THE ROLE OF COLLATERAL REQUIREMENTS IN THE CRISIS: ONE TOOL FOR TWO OBJECTIVES?

Paolo Fegatelli *

Banque centrale du Luxembourg

Abstract: The implications of central bank collateral requirements for the monetary policy transmission mechanism and the working of the money market have often been neglected. Such implications, however, have clearly manifested during the course of the 2007-2009 crisis. As liquidity was vanishing in the interbank market, banks started to use (and abuse of) central bank funding more intensively, in order to cover their short-term financing needs. As a result, central bank collateral eligibility criteria have become even more relevant than the short-term rate as a factor of monetary policy transmission as well as a driver of liquidity in the interbank market. Thus, in the light of a retrospective analysis of some major events affecting monetary policy in the Euro area in the last two years, this study intends to properly formulate the problem related to the choice of 'optimal' collateral requirements, by illustrating their interrelations with other central bank policy tools and targets. Ultimately, this approach allows us to derive a non-exhaustive set of recommendations for collateral and interest rate policies, as well as for central banks' exit strategies from the current unconventional measures.

JEL Classification: E58, E51, E52

Keywords: Collateral, Monetary policy, Central bank, Interbank market, Financial stability

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* Phone: +352 - 4774 4519

Fax: +352 - 4774 4970

E-mail: paolo.fegatelli@bcl.lu

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1 Introduction

The modalities by which modern central banking conceives financing the banking sector focus on the use of collateral – in the form of 'safe' financial instruments – as an inescapable requirement for financial institutions demanding central bank funding. As an example, the Guideline of the European Central Bank on monetary policy instruments and procedures of the Eurosystem states that "pursuant to Article 18.1 of the Statute of the ESCB, all Eurosystem credit operations (i.e. liquidity-providing operations) have to be based on adequate collateral"[1].

While the usage of collateral has traditionally been seen only from a microeconomic point of view – i.e. as a tool to hedge cash lenders in secured money market transactions against the default risk of the respective counterparty – the implications for the monetary policy transmission mechanism have often been neglected. Such implications, however, have powerfully emerged during the course of the subprime crisis. As liquidity was vanishing in the money market, banks have started to use (and, according to market opinions, sometimes abuse of) central bank funding more intensively, in order to cover their short-term financing needs. As a result, central bank collateral eligibility criteria have become even more relevant than the short-term rate as a factor of monetary policy transmission as well as a driver of liquidity in the interbank market.

Thus, the present study intends to properly formulate the problem related to the choice of 'optimal' collateral requirements. We refer to a grey area, often neglected also in the economic and financial literature, implicating the use of a central-bank tool for two potentially conflicting objectives: 1) the protection against the counterparty risk implicit in monetary policy operations (implying a microeconomic dimension), and 2) the transmission of the monetary policy input to the banking sector (implying a macroeconomic dimension). Balancing between these two objectives is at the heart of the issue concerning the choice of optimal collateral eligibility criteria.

Ultimately, two further political questions underlie (and complicate) the quest for such an optimal choice. On one hand, we have the question of up to what extent it is legally and morally acceptable for central banks to take on the credit and systemic risk linked to the acceptance of illiquid guarantees. On the other, it remains unclear whether the current central bank collateral policies are actually prizing the moral hazard of those bank managers who took advantage of their risky positions – before the crisis – and of the benignity of the central bank – now.

Finally, from a financial stability point of view, it is noteworthy that any question concerning collateral is strictly related to the safety and systemic risk of market infrastructures, such as security settlement systems. This happens for two distinct

[1] Guideline of the European Central Bank of 7 March 2002 (ECB/2002/2), amending Guideline ECB/2000/7 on monetary policy instruments and procedures of the Eurosystem.

reasons. First, the choice of haircuts and other collateral eligibility criteria by the operators of clearing and settlement systems directly reflect the central bank policies in this field. So, for instance, when evaluating the systemic risk implications stemming from the adoption of lower haircuts, central banks should consider not only the environment which is more familiar to them (i.e. monetary policy operations), but also the likely impact on market infrastructures run by for-profit entities. Second, in this study we provide some evidence that the evolution of business volumes at Clearstream over the past decade has been someway affected by the collateral eligibility criteria of the ECB compared to the money market standards (the latter being also impacted, in turn, by the collateral requirements and monetary policy decisions of the central bank).

