling. This type of risk has assumed some importance as a result of the crisis of American Savings and Loans of the eighties. Immediately after such breakdown, in fact, economists developed

the Federal Reserve Economic Value Model, based on the economic value perspective. Such a model is described, for example, in Houpt and Embersit (1991), English (2002) and English et al. (2012).

In 2004 the Basel Committee (BIS, 2004) published the final version of the technical document entitled "Principles for the management of the interest rate risk", which proposes a measurement methodology based on the same logic underlying the model developed by the Federal Reserve. The model proposed by the Basel Committee has been the subject of further academic research, carried out, for example, by Fiori and Iannotti (2007), and by Entrop, Wilkens, and Zeisler (2009). A key research issue that has emerged is the treatment of on-demand positions, which are the ones with the highest reactivity to monetary rate changes. Blochlinger (2015) has shown that on-demand positions are very important risky options, and have shown how to hedge their embedded risk.

On-demand positions are present in both the lending and in the deposit side of the balance sheet. However, on-demand deposits are more relevant, being exogenous to the bank, and with a "real" maturity that is much longer than what implied by their on-demand contractual nature. Indeed, regulatory authorities, such as the Basel Committee, suggest that, for the calculation of interest rate risk, on-demand deposits (but not lendings) could be allocated to different time maturity bands, from very short ones (up to one month) to long ones (more than twenty years).

The first aim of this paper is to broaden the error correction model of Chong et al. (2006), in a predictive performance comparison framework. Our results show that the error correction model performs quite well in a predictive sense. We also show that a more parsimonious model, described by only one equation, rather than two, is not inferior in terms of predictive performance, and, therefore, represents a valid alternative.

The second aim of the paper is to propose an allocation structure for on-demand deposits based on the predicted term structure of bank interest rates, based on a forward-looking perspective, rather than on a historical, backward-looking one, as done in the current practice.

Our proposed methods are applied to data from the recent period (1999-2014), of a southern European country, with a traditional banking sector: Italy.

The paper is structured as follows. Section 2 describes the proposed models and, in particular: Section 2.1 describes the error correction model; Section 2.2 motivates and introduces the new proposed model; Section 2.3 provides the predictive performance environment used to compare the two models; Section 2.4 presents our proposal for the allocation of on demand deposits. Section 3 shows the empirical evidence obtained from the application of the models and, in particular: Section 3.1 describes the available data; Section 3.2 presents the estimation results obtained when the models are applied to such data; Section 3.3 compares the models in predictive performance; Section 3.4 contains the application of the models to interest rate risk measurement. Finally, Section 4 concludes with some final remarks.

## 2 Methodology

### 2.1 The Error Correction Model

In line with the contribution of Chong et al. (2006), the relationship between monetary rates and administered bank rates can be analyzed with the use of the Error Correction Model (ECM), following the procedure proposed by Engle and Granger (1987). The model is based on two equations. A long-run relationship provides a measure of how a change in the monetary rate is reflected in the bank rate. A short-run equation, which includes an error correction term, analyzes variations of the administered interest rates as a function of variations in the monetary rates.

Indeed, Chong et al. (2006) extended Engle and Granger by allowing the effect of the error correction term to depend on its sign. Their complete model can be formalized as follows:

$$\left\{ \begin{array}{l} BR_t = k + \beta \cdot MR_t + \epsilon_t \\ \Delta BR_t = \alpha \cdot \Delta MR_t + \delta_1(BR_{t-1} - \beta \cdot MR_{t-1} - k) + \\ \quad + \delta_2(BR_{t-1} - \beta \cdot MR_{t-1} - k) + u_t, \end{array} \right. \quad (2.1)$$

where

$$\begin{cases} \delta_1 = 0 & \text{if } BR_{t-1} - \beta \cdot MR_{t-1} - k < 0, \\ \delta_2 \neq 0 & \text{otherwise;} \end{cases}$$

$$\begin{cases} \delta_2 = 0 & \text{if } BR_{t-1} - \beta \cdot MR_{t-1} - k > 0, \\ \delta_1 \neq 0 & \text{otherwise.} \end{cases}$$

In equation (2.1)  $BR_t$  and  $MR_t$  represent, respectively, the bank administered rates and the monetary rates at time  $t$ ;  $\beta$  is a regression coefficient that gives a measure of the extent of the monetary rate transmitted on bank rates in a long-term perspective: in the case of  $\beta=1$ , the whole monetary rate is transmitted on the administered rate, while a value between 0 and 1 means that only a partial transmission mechanism occurs;  $k$  is a constant that synthetizes all other factors that, in addition to the dynamics of monetary rates, may affect the transmission mechanism of the monetary policy on bank rates as, for example, the market power and the efficiency of a bank;  $\varepsilon$  is the error term of the long-run equation;  $\delta_1$  and  $\delta_2$  represent the adjustment speeds converge towards the equilibrium level; finally,  $u_t$  is the error term of the short-run equation.

## 2.2 The proposed model

The aim of this subsection is to propose a bank rate model that, while based on the ECM, is more parsimonious and, therefore, easier to interpret and manage.

To achieve this aim we examine the main components of the error correction model, so to establish a statistical methodology for their simplification.

First, it is of interest to check whether the assumption of a double error correction coefficient, introduced by Chong et al. (2006), is justified and strictly necessary. To check this point the previous model can be compared, in a hypotheses testing framework, with the following nested model:

$$\begin{cases} BR_t = k + \beta \cdot MR_t + \epsilon_t \\ \Delta BR_t = \alpha \cdot \Delta MR_t + \delta(BR_{t-1} - \beta \cdot MR_{t-1} - k) + u_t. \end{cases} \quad (2.2)$$

Differently from equation (2.1) the model in (2.2) contains only one adjustment speed, so it does not admit the possibility of an asymmetric convergence of the administered interest rate to its equilibrium level.

Second, the error correction model contains one equation for the level of administered interest rates, and one for its variations. The two can be analyzed separately, with the simple regression models:

$$BR_t = k + \beta \cdot MR_t + \epsilon_t \quad (2.3)$$

$$\Delta BR_t = k + \beta \cdot \Delta MR_t + u_t. \quad (2.4)$$

While model (2.3) explains the levels of banking rates in terms of the level of monetary ones, equation (2.4) is a model for the variations of bank rates in terms of the variations of monetary rates. These models, albeit very simple, should be considered in practical applications, and compared in predictive performance with the error correction model, to check whether the latter can be simplified.

We anticipate that the above models are too simple to lead to a good predictive performance. However, the idea of replacing the error correction model with a one-equation one is tempting and, therefore, we now propose a one equation model that can be a valid competitor of the ECM. To achieve this aim we first examine the economic rationales behind the relationship we would like to investigate.

From a microeconomic viewpoint, as deposits are saving tools in competition with other instruments (such as bonds), it seems quite reasonable to assume that banks decide on the administered rate looking primarily at its level. Starting from the level, one can always obtain its variation through differentiation. A second consideration concerns the determinants of administered bank levels. Again, it is reasonable to think that bank deposit rates depend on both the level and on the variation of monetary rates. A third assumption, particularly important when monetary rates are close to zero, is that the level of deposit rates depends on the previous level of the same quantity, to allow for a slow and partial reaction to monetary rate changes, given that deposit rates affect considerably the income of a bank.

A macroeconomic perspective confirms the previous assumption: in particular, that is correct to consider, as a response variable, the level of the administered rate and not its variations. This because the relevant response variable for an expansion/restriction effect on the economy is represented by the level of the rates; on the explanatory side, we can model administered rate levels as a function of changes in the monetary rates, but also of their levels, which remain important even when close to zero.

On the basis of the above economic rationales, our proposed model is the following:

$$BR_t = k + \beta \cdot MR_{t-1} + \gamma \cdot \Delta MR_t + \delta \cdot BR_{t-1} + \epsilon_t. \quad (2.5)$$

The proposed model can be equivalently written in terms of the variations of the administered rates:

$$\Delta BR_t = k + \beta \cdot MR_{t-1} + \gamma \cdot \Delta MR_t + (\delta - 1) \cdot BR_{t-1} + \epsilon'_t. \quad (2.6)$$

To improve interpretability, the proposed model can also be expressed in a differential form:

$$\frac{dBR}{ds} = \beta \cdot \left[ \frac{dMR}{ds} \right]_{s=t} + \gamma \cdot \left[ \frac{d^2 MR}{ds^2} \right]_{s=t} + \gamma \cdot \left[ \frac{dBR}{ds} \right]_{s=t-1}. \quad (2.7)$$

The previous equation shows that the model can be interpreted as a "physical" description of the banking behavior in terms of deposit interest rates through its differentiation: the derivative of the bank administered rate depends both on the speed and on the acceleration/deceleration of monetary rates, as well as on the derivative of the administered rate with respect to its level in the previous time.

Note that the proposed model can be directly compared with the ECM with one adjustment speed. Comparing equation (2.2) and equation (2.5) it is clear that our proposal is a particular case of the latter, with some constraints on the parameters. By using the notational index 1 for the coefficients of the one-speed ECM and the index 2 for the coefficients referred to the proposed model, such constraints are the following:

$$\begin{cases} -\delta_1 k_1 = k_2, \\ -\delta_1 \beta_1 = \beta_2, \\ \alpha_1 = \gamma_2, \\ \delta_1 + 1 = \delta_2. \end{cases} \quad (2.8)$$

Note, in particular, that the last equation in (2.8) implies that  $\delta_1 - 1$  represents the adjustment speed to which bank administered rates react to changes in the monetary rates, equivalently as the parameters  $\delta_1$  and  $\delta_2$  of Chong et al. (2006) Error Correction Model.

A full comparison of our model with the ECM cannot be easily carried out in a statistical testing framework, as the two models are, evidently, not nested; however, they can be compared in terms of predictive performance and, for this purpose, the next Subsection introduces an appropriate methodology.

A different comparison between the two models can be carried out by looking at their time dynamics. This is of particular interest in the context of interest rate risk modeling.

For sake of simplicity we illustrate this comparison for the first three one-month rates and, then, for the general situation. For the error correction model, we consider the case of  $\delta_1 \neq 0$ ; the other case of  $\delta_2 \neq 0$  can be obtained analogously, replacing  $\delta_1$  with  $\delta_2$ . Then, assume that:

$$\begin{cases} \delta_1 \neq 0, \\ BR(0) = BR_0, \\ MR(0) = MR_0; \end{cases}$$

then, for the first month ahead:

$$\begin{aligned} BR_1 &= BR_0 + \Delta BR_1 = \\ &= BR_0(1 + \delta_1) + \alpha \Delta MR_1 - \delta_1 \beta MR_0 - \delta_1 k. \end{aligned}$$

For the second and the third month ahead, instead, we obtain:

$$\begin{aligned} BR_2 &= BR_1 + \Delta BR_2 = \\ &= BR_0(1 + \delta_1)^2 + \Delta MR_1(\alpha + \delta_1 \alpha - \delta_1 \beta) - \delta_1 \beta MR_0(2 + \delta_1) + \\ &\quad + \alpha \Delta MR_2 - 2\delta_1 k; \end{aligned}$$

$$\begin{aligned} BR_3 &= BR_0(1 + \delta_1)^3 + \Delta MR_1[\alpha + \delta_1(\alpha - \beta)(2 + \delta_1)] + \\ &\quad - MR_0 \delta_1 \beta [(1 + \delta_1)(2 + \delta_1) + 1] + \Delta MR_2(\alpha - \delta_1 \beta) - \delta_1 k(3 + 2\delta_1). \end{aligned}$$

For our proposed model, assuming the same initial values  $BR_0$  and  $MR_0$  for the bank and the monetary interest rates, we find the following equation for the first month ahead:

$$BR_1 = MR_0 \beta + \Delta MR_1 \gamma + BR_0 \delta + k.$$

whereas for the second and the third month ahead we obtain:

$$BR_2 = MR_0 \beta (1 + \delta) + \Delta MR_1 [\beta + \delta \gamma] + \Delta MR_2 \gamma + BR_0 \delta^2 + k(1 + \delta);$$

$$\begin{aligned} BR_3 &= MR_0 \beta (1 + \delta + \delta^2) + \Delta MR_1 [\beta + \delta(\beta + \delta \gamma)] + \\ &\quad + \Delta MR_2 [\beta + \delta \gamma] + \Delta MR_3 \gamma + BR_0 \delta^3 + k \delta (1 + \delta). \end{aligned}$$

From the above calculations we can derive a general iterative formula for both models, in order to calculate bank interest rates at any time  $t$  ( $BR_t$ ), as functions of the levels of bank rates at time  $t-1$  ( $BR_{t-1}$ ).

For the error correction model such iterative equation is:

$$BR_t = BR_{t-1}(1 + \delta_1) - \delta_1 \beta \left[ MR_0 + \sum_{s=1}^{t-1} \Delta MR_s \right] + \alpha \Delta MR_t - \delta_1 k. \quad (2.9)$$

Similarly, for our proposed model we obtain:

$$BR_t = \delta BR_{t-1} + \beta \left[ MR_0 + \sum_{s=1}^{t-1} \Delta MR_s \right] + \gamma \Delta MR_t + k. \quad (2.10)$$

### 2.3 Predictive performance assessment

While the assumption of a double error correction coefficient can be easily tested against a one error correction model, other simplifications of the ECM model require a more general set-up. This can be provided, for example, by a predictive performance framework that we are going to illustrate in this subsection. Doing so, we can enrich the error correction model with a validation procedure that is, to our knowledge, not yet available in the literature.

In order to predict bank rates, we need to estimate reasonable future values of the monetary rates. Consistently with the literature, we assume that their variation follows a Wiener process.

More formally, assume that we want to predict the level of monetary rates for each of the next 12 months. Let  $\widehat{\Delta MR}_i$  indicate the variation of the monetary rate in a given month. We then assume that  $\widehat{\Delta MR}_i$  are independently and identically distributed Gaussian random variables, so that:

$$\begin{cases} \widehat{\Delta MR} \sim N(0, \sigma^2) \\ \widehat{MR}_i = \widehat{MR}_{i-1} + \widehat{\Delta MR}_i \quad i = 1, \dots, 12. \end{cases} \quad (2.11)$$

Equation (2.11) describes a recursive procedure to obtain predictions of the monetary rates for a given year ahead, based on the Wiener process assumption. We can then insert the predicted monetary rates as regressor values in the models of the previous Subsection and, thus, obtain predictions for the administered bank rates. In particular, for model (2.1) we obtain:

$$\begin{cases} \widehat{BR}_i = \widehat{BR}_{i-1} + \widehat{\Delta BR}_i, \\ \widehat{\Delta BR}_i = \alpha \cdot \widehat{\Delta MR}_i + \delta_1 (\widehat{BR}_{i-1} - \beta \cdot \widehat{MR}_{i-1} - k) + \\ \quad + \delta_2 (\widehat{BR}_{i-1} - \beta \cdot \widehat{MR}_{i-1} - k) \end{cases}$$

where

$$\begin{cases} \delta_1 = 0 & \text{if } \widehat{BR}_{i-1} - \beta \cdot \widehat{MR}_{i-1} - k < 0, \\ \delta_2 \neq 0 & \text{otherwise}; \end{cases}$$

$$\begin{cases} \delta_2 = 0 & \text{if } \widehat{BR}_{i-1} - \beta \cdot \widehat{MR}_{i-1} - k > 0, \\ \delta_1 \neq 0 & \text{otherwise}. \end{cases}$$

For model (2.5) we obtain that:

$$\widehat{BR}_i = k + \beta \cdot \widehat{MR}_{i-1} + \gamma \cdot \widehat{\Delta MR}_i + \delta \cdot \widehat{BR}_{i-1}.$$

According to the standard cross-validation (backtesting) procedure, to evaluate the predictive performance of a model, we can compare, for a given time period, the predictions of monetary rates obtained with the previous equations with the actual values. To obtain a robust measurement we can indeed generate  $N$  scenarios of monetary rates, using (2.11), and obtain the corresponding bank rates, using either (2.1) or (2.5). On the basis of them we can calculate and approximate Monte Carlo expected values and variances of the predictions, as follows.

Let  $Y$  be a bank rate to be predicted at time  $i$ , with unknown density function  $f_Y(y)$ . The expected value of  $Y$  can then be approximated with

$$\widehat{\mathbb{E}(Y)} = \frac{1}{N} \sum_{k=1}^N y^{(k)}, \quad (2.12)$$

and its variance with

$$\widehat{\text{var}(Y)} = \frac{1}{N^2} \sum_{k=1}^N [y_k - \widehat{\mathbb{E}(Y)}]^2. \quad (2.13)$$

In the next section we will use (2.12) and (2.13) to compare model predictive performances. Before proceeding, we would like to remark that the random number generation at the basis of the Monte Carlo algorithm is pseudo-random, and depends on an initial seed. Different seeds may lead to different results so that models can not be compared equally. We have thus decided to use the same random seed for all models, so that the differences in performances are not biased by the Monte Carlo random mechanism.

## 2.4 On-demand deposits allocation

The allocation of on-demand customer deposits to an appropriate maturity time is a significant criticality in interest rate risk modeling, as well as in asset and liability management of banks, given their particular characteristics. The latter include: (i) the absence of a contractual maturity, with the correlated ability of the depositor to withdraw the funds at any time; (ii) the stability of the masses in time, along with the diversification of counterparties that makes total volumes basically constant; (iii) the partial and delayed reaction of banks as a result of changes in the monetary rate.

Theoretically, on-demand deposits could be assigned a zero maturity. Doing so, however, the term structure of the liabilities of a bank does not match the term structure of the assets which, especially on the lending side, is characterized by positions with different maturities. Asset and liability management becomes, therefore, based on an incorrect representation of the cash flows of a bank, and this may bias interest rate risk measurement. For example, an increase of monetary rates has a negative impact, lower than it should be, as the duration of liabilities is lower than the real one. Similarly, a decrease of monetary rates has a positive impact, lower than it should be.

Having established that a zero maturity cannot be the right time allocation for on-demand deposits, it remains the issue of finding an appropriate one.

On one hand, an allocation shifted towards short maturities reflects the contractual nature of these deposits, which are subject to withdrawal at any time; on the other hand, an allocation shifted towards long maturity reflects their stability as a major source of funding.

From an asset and liability management perspective, a correct procedure seems to allocate on-demand deposits to their actual maturity. This can be estimated statistically, analyzing the observed decay of the volumes of deposits: the approach followed, in current practice, by many banks. In this context, on demand deposits are split between a non core component, which remains at a zero maturity, and a core component, whose volumes in the different maturity bands are estimated by means of a moving average filter, such as that proposed by Hodrick and Prescott (1997).

From an interest rate risk perspective, it is important to consider what regulatory requirements prescribe. The Basel Committee on Banking Supervision does not give specific guidelines in its main documentation on interest rate risk modeling (BIS, 2004); it does so in the recent document on the Net Stable Funding Ratio (BIS, 2014), where it suggests a decay percentage of 5% or of 10% of on-demand deposits in the first year. National regulators are more prescriptive; for example, the Bank of Italy, whose data will be analyzed in the application Section, suggests to allocate 25% of deposits in the non-core component and to allocate the remainder in the following five years, with a 1/60 decay in each month.