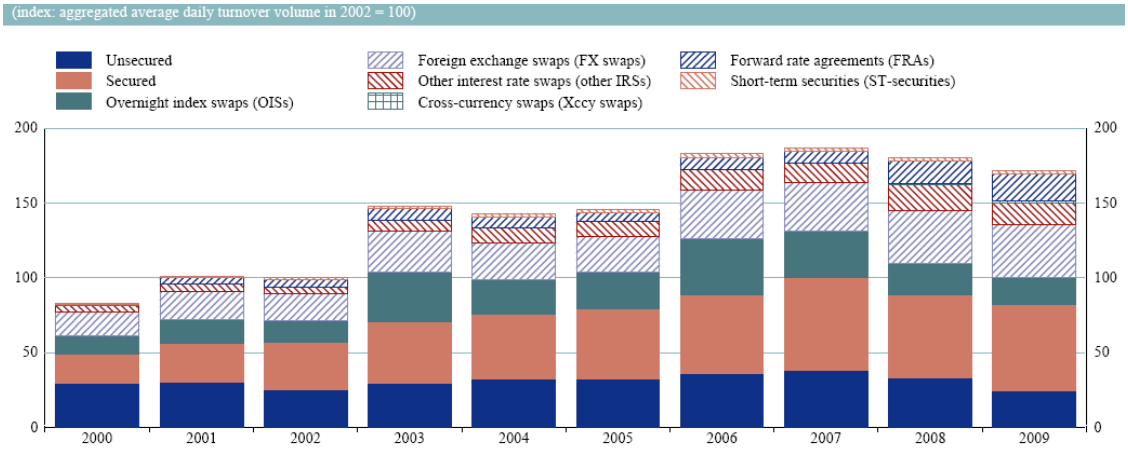
The structure of this study is the following. In the next chapter, we will focus on the use of collateral in the repo market, and provide some hints about the crucial role of repos for the implementation of the ECB's monetary policy. Based on the analysis of business data from Clearstream, we will see how the events linked to the 2007-2009 crisis have affected the repo market and revealed the importance of collateral availability for banks refinancing in the money market. Chapter 3 will present a simple theoretical framework to correctly analyze the monetary transmission mechanism on the basis of the interactions between central bank funding and interbank market. We have used this framework in Chapter 4, in order to analyze the events following the collapse of Lehman Brothers, and provide an interpretation of certain measures taken by the ECB in the context of its 'enhanced credit support' to markets. In our analysis, we have focused in particular (but not only) on the role of the ECB's collateral eligibility criteria with regard to the different objectives of the central bank's policy actions. Unpublished business data from Clearstream have been used to validate our rationale, especially with regard to the Eurosystem's outright purchases of covered bonds. In Chapter 5 we will discuss a set of policy prescriptions, stemming directly from our previous analysis. Again, the multifaceted role of collateral requirements as a policy tool will be at the centre of our considerations, also in the light of different 'exit strategy' alternatives currently under examination. In particular, we will look at the relation between collateral policy and interest rate policy, and see how central banks could use collateral requirements as a countercyclical instrument. Ultimately, central banks should fix their collateral eligibility criteria on the basis of an integrated approach, which should take into account the existence of multiple objectives and multiple instruments to pursue those objectives. As a consequence, collateral requirements should not be set independently from any relevant instrument and target. Chapter 6 will conclude this study, and present a summary of the main findings.

2 The role of collateral requirements from a 'macro' prospective

2.1 Collateral, repos and monetary policy

The use of collateral – i.e., a borrower's pledge of specific "property or right of action given as additional to the obligation of a contract or the like"[2] – is centuries old; however, only in recent times it has become popular, in parallel with the important growth of three markets where collateral is used as a safeguard against counterparty risk: repurchase agreements (repos), securities lending, and over-the-counter (OTC) derivatives[3]. Especially the events following the Russian debt crisis in 1997 and the successive LTCM collapse in 1998 marked a turning point and stimulated an increased consciousness of the importance of collateralization as a highly successful credit risk mitigation tool[4]. Since then, a major consequence has been the gradual transformation of money market lending from 'unsecured' to 'secured'. This long-term trend had already started well before the onset of the subprime crisis in the summer 2007; though the events which followed the Lehman collapse have certainly reinforced it. The chart below provides a historical view on the aggregate daily turnover of the Euro money market, split by segment, as for the latest Euro money market survey conducted by the ECB[5].

Chart 1. Aggregated average daily turnover of the euro money market (source: ECB, September 2009, p. 29)



Note: The panel comprised 85 credit institutions in 2000 and 2001 and 105 credit institutions thereafter.

[2] The Oxford English Dictionary.
[3] Corrigan and de Terán (2007), p. 19.
[4] Ibid., pp. 19-22.
[5] ECB (September 2009). In turn, collateralization has definitely favored securitization, given the importance of having good-quality collateral as a precondition to stretch a bank's balance sheet: banks have strived to turn any illiquid asset in good-quality securities that could eventually be either sold or used as collateral to achieve additional (low-cost) funding capacity.

From the point of view of the microeconomic theory, the effects of collateralization are well known, and are analogous to those of most financial guarantees. Thus, collateral is normally used to enhance the level of protection of a lender against the default risk of its borrower. Assuming a correct evaluation of the collateral asset and the respective haircut[6], this protection is ensured by the necessity of a double default – by both the borrowing party and the collateral security issuer – for the lending party to suffer a loss[7]. Therefore, "the use of collateral brings additional surety, frees up bilateral counterparty credit lines, reduces borrowing rates and makes it possible to continue growing trading activity. In addition, collateralization may permit a reduction in economic or regulatory capital"[8].