Here we join the two perspectives and propose an allocation model that, while consistent with the regulatory methodology on interest rate risk, also takes the asset and liability management view into account. Specifically, we propose that the allocation of on-demand deposits to different time maturity bands is performed, once regulatory requirements are satisfied, using allocation coefficients that are function of the predicted administered rate changes.

More precisely, we propose to allocate the 75% of deposits (core component) proportionally to time band specific weight coefficients. Indicate a time period with  $j$ , with initial time  $i_j$  and final time  $f_j$ . We can allocate in it a volume that is equal to the total core component volume times the following weight:

$$W_j \propto e^{(BR_{f_j} - BR_{i_j}) \cdot (f_j - i_j)}$$

where  $BR_{fj}$  and  $BR_{ij}$  are the bank rates that correspond, respectively, to the final and initial time points of the  $j$ -th time band and the proportionality symbol means that, in order to obtain their correct value, the weights should be normalized dividing each of them by their sum.

The rationale behind our proposal is that, rather than using a constant allocation or a historical one, one can use an allocation of on-demand deposits that is based on the possible future evolution of interest rates, according to a forward-looking, rather than a backward-looking perspective. In this perspective, time periods with higher interest rates attract more volumes and, conversely, time bands with lower interest rates attract less volumes.

To calculate the previous weights, we can use the one-month ahead predicted bank rates described in Subsection 3.3. Let  $N=f_j$  be, without loss of generality, a specific time point (expressed in terms of months from the current date). The interest rate that corresponds to a maturity equal to  $N$ ,  $BR_N$ , can be obtained as follows:

$$(1 + BR_N)^N = \prod_{j=0}^{N-1} (1 + {}_j BR_1), \quad (2.14)$$

where  ${}_j BR_1$  are the forward one month ahead bank administered interest rates predicted at time  $0$ . For example, for the ECM model:

$$\begin{cases} {}_j BR_i = \widehat{BR}_{i-1} + \widehat{\Delta BR}_i, \\ \widehat{\Delta BR}_i = \alpha \cdot \widehat{\Delta MR}_i + \delta_1 (\widehat{BR}_{i-1} - \beta \cdot \widehat{MR}_{i-1} - k) + \\ \quad + \delta_2 (\widehat{BR}_{i-1} - \beta \cdot \widehat{MR}_{i-1} - k) \end{cases}$$

where

$$\begin{cases} \delta_1 = 0 & \text{if } \widehat{BR}_{i-1} - \beta \cdot \widehat{MR}_{i-1} - k < 0, \\ \delta_2 \neq 0 & \text{otherwise;} \end{cases}$$

$$\begin{cases} \delta_2 = 0 & \text{if } \widehat{BR}_{i-1} - \beta \cdot \widehat{MR}_{i-1} - k > 0, \\ \delta_1 \neq 0 & \text{otherwise.} \end{cases}$$

while for our proposed model:

$${}_j BR_i = k + \beta \cdot \widehat{MR}_{i-1} + \gamma \cdot \widehat{\Delta MR}_i + \delta \cdot \widehat{BR}_{i-1}.$$

We remark that our approach could be compared with others, in terms of interest rate risk impact. This in line with what claimed in Esposito et al. (2013), who emphasize the importance of assessing the sensitivity of interest rate risk to different allocations of on-demand deposits. We also remark that an approach for the allocation of on-demand deposits similar to ours has been introduced in Cocozza et al. (2015): the main difference is that, in that paper the authors use, rather than the predicted bank rates, the rates that correspond to a hypothetical \$pm 100\$ basis point variation of the monetary rate transmitted by the ECM model. Finally, we remark that Blochlinger (2015) propose to hedge on-demand deposits, seen as a risky option, using a forward looking perspective similar to ours, based on a non linear model for deposit rate jumps.

### 3 Data analysis and results

#### 3.1 Descriptive analysis

The recent financial crisis has had a major impact on the banking sector and, in particular, has led to a change in the relationship between monetary and administered rates and, therefore, to the transmission mechanisms of monetary policies. In the Eurozone, characterized by one monetary authority (the European Central Bank), that regulates still fragmented national markets, this effect is particularly evident: southern european countries, differently from what expected, have benefited very little from the drop of monetary rates that has followed the financial crisis.

To investigate the above issues we focus on a southern european country, Italy, for which the transmission of monetary impulses is particularly problematic, given the importance of the banking sector and the difficult economic situation.

Accordingly, we have collected monthly time series data on monetary rates and on aggregate bank deposits administered rates from the statistical database provided by the Bank of Italy, for the period ranging from January 1999 to December 2014.

For the purposes of our analysis, the monetary rate used in this paper is the 1-month Euribor. This choice has been based on the fact that this rate has a greater correlation with the administered bank rate with respect to the other monetary rates, such as the EONIA and the Euribor at 3 and 6 months, as can be seen in Table 3.1.

	EONIA	Euribor (1m)	Euribor (3m)	Euribor (6m)	Bank Rate
EONIA	1.0000				
Euribor (1m)	0.9904	1.0000			
Euribor (3m)	0.9801	0.9951	1.0000		
Euribor (6m)	0.9701	0.9876	0.9972	1.0000	
Bank Rate	0.9488	0.9512	0.9453	0.9333	1.0000

Table 3.1: Correlation matrix between the EONIA rate, the Euribor rates and the Bank administered rate

Figure 3.1 represents the time series of the chosen monetary rates, along with that of the aggregate administered bank rates on deposits, for the considered time period.

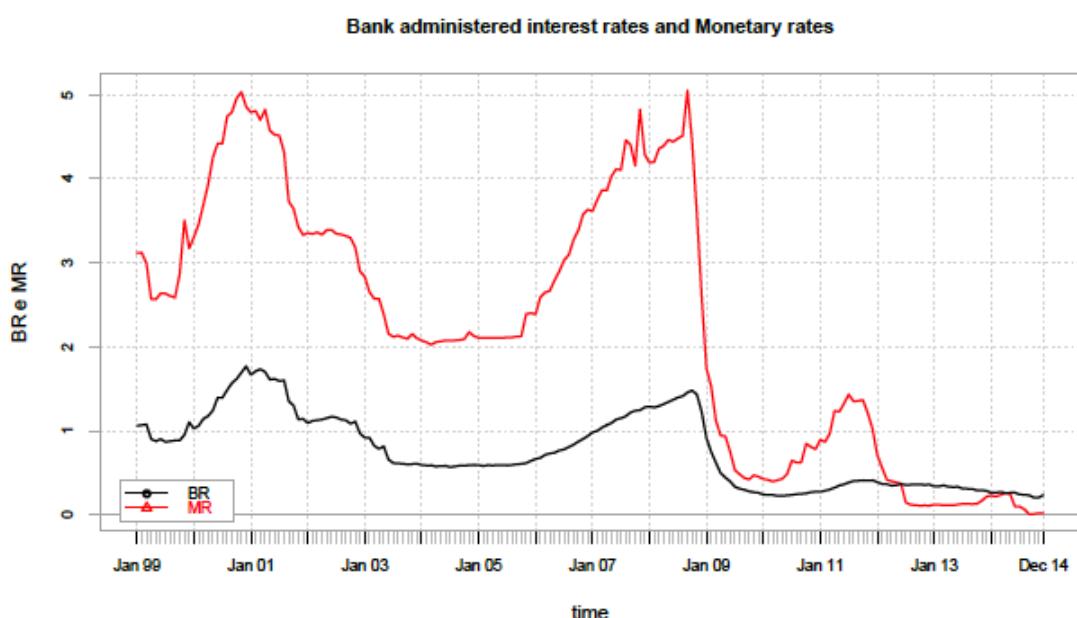


Figure 3.1: The observed monetary and administered bank rates

From Figure 3.1 note that both the administered and the monetary rates rapidly decreased in 2008 and 2009, while in the last two years they have remained quite stable and close to zero. Moreover, the two curves seem to have the same shape between 1999 and 2008, while the relationship between the two radically changes in the following years, leading to overlaps and different behaviors.

In other words, the correlation pattern between the bank administered rate and the monetary rate shows a very heterogeneous behavior: before 2008 they seem to have a stable relationship; in 2008 they both dropped; after that time they look stable and close to zero, with a relationship that is indeed quite different from the one observed before the crisis.

To obtain further insights, in Figure 3.2 we present the histogram and the corresponding density estimate of the two rates.

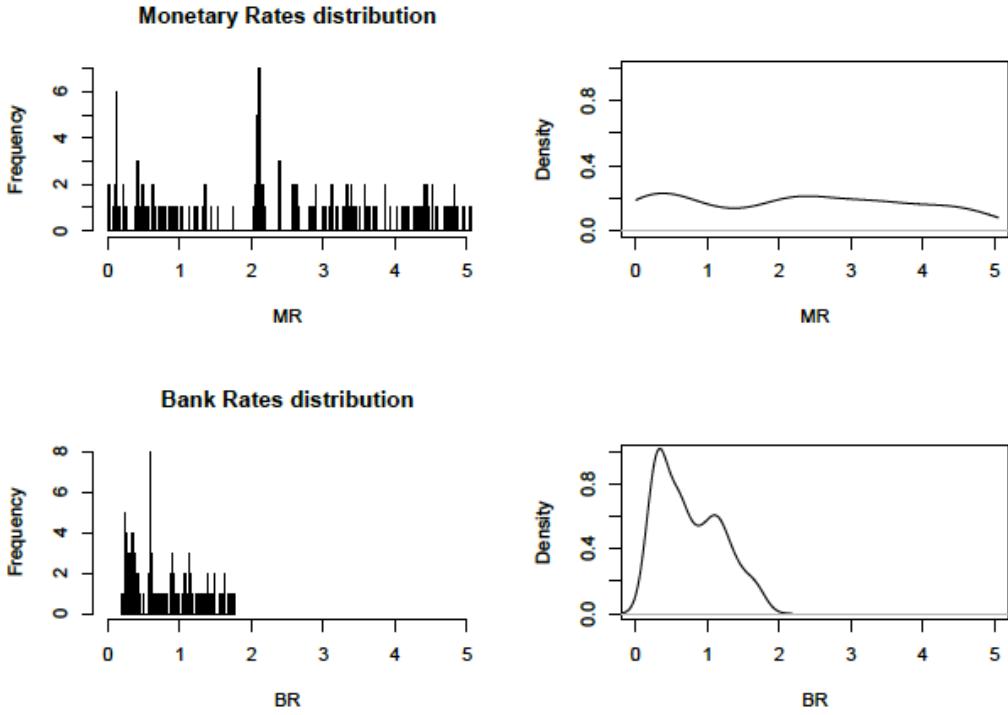


Figure 3.2: Distribution of the monetary and the administered bank rates

Figure 3.2 reveals that bank administered interest rates are more concentrated around their mean value, while monetary rates are quite spread.

It is also interesting to compare the distributions of the variations of the two rates, represented in Figure 3.3.

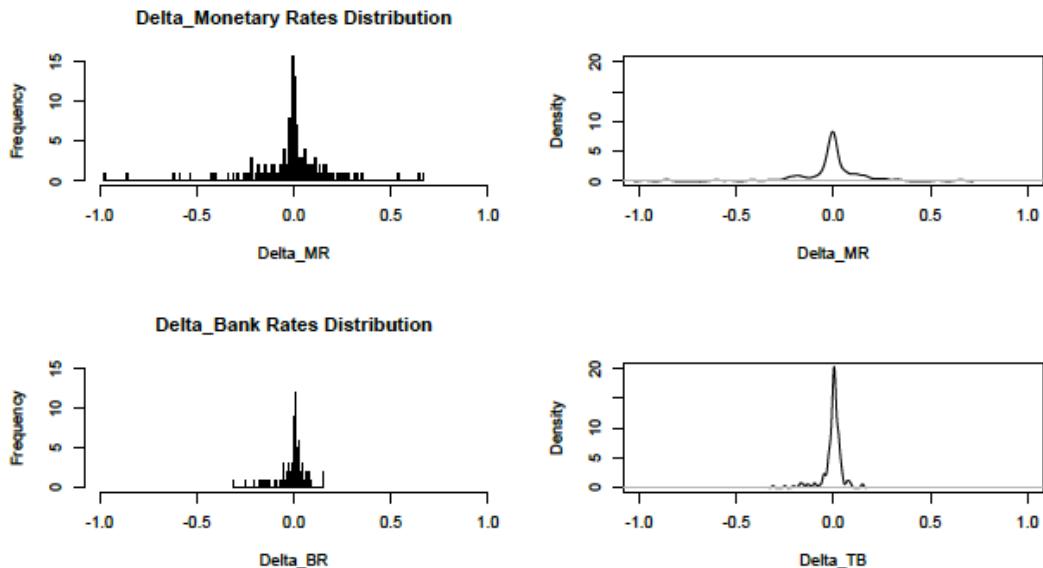


Figure 3.3: Distribution of the variations of monetary and administered bank rates

From Figure 3.3 note that the variations of the administered bank rates are more concentrated around zero, while monetary rates seem to have broader variations. Indeed, the behavior of  $\Delta MR$  justifies the assumption of considering the variations of monetary interest rates as a Wiener process, so that they can be modeled according to equation (2.11).

We have previously commented on the change in the relationship between the two rates, comparing the situation before and after 2009. This switching behavior can be easily seen by looking at the correlation between the rates and their variations. Table 3.2 shows the correlations between the rates and between their variations in the two periods (1999-2008) and (2009-2014), before and after the financial crisis.

	1999 - 2008	2009 - 2014	1999 - 2014
BR, MR	0.95	0.71	0.96
$\Delta BR, \Delta MR$	0.43	0.83	0.58

Table 3.2: Correlation matrix between rates and their variations, in different periods

From Table 3.2 note that the correlation between the levels of bank and monetary rates has decreased after 2009, while the correlation between the variations of the administered bank rates and those of the monetary rates has increased during the same period.

### 3.2 Model estimates

For the models proposed in Section 3.1 and 3.2 we now show the corresponding parameter estimates, considering the following four time series: (a) data from 1999 to 2007; (b) data from 1999 to 2008; (c) data from 2009 to 2013; (d) data from 1999 to 2013. This choice of data windows is consistent with the aim of investigating the switching behavior in the correlation structure of interest rates, which has occurred during the years 2008 and 2009. On the basis of this windows selection we intend to obtain predictions for the years 2008, 2009 and, finally, for the last available year, 2014. Predictions that can be compared with the actual occurred value, thus giving a measure of model predictive performance.

We now show the parameter estimates for all the considered models, including the two simple univariate linear models, and the four periods we have chosen. For each estimate we also report the corresponding *t-value*, and the  $R^2$  contribution of each model.

Table 3.3 shows the parameter estimates for the error correction model proposed by Chong et al. (2006) which, we recall, has two equations and, correspondingly, two  $R^2$  measures.

	1999 - 2007		1999 - 2008		2009 - 2013		1999 - 2013	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
$k$	-0.133	-3.426	-0.100	-2.542	0.263	12.265	0.146	7.896
$\beta$	0.351	29.741	0.341	29.425	0.138	4.836	0.271	41.114
$\alpha$	0.107	4.412	0.0909	4.863	0.096	4.430	0.126	7.455
$\delta_1$	-0.286	-5.028	-0.288	-5.513	-0.348	-11.214	-0.175	-5.154
$\delta_2$	-0.209	-4.194	-0.220	-4.680	-0.032	-0.813	-0.109	-3.008
$R^2$ long	0.893		0.880		0.287		0.905	
$R^2$ short	0.443		0.485		0.902		0.449	

Table 3.3: Parameter estimates for the error correction model with two adjustment speeds

From Table 3.3 note that, for the error correction model with two adjustment speeds, the results confirm a radical change in the relationship between the variables during the period under analysis: remembering that the long-run equation models the levels of interest rates, while the short-run equation is a function of the variations of the rates, it is clear that in the last few years the levels of the rates have become less and less important, while their variations have gained exploratory capacity. Table 3.4 shows the parameter estimates for the error correction model with one adjustment speed.

	1999 - 2007		1999 - 2008		2009 - 2013		1999 - 2013	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
$k$	-0.133	-3.426	-0.100	-2.542	0.263	12.265	0.146	7.896
$\beta$	0.351	29.741	0.341	29.425	0.138	4.836	0.271	41.114
$\alpha$	0.111	4.620	0.096	5.300	0.145	5.316	0.131	7.903
$\delta$	-0.242	-6.388	-0.250	-7.132	-0.235	-6.707	-0.144	-5.721
$R^2$ long	0.893		0.880		0.287		0.905	
$R^2$ short	0.437		0.480		0.822		0.444	

Table 3.4: Parameter estimates for the error correction model with one adjustment speed

From Table 3.4 note that the error correction model with only one adjustment speed shows results very similar to those reported in Table 3.3: in particular, it has similar  $R^2$  values, meaning that this simplified version of the error correction model fits past data quite well and, therefore, it may suffice. As a further confirmation, it can be shown that the equality assumption  $\delta_1 = \delta_2$  in Chong et al. (2006) model is rejected only in one of the four considered time windows.

Table 3.5 shows the parameter estimates for the simple linear model in terms of the levels of the bank interest rates.

	1999 - 2007		1999 - 2008		2009 - 2013		1999 - 2013	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
$k$	-0.133	-3.426	-0.100	-2.542	0.263	12.265	0.146	7.896
$\beta$	0.351	29.741	0.341	29.425	0.138	4.836	0.271	41.114
$R^2$	0.893		0.880		0.287		0.905	

Table 3.5: Parameter estimates for the linear model in terms of the levels of bank interest rates

From Table 3.5 note that the estimates obtained with the univariate linear model for interest rates are similar to those obtained by using the long-run equation of the error correction model.

Table 3.6 shows the parameter estimates for the simple linear model in terms of variations of bank interest rates.

	1999 - 2007		1999 - 2008		2009 - 2013		1999 - 2013	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
$\beta$	0.149	5.444	0.131	6.344	0.278	11.28	0.162	9.592
$R^2$	0.219		0.254		0.683		0.341	

Table 3.6: Parameter estimates for the linear model in terms of the variation of bank interest rates

From Table 3.6 it is clear that the univariate linear model for the variations of administered bank interest rates, calculated as a function of the variations of monetary rates, shows different results: first of all, the intercept term is not significant; secondly,  $R^2$  values have an opposite trend with respect to those in 3.5, increasing during the last period. This result is a further confirmation of the changing regime after 2009.

Table 3.7 shows the parameter estimates for our proposed model.

	1999 - 2007		1999 - 2008		2009 - 2013		1999 - 2013	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
$k$	-0.064	-4.394	-0.061	-4.561	0.077	8.498	-	-
$\beta$	0.100	9.369	0.098	10.992	-	-	0.042	6.205
$\gamma$	-	-	-	-	-	-	0.091	4.750
$\delta$	0.743	25.695	0.746	30.454	0.731	24.544	0.869	40.836
$R^2$	0.986		0.987		0.974		0.998	

Table 3.7: Parameter estimates for the proposed model

Table 3.7 shows that our new model presents an interesting behavior. For the whole period 1999-2013 all variables (apart from the intercept) are significant to describe the administered interest rates. But the situation changes if one concentrates on the first or on the second period: within the years 1999-2007 and 1999-2008 the variations of the monetary rates do not affect the level of bank rates; on the contrary, during the last period the only significant variable is the autoregressive component. This is a clear evidence of the fact that, when rates are close to zero as in the last few years, administered interest rates are not affected by monetary rates, or by their variations, but, rather, they depend only on their past values.

### 3.3 Predictive performance

After having estimated the coefficients of the different models we then predict monthly administered bank interest rates and their variations for 2008, 2009 and 2014, using a range of monetary rates scenarios, simulated from a Wiener process as previously described. In particular, for the 2014 prediction we performed the simulations by using the coefficients obtained both by considering the whole period (1999-2013) and the second part of the time range under examination (2009-2013). In Figure 3.4 a comparison between the predictions for 2014 (data from 1999 until 2013) obtained with the error correction model and our proposed model is shown.

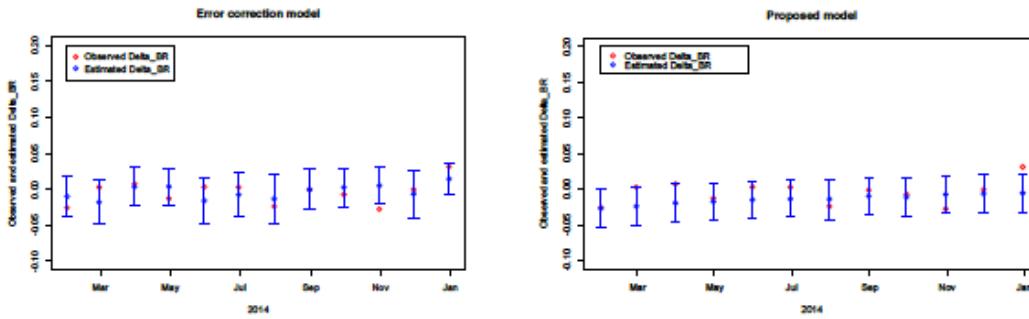


Figure 3.4: The estimated variations of administered interest rates for 2014, obtained with the error correction model and with our proposed model by using coefficients calculated on the whole period 1999 - 2013.

As a measure of predictive performance we have calculated the root mean square errors of the predictions from all models. Here we present the prediction results in terms of variations of bank rates rather than on their levels. This because, in this case, all the predictions are more challenging, being the variations on a smaller scale.

In Table 3.8 the root mean square errors of the predicted variations of administered interest rates obtained with the error correction model and our proposed new model are reported.

Model	2008 (1999-2007)	2009 (1999-2008)	2014 (2009-2013)	2014 (1999-2013)
Error correction model	0.055	0.171	0.016	0.003
Proposed model	0.065	0.069	0.014	0.018

Table 3.8: A comparison between the root mean square errors of the predictions of  $\Delta BR$

The first column of Table 3.8 refers to the prediction errors for the year 2008, obtained with the two selected models, and using coefficients estimated on data from 1999 to 2007. Similarly, the second and the third column report root mean square errors for 2009 and 2014. We decided to compare predictions on these crucial years because they represent the breaking points before and after which the relationship between the rates radically changes. The objective is thus to verify whether the two models can adapt to such strong variations in the underlying economic system. Note that the last two columns both refer to estimations for 2014, but the first one uses coefficients estimated only the second period data, while the second one is based on estimations on the entire period 1999-2013.

From the analysis of Table 3.8 some interesting conclusions emerge: (a) both models predict quite well future variations of bank interest rates; (b) the error correction model works better on the whole period and, most interestingly, (c) our proposed model supplies great improvements for the crucial year 2009. This means that the new model is much more flexible than the Error Correction Model, and it is able to capture essential changes in the economy not only from an estimation fit point of view, as seen in the last subsection, but also in a predictive perspective.

### 3.4 Application to interest rate risk

Movements in interest rates can have a negative impact on both the income results and on the economic value of a bank. This has given rise to two distinct, albeit complementary, perspectives to measure the exposure to interest rate risk: the income perspective and the economic value perspective. In the first one the analysis is based on the impact of changes in monetary rates on short-term profits and losses of banks; in the second one, instead, the attention is focused on the sensitivity of the assets and the liabilities of a bank to changes in monetary rates.

In this application we confine our risk measurement to on-demand deposits. For the evaluation of interest rate risk, we consider the allocation of such deposits in time maturity periods as described in Section 3.4. For ease of illustration, we consider only a one year period ahead. Table 3.9 and Table 3.10 describe the weight coefficients that result, respectively, from the application of the ECM and of the proposed model.

Maturity	1999-2007 (2008)	1999-2008 (2009)	2009-2013 (2014)	1999-2013 (2014)
Up to 1 month	0.0835	0.0793	0.0834	0.0834
From 1 to 3 months	0.1660	0.1644	0.1667	0.1666
From 3 to 6 months	0.2500	0.2516	0.2501	0.2511
From 6 months to 1 year	0.5005	0.5047	0.4998	0.4989

Table 3.9: Allocation weights for ECM

Maturity	1999-2007 (2008)	1999-2008 (2009)	2009-2013 (2014)	1999-2013 (2014)
Up to 1 month	0.0842	0.0803	0.0833	0.0838
From 1 to 3 months	0.1666	0.1667	0.1667	0.1682
From 3 to 6 months	0.2499	0.2511	0.2500	0.2513
From 6 months to 1 year	0.4993	0.5019	0.5000	0.4967

Table 3.10: Positioning coefficients for the proposed model

By comparing Table 3.9 with Table 3.10 note that allocation coefficients are quite stable across time periods: this is consistent with the fact that, for the predicted years (2008, 2009 or 2014), the monthly variations of administered bank rates are quite stable. The allocation weights are, therefore, essentially a function of the number of months in each time maturity period. If the allocation were done proportionally to the number of months, as suggested by some regulators, we would indeed get similar results.

Note also that the ECM and the proposed model lead to very similar allocations, and this is a further evidence that our model, being more parsimonious, should be preferred.

The measurement of the exposure to interest rate risk in the banking book from the income perspective takes place over a short-term period (called gapping period); in operating practice, this is usually equal to 1 year. According to this approach we can use the repricing gap model, which calculates the expected change in the interest margin (IM) as the result of a change in monetary rates. The corresponding formula is the following:

$$\widehat{\Delta IM} = \widehat{\Delta MR}_j \cdot \sum_j_{(t_j \leq T)} G'_{t_j} \cdot (T - t_j^*) = \widehat{\Delta MR}_j \cdot G_T^w, \quad (3.1)$$

where  $G'_{t,j}$  indicates a marginal time gap (= assets - liabilities),  $t_j^* = (t_j + t_{j-1})/2$  represents the average time maturity, and  $G_T^w$  indicates the cumulative gap.

In Table 3.11 we present, for each node in the term structure of interest rates, the impact on the interest margin of a positive change of 200 basis points (the Basel II level) in the level of monetary rates, when the ECM model is used to allocate volumes and it is assumed to consider core on-demand deposits totaling to 100 euro.

Maturity	$T - t_j^*$	1999-2007 (2008)	1999-2008 (2009)	2009-2013 (2014)	1999-2013 (2014)
Up to 1 month	0.9583	-0.1600	-0.1521	-0.1598	-0.1599
From 1 to 3 months	0.8333	-0.2768	-0.2740	-0.2778	-0.2777
From 3 to 6 months	0.6250	-0.3125	-0.3145	-0.3126	-0.3138
From 6 months to 1 year	0.2500	-0.2502	-0.2523	-0.2499	-0.2495
		-0.9995	-0.9929	-1.0001	-1.0009

Table 3.11: Expected changes in the interest margin for ECM

In Table 3.12 we present, for each node in the term structure of interest rates, the impact on the interest margin of a positive change of 200 basis points (the Basel II level) in the level of monetary rates, when our proposed model is used to allocate volumes.

Maturity	$T - t_j^*$	1999-2007 (2008)	1999-2008 (2009)	2009-2013 (2014)	1999-2013 (2014)
Up to 1 month	0.9583	-0.1614	-0.1540	-0.1597	-0.1605
From 1 to 3 months	0.8333	-0.2776	-0.2778	-0.2778	-0.2804
From 3 to 6 months	0.6250	-0.3124	-0.3139	-0.3125	-0.3141
From 6 months to 1 year	0.2500	-0.2496	-0.2509	-0.2500	-0.2483
		-1.0010	-0.9966	-1.0000	-1.0033

Table 3.12: Expected changes in the interest margin for the proposed model

Comparing Table 3.11 with Table 3.12 note that, as could be expected from the corresponding volume allocation tables, there are not substantial differences between the two models and across the different time periods, as could be expected for the similar allocation weights in Tables 3.9 and 3.10.

We remark that, in the above tables, we have considered the impact of an increase in monetary rates. The impact of a decrease is obviously opposite.

The measurement of the exposure to interest rate risk in the economic perspective can be based on the regulatory approach described in Basel II (BIS, 2004), which relies on the concepts of duration and modified duration. For a given (net) position, let  $F_t$  be the cash flow and  $t$  its corresponding maturity;  $MR$  represents the interest rate at maturity, and  $NP$  is the total net position market value. The duration  $D$  can be calculated as

$$D = \sum_{t=1}^T t \cdot \frac{F_t}{\frac{(1+MR)^t}{NP}}, \quad (3.2)$$

while the modified duration is

$$MD = \frac{D}{1 + MR}. \quad (3.3)$$

It is well known that variations in the market value of a position can be expressed by the formula

$$\frac{\partial NP_i}{\partial MR_i} = -NP_i \cdot MD_i, \quad (3.4)$$

so that the variation of the economic value of a bank can be expressed by

$$dEV = \sum_i \sum_j dNP_{ij}, \quad (3.5)$$

where  $i$  specifies a time slot (fourteen, according to BIS, 2014), while  $j$  considers different currencies.

The previous equations refer to the general case: remembering that net positions are defined as the difference between assets and liabilities, the sign in the second member of equation (3.4) becomes positive if we consider only on-demand deposits. Moreover, equation (3.5) can be simplified by considering its discrete version:

$$\Delta EV = - \sum_i \sum_j NP_{ij} \cdot MD_{ij} \cdot \Delta MR_{ij}, \quad (3.6)$$

In Table 3.13 we present, for each node in the term structure of interest rates, the impact on the economic value of a positive change of 200 basis points (the Basel II level) in the level of the monetary rate, when the ECM model is used to allocate volumes and it is assumed to consider core on-demand deposits totaling to 100 euro. We have employed the approximate duration suggested by the Basel Committee (BIS, 2004).

Maturity	Duration	1999-2007 (2008)	1999-2008 (2009)	2009-2013 (2014)	1999-2013 (2014)
Up to 1 month	0.0400	-0.0067	-0.0063	-0.0067	-0.0067
From 1 to 3 months	0.1600	-0.0532	-0.0526	-0.0533	-0.0533
From 3 to 6 months	0.3600	-0.1800	-0.1811	-0.1801	-0.1808
From 6 months to 1 year	0.7100	-0.7106	-0.7166	-0.7097	-0.7084
		-0.9505	-0.9566	-0.9498	0.9492

Table 3.13: Expected changes in the economic value for ECM

In Table 3.14 we present, for each node in the term structure of interest rates, the impact on the economic value of a positive change of 200 basis points (the Basel II level) in the level of the monetary rate, when our proposed model is used to allocate volumes, under the same assumptions as before.

Maturity	Duration	1999-2007 (2008)	1999-2008 (2009)	2009-2013 (2014)	1999-2013 (2014)
Up to 1 month	0.0400	-0.0067	-0.0064	-0.0067	-0.0067
From 1 to 3 months	0.1600	-0.0533	-0.0533	-0.0533	-0.0538
From 3 to 6 months	0.3600	-0.1799	-0.1808	-0.1800	-0.1809
From 6 months to 1 year	0.7100	-0.7090	-0.7126	-0.7100	-0.7053
		-0.9489	-0.9531	-0.9500	-0.9468

Table 3.14: Expected changes in the economic value for the proposed model

Comparing Table 3.13 with Table 3.14 note that, for the economic capital as well, there are not substantial differences between the two models and across the different time periods, as expected.

A comparison between the interest rate risk in the income rather than in the economic perspective shows that the main difference between the two is due to the different consideration of the time factor ( $T-t^*$ ) for the former and the duration for the latter.

## 4 Conclusions

The main contribution of this paper is in the understanding and improvement of the Error Correction Model, used in standard professional practice to model variations of the administered bank rates as a function of monetary rates. We add to the model a predictive methodology, that allows its validation, and propose a simpler to interpret one equation model, that can be seen as a special case of the ECM itself.

We also contribute to the literature in interest rate risk by suggesting a forward looking method to allocate on-demand deposits to non-zero time maturity bands, according to the predicted bank rates.

We have shown the implications of our proposals on data for the aggregate Italian banking sector, that concerns the recent period, characterized by a substantial shift in the relationship between monetary and bank rates, with the former getting close to zero.

Future research in this topic may involve the use of time-inhomogeneous stochastic differential equations and dynamic linear models, in order to improve the model ability to adapt to dynamic changes.

From an applied viewpoint, it may be of interest to analyze the relationship between monetary and bank rates also on the asset side, and derive a spread measurement.

Finally, a further extension should consider the microeconomic impact of the found relationships on the probability of default of both financial and non financial corporates, enriched with a systemic correlation perspective.

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Finally, the views expressed in this paper are those of the authors and they do not reflect the views or policies of their Institutions: Banco di Desio e della Brianza, Monte dei Paschi di Siena, University of Pavia.

Laura Parisi, Igor Gianfrancesco, Camillo Giliberto e Paolo Giudici

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# Un modello quantitativo a servizio delle valutazioni del rischio paese nell'attività di export

di Maurizio Vallino<sup>1</sup> (Banca Carige SpA)

## ABSTRACT

The financial crisis has induced businesses to offset the decline in domestic and European turnover by tapping into markets of emerging economies. The article explores the consequent country credit risk and proposes a model for managing this risk, in the framework of using the documentary credit.

La crisi finanziaria spinge le aziende a compensare il ridimensionamento del fatturato domestico e europeo con l'apertura ai mercati delle economie emergenti. L'articolo analizza il rischio paese che ne consegue e propone un modello di gestione di tale rischio, nell'ambito dell'utilizzo dello strumento del credito documentario.

## Premessa

La crisi finanziaria che ha colpito, a partire dal 2007, il mondo occidentale ha comportato, per l'Italia, un calo di PIL di quasi il 9% negli ultimi sette anni.

Tale diminuzione ha inciso, ovviamente, sulle aziende con conseguenti contraccolpi negativi sulle strutture finanziarie delle stesse.

Tra le strategie utili al loro miglioramento vi è quella di compensare il ridimensionamento del fatturato domestico ed europeo con un aumento di quello verso i paesi emergenti che sono state coinvolti nella crisi solo marginalmente e che presentano tassi di crescita dell'economia elevati e con perduranti potenzialità di espansione.

L'apertura verso nuovi mercati in Asia o in America latina comporta un processo di selezione dei paesi di interesse in funzione dei propri prodotti, di analisi delle regole di funzionamento del potenziale nuovo mercato, di contatti con i nuovi clienti stranieri e l'instaurazione delle nuove reazioni commerciali.

L'obiettivo del presente articolo è quello di analizzare il rischio paese che l'impresa assume con l'apertura di nuovi mercati utilizzando lo schema del credito documentario, strumento che garantisce il venditore in quanto trasferisce il rischio di credito in capo alla banca del compratore. (Tavola 1).

## L'analisi del rischio

Come si evince dall'analisi dello schema del credito documentario, l'azienda esportatrice è esposta al rischio che la banca del paese dell'azienda importatrice non adempia al pagamento; tale rischio può essere idealmente scomposto nel rischio paese (rischio di non adempienza derivante da difficoltà che colpiscono l'intero sistema finanziario della nazione) e nel rischio banca (rischio di non adempienza derivante da difficoltà che colpiscono la sola banca obbligata).

Ne consegue che l'azienda esportatrice, nella sua valutazione del rischio, debba analizzare entrambe le fattispecie avvalendosi, sia di un modello per valutare lo stato in cui risiede l'azienda importatrice, sia di un modello per valutare la banca che garantisce il pagamento.

Lo schema di analisi che si propone utilizza otto driver per il rischio paese (la categoria di rischio Sace, il rating, lo *spread* dei *Credit Default Swap*, il debito pubblico, il deficit annuo, la disoccupazione, i livelli dei tassi e l'inflazione) e sei driver per il rischio banca (l'affidabilità del paese, la solvibilità, la redditività, l'efficienza strutturale, l'efficienza allocativa e l'analisi andamentale).

L'obiettivo è quello di suddividere i paesi e le banche in diverse fasce di rischio e di affidabilità e di pervenire a un giudizio di sintesi per una prima valutazione rapida ed oggettiva sulla fattibilità dell'operazione di export.

Sono di seguito proposte, a titolo di esempio, alcune possibili regole di selezione che, naturalmente, possono essere riconsiderate da ciascuna impresa esportatrice in funzione del proprio «appetito» per il rischio.

Qualora il modello proposto fornisse indicazioni di inaffidabilità per alcuni paesi o per alcune banche questo non precluderebbe comunque la fattibilità dell'operazione in quanto l'azienda esportatrice potrebbe valutare di chiedere alla propria banca di confermare il credito documentario, cioè di assumerne i rischi finanziari, diventandone ulteriore garante anche se ciò, ovviamente, comporterebbe costi addizionali che potrebbero modificare la convenienza dell'operazione.

## L'analisi del rischio paese

Lo schema di selezione proposto prevede un primo cancello costituito dalla categoria di rischio di Sace, che fornisce un giudizio di affidabilità dei paesi con una scala da zero (i migliori) a sette (i peggiori).

Il modello proposto prevede di analizzare l'affidabilità solo dei paesi con giudizio Sace compreso tra zero e quattro, scartando a priori quelli con categoria di rischio pari o superiore a cinque.

<sup>1</sup> Le considerazioni espresse sono frutto esclusivo del libero pensiero dell'autore e non impegnano in alcun modo l'istituto di appartenenza. In collaborazione con la rivista "Amministrazione & Finanza"

### Gli indicatori

I paesi che superano il filtro di Sace vengono suddivisi in tre fasce di affidabilità e una fascia di non affidabilità, in funzione dei seguenti indicatori (Tavola 2):

- il rating: questo costituisce, nell'analisi di valutazione proposta, il secondo driver di valutazione da parte di un organismo esterno dopo quello di Sace che permette all'azienda esportatrice, tra l'altro, di confrontarsi con una valutazione quantitativa del rischio associato a ciascuna classe di rating. Le principali agenzie di rating, infatti, pubblicano le percentuali medie, minime e massime di default per ciascuna classe di rating, osservate in un ampio periodo storico. A mero titolo di esempio, Standard & Poor's mostra percentuali medie di default a un anno inferiori allo 0,1% per la classe A, del 0,2% per la classe BBB, del 1% per la classe BB e di quasi il 5% per la classe B.

Il modello prevede di considerare affidabili i paesi con rating sino a BB- compreso, considerando in fascia 1 quelli con rating pari o superiore ad A-, in fascia 2 quelli con rating compreso tra BBB- e BBB+ e in fascia 3 quelli con rating compreso tra BB- e BB+. I paesi con rating inferiore vengono considerati non affidabili.

- lo spread dei contratti CDS a cinque anni: tale indicatore, reperibile per gran parte dei paesi, si affianca all'analisi del rating in quanto si è spesso dimostrato più reattivo di quest'ultima e capace di cogliere prima i segnali di difficoltà. Anche in questo caso si tratta di un indicatore oggettivo che possiamo assimilare al costo di un'assicurazione che copre, per cinque anni, il rischio di default di uno stato. I paesi sono distinti nelle tre fasce di rischio in funzione di valori sotto i 200 bp (per la prima fascia), di valori sino a 275 bp (per la seconda fascia) e di valori sino a 350 bp (per la terza fascia). I paesi con CDS a cinque anni quotati oltre i 350 bp sono considerati non affidabili e, quindi, di quarta fascia;
- il rapporto debito pubblico / PIL e il deficit annuo: le soglie per definire i paesi di prima fascia sono quelle che devono rispettare i paesi aderenti alla moneta unica europea e, quindi, del 60% per il rapporto debito pubblico/PIL e del 3% per il deficit annuo. I paesi di seconda e terza fascia presentano, rispettivamente, un rapporto di debito/PIL sino al 80% e al 100% e un deficit rispettivamente sino al 4% e al 5%;
- il tasso di disoccupazione, l'inflazione e il livello dei tassi finanziari: per tali indicatori non sono previste delle soglie numeriche ma solo un'analisi qualitativa di coerenza tra la fascia di rischio attribuita e lo situazione finanziaria del paese.

**Tabella 1 – Ciclo del credito documentario**

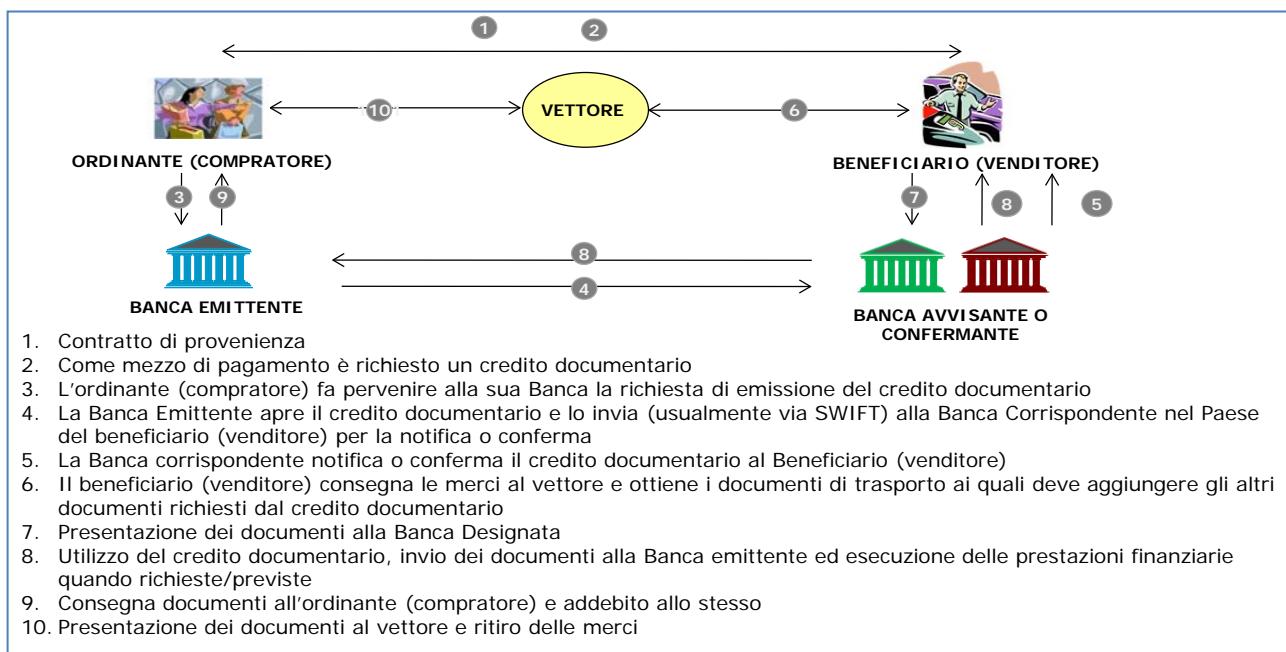
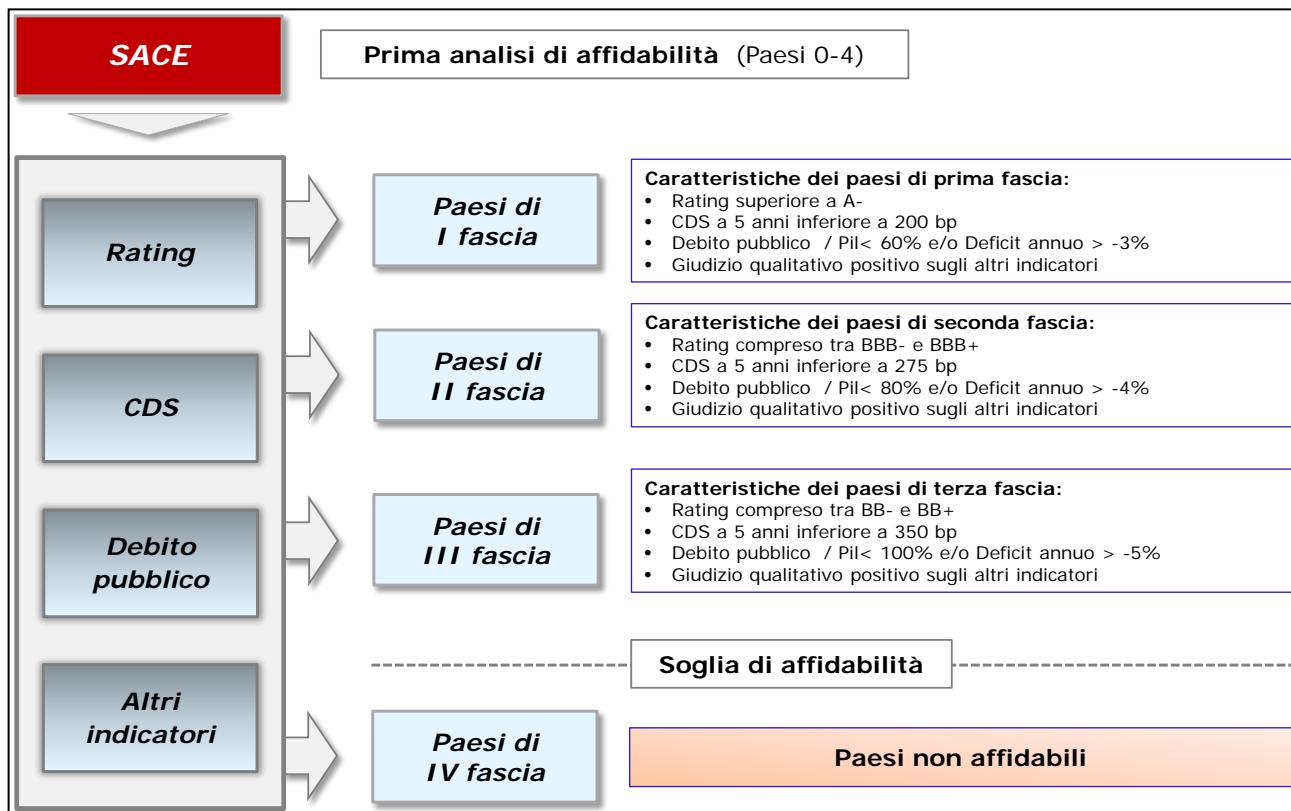


Tabella 2 – Il rischio paese



#### L'analisi del rischio banca

Il modello di analisi proposto permette di individuare, all'interno dei singoli Paesi ritenuti affidabili, le banche meritevoli di fido.

#### *Gli indicatori*

Queste vengono suddivise in tre fasce di affidabilità e una fascia di non affidabilità in funzione dei seguenti indicatori (Tavola 3):

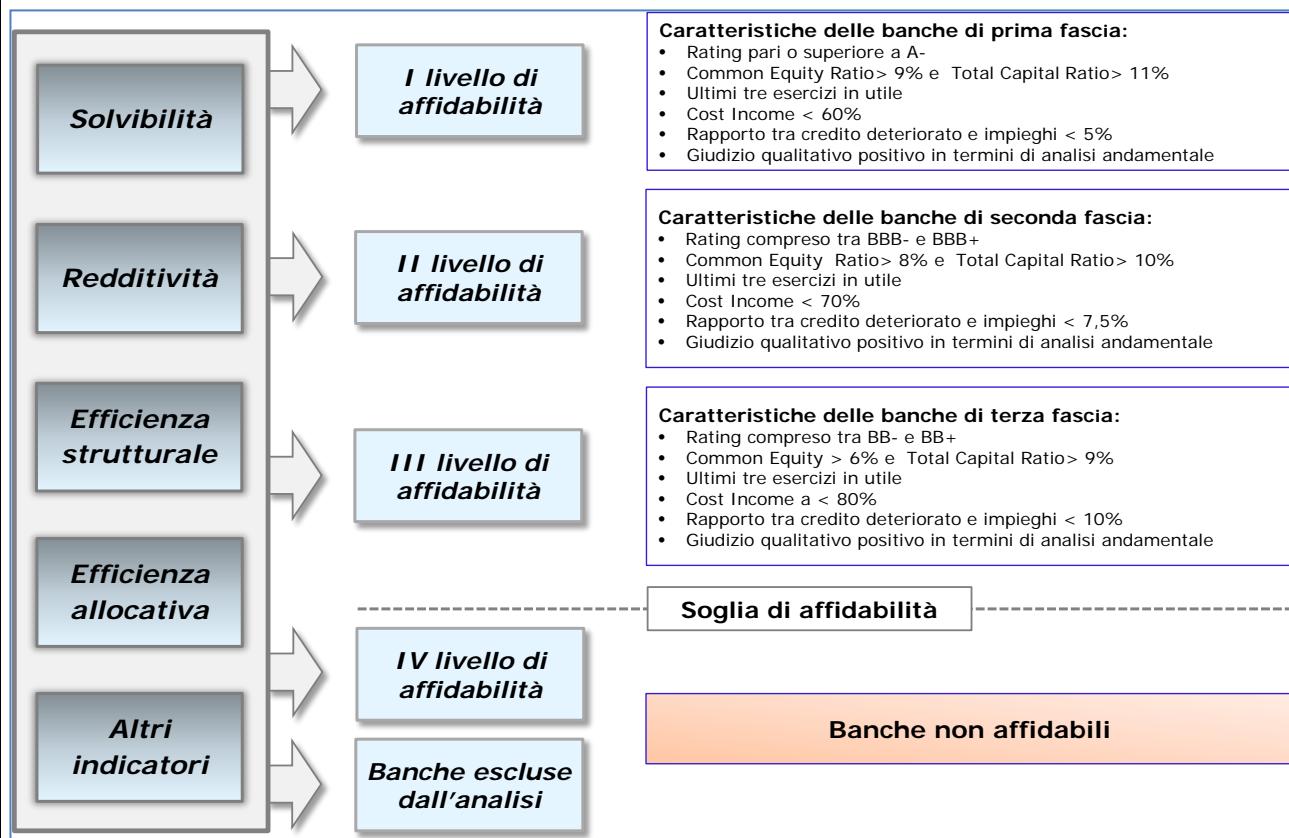
- il rating: tale giudizio esterno viene utilizzato con le stesse metriche e criteri dell'analisi sui paesi sopra descritta;
- il *Common Equity Ratio* e il *Total Capital Ratio*: le valutazioni su tali coefficienti sono effettuate tenuto conto della soglia minima di *Common Equity Ratio* richiesta alle banche vigilate dalla BCE che è pari al maggior valore tra l' 8% e il 5,5% addizionato dall'impatto di stress test avverso che, nell'esercizio di Comprehensive Assessment sui bilanci del 2013, è risultato mediamente pari al 3,5%. Le banche di prima fascia avranno, pertanto, valori di *Common Equity Ratio* e di *Total Capital Ratio* rispettivamente superiori al 9% e al 11%; quelle di seconda fascia valori rispettivamente superiori all' 8% e al 10% e quelle di terza fascia valori rispettivamente superiori al 7% e al 9%. Le banche con capitalizzazione inferiore sono assegnate alla quarta fascia e quindi giudicate non affidabili;
- l'andamento reddituale positivo negli ultimi tre anni: questo è richiesto per tutte le tre fasce di affidabilità come elemento per giudicare la buona gestione dell'azienda. Ciò premesso, un'analisi qualitativa più approfondita potrebbe far considerare affidabili istituti privi del requisito ma molto patrimonializzati e all'interno di un ben definito percorso di riequilibrio del profilo reddituale;
- il rapporto di *cost/income*: tale coefficiente fornisce un'indicazione del profilo di efficienza delle banche che vengono articolate nelle tre fasce affidabilità rispettivamente con valori non superiori al 60%, al 70% e all' 80%. Le banche con valori superiori all' 80% sono considerate non affidabili e, quindi, allocate nella quarta fascia;
- l'incidenza dei crediti deteriorati sugli impieghi: si tratta di un indicatore di efficienza allocativa e fornisce una immediata rappresentazione della qualità del portafoglio impieghi dell'azienda di credito. Le fasce di rischio prima, seconda e terza presentano valori rispettivamente inferiori al 5%, al 7,5% e al 10%;
- analisi andamentale: questa rappresenta la componente qualitativa della valutazione di affidamento e deve considerare almeno tre anni per poter valutare in quale direzione si stia muovendo la banca.

I parametri sopra descritti rappresentano indicatori di equilibrio strutturale e di patrimonializzazione utilizzati comunemente per valutare il grado di robustezza e affidabilità degli istituti di credito e sono sufficientemente confrontabili a livello mondiale, anche se le regole contabili e i principi di Basilea sulla solvibilità delle banche sono applicati in maniera non del tutto omogenea.

## Altri elementi

Tra gli ulteriori elementi qualitativi da includere nell'analisi e che potrebbero migliorare il giudizio della banca di almeno una fascia vi è il tema relativo alla proprietà. Qualora l'azienda di credito appartenga ad uno stato giudicato affidabile, e si ritenga che questi interverrebbe con un'iniezione di liquidità o di capitale in caso di difficoltà finanziarie della banca, si determina un miglioramento del giudizio sulla stessa.

**Tabella 3 – Il rischio banca**



## La relazione dei due modelli e la costruzione di un sistema di limiti per le operazioni di export

L'azienda esportatrice, attraverso la combinazione dei due modelli sopra descritti, può costruire un sistema di limiti operativi e di esposizione per l'attività di export, in funzione del livello di rischio.

L'azienda si può dotare, pertanto, di un modello di governo del rischio che stabilisce a priori le esposizioni massime, sia in senso assoluto, sia in funzione della rischiosità dei singoli paesi e delle singole banche estere.

L'obiettivo è quello di stabilire un plafond di esposizione verso le banche estere nell'ottica della diversificazione e del contenimento del rischio.

Tale *plafond* può essere articolato in importi diversi in funzione della fascia di rischiosità dei paesi e, successivamente, presentare massimali diversi per le varie fasce di rischiosità delle banche (cfr. Tabella 4).

Ciò permette all'azienda di valutare oggettivamente e rapidamente le nuove potenziali operazioni di export, all'interno di un sistema di deleghe e di poteri ben definito e calato nell'organigramma aziendale.

Tabella 4 – Il sistema dei limiti per le operazioni di export



### I dati e il loro aggiornamento

Un’azienda esportatrice attiva nel commercio estero in diverse nazioni e con più controparti per ogni mercato ha la necessità, non solo di reperire molte informazioni sui diversi paesi e sulle relative banche, ma anche di tenerle aggiornate nel tempo. Alcuni dati possono essere, infatti, molto volatili (ad esempio la quotazione dei CDS) e ne risulta necessario un frequente aggiornamento.

Tale attività potrebbe essere supportata dall’utilizzo di provider specializzati nei dati finanziari (ad es. Bloomberg o Reuter) che permettono di impostare, sia per i paesi, sia per le banche, dei fogli elettronici con i dati richiesti dalle analisi sopradescritte che, una volta impostati, si aggiornano automaticamente.

Tali provider possono essere utilizzati anche per le analisi di bilancio sulle banche e permettono di avere una rappresentazione dei dati annuali e/o infrannuali anche controvalorizzati in euro o in dollaro.

E’ tuttavia necessario tenere presente delle peculiarità di ciascuna nazione: i dati di bilancio e i ratio di solvibilità delle banche possono essere non omogenei tra i diversi paesi, in quanto possono variare, sia le regole di contabilizzazione, sia il recepimento delle Direttive di Basilea sul capitale, così come l’anno finanziario si può concludere in date differenti (ad esempio al 31 marzo in India).

E’ opportuno precisare, infine, che non sempre i provider finanziari possono fornire tutti i dati per ogni banca e che, talvolta, sia necessario analizzare, per alcuni istituti finanziari, i bilanci sui siti che non sempre sono disponibili in inglese. Per alcuni paesi, infine, è molto difficile disporre di bilanci infrannuali o di bilanci aggiornati (ad esempio per l’Algeria).

L’azienda che volesse, invece, iniziare a lavorare sui mercati emergenti senza avvalersi di un provider di dati finanziari potrebbe comunque, sia pure con tempi più lunghi, reperire le informazioni sul web.

Per quanto concerne i paesi, molte informazioni sono presenti sul sito di Sace o sui siti delle principali società di rating.

Per l’analisi delle banche, invece, si renderà necessario accedere ai siti delle stesse ed effettuare le analisi sulle versioni pubblicate in inglese dei relativi bilanci. La versione inglese del bilancio è sufficientemente diffusa tra le banche attive nel commercio estero, anche se alcune banche sudamericane si limitano alla sola edizione in lingua locale.

### Conclusioni

La necessità e l’opportunità di recuperare le quote di mercato domestiche perse a seguito della crisi finanziaria espandendo e sviluppando l’export comporta, come abbiamo visto, la gestione del rischio paese.

Tale rischio, che si scinde nel rischio paese e nel rischio banca, può essere gestito con dei semplici modelli di analisi parametrizzabili in funzione dell’appetito al rischio della singola azienda esportatrice.

La combinazione dei due modelli in una griglia condivisa permette di costruire un sistema di limiti operativi e di esposizione verso le banche estere che consente all’azienda esportatrice di rendere oggettive le decisioni in materia di rischio paese e di essere competitiva con la concorrenza nei tempi di risposta all’interno dello schema del credito documentario che trasferisce il

rischio dall'azienda importatrice alla banca della stessa.

Le soglie proposte nell'articolo rappresentano un'ipotesi sufficientemente prudenziale: è evidente che i limiti e le soglie devono essere integrate nei processi decisionali di ciascuna azienda ed essere coerenti e rappresentare l'appetito al rischio della stessa.

Si precisa, infine, che i modelli sopradescritti hanno la funzione di permettere una prima analisi massiva di paesi e banche: una volta valutato positivamente un istituto creditizio

Maurizio Vallino

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### **Proprietà, Redazione e Segreteria:**

Associazione Italiana Financial Industry Risk Managers (AIFIRM), Via Sile 18, 20139 Milano

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