Collateral used in repo trades is normally composed of fixed-income assets, following the standards adopted by most central banks for their open market operations. Indeed, debt securities – including government and corporate bonds, bank debt and asset-backed securities – are still the only source of collateral that is eligible nowadays for central bank refinancing operations[9]. The reason relates to the much lower price volatility and easier pricing that used to characterize most debt instruments, at least until the start of the subprime crisis, compared to other categories of financial assets (e.g. equities).

For central banks, collateral is extremely important, because related to their offer of refinancing facilities to banks. Such facilities, mainly consisting of open market operations and other lending facilities, focus on repos as a "money market tool with the money supplied being considered economically as a loan, and repo payments considered as loan interest"[10]. "Repos create money by increasing the reserve account at a bank – that is, by creating a new liability of the central bank. Money is withdrawn with a reverse repo by decreasing the reserve account of a bank – that is, by withdrawing a liability of the central bank"[11]. Indeed, "it is […] one of the oldest and least

[6] "Haircut : The percentage of a security pledged as collateral that must be deducted from its current valuation to account for possible declines in value that may occur before assets can be liquidated. The haircut is usually smaller for a well-traded security and higher for a smaller, riskier and less liquid asset. The haircut should protect the cash lender against a possible decline in value that may occur before assets can be liquidated" (Corrigan and de Terán, 2007, p. 21).

[7] From here, the importance of having a zero or even negative correlation between borrower and issuer defaults.

[8] Corrigan and de Terán (2007), p. 44. All these features are critical, when combined with the effects of securitization, in order to explain one of the most relevant factors at the heart of the current crisis: banks' over-leverage (see next Section and later Chapter 5, in particular Section 5.4).

[9] As for the changes to the ECB collateral framework during the crisis, see later in Section 4.3.

[10] Corrigan and de Terán (2007), p. 59. For the purpose of this paper, the distinction between 'repurchase agreements' and 'collateralized loans' is irrelevant, so that our definition of 'repos' includes both types of contract.

[11] Ibid., p. 169. The definitions of 'repo' and 'reverse repo' depend fundamentally on the point of view of the two counterparties involved in the transaction: thus, the same trade is defined to be a 'repo' from the prospective of the cash-borrower (collateral-giver), and a 'reverse repo' from the point of view of the cash-lender (collateral-taker). Notice that, when dealing with repos as a monetary policy tool, Corrigan and de Terán (2007) have adopted the prospective of the banks

disputed principles that a central bank should not, under any circumstances, provide unsecured credit to banks"[12].

"Repos are attractive as a monetary policy instrument because they carry a low credit risk while serving as a flexible instrument for liquidity management. In addition, they can serve as an effective mechanism for signaling the stance of monetary policy. Repos have been widely used as a monetary policy instrument among European central banks and, with the start of EMU in January 1999, the Eurosystem adopted repos as a key instrument. For the central banks that use them, repos have often become the most important monetary policy instrument. The attractiveness of repos as a monetary policy instrument derives from the fact that the features of repo contracts are well suited to influence the interest rate level through two of the main channels used to implement monetary policy. Repos are both a flexible instrument for controlling liquidity in money markets and an effective mechanism for signaling to markets the desired level of interest rates"[13].

Given the relevance of the repo instrument for the practical implementation of central banks' liquidity provision to the banking system, it is surprising to observe the scarcity of literature trying to incorporate the most relevant features of repo markets into macroeconomic models or theories of monetary policy[14]. In particular, as far as we know, the macroeconomic effects of repo collateral availability and repo collateral requirements – as possible borrowing constraints – on the monetary transmission mechanism is a topic that has never been treated up to now, probably due to the abundance of liquidity in the interbank market until the summer 2007.

Nonetheless, at the beginning of 2008 Tobias Adrian and Hyun Song Shin published an enlightening study relating the development of the U.S. repo market to the 'quality' of the Fed's monetary policy. In short, Adrian and Shin (2008) use empirical data to show that banks increase their leverage during asset price booms and reduce it during bursts, due to the joint use of Value-at-Risk methodologies – to model their risk and economic capital – and mark-to-market models – to price their assets. As this pro-cyclical behavior exacerbates financial market fluctuations, the paper proposes a new definition of

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which ask for funding (cash-takers), as opposed to the prospective of the central bank (cash-giver), for whom lending takes place through 'reverse repos' (properly said). For convenience, in order to maintain a smooth and consistent treatment of this topic from here onwards, in the rest of this study we have stuck to the Corrigan-de Terán definitions (i.e., the borrowing banks' point of view).

[12] Ibid. For example, Article 18.1 of the Statute of the Eurosystem and of the ECB prescribes that any credit operation should be "based on adequate collateral". As for a list of reasons that should discourage central bank unsecured lending, see again Corrigan and de Terán (2007), pp. 58-59.

[13] Ibid., pp. 57-58.

[14] For example, when we look at the most recent central bank literature, Ewerhart and Tapking (2008) model banks' choice of collateral assets and the impact of changes to central banks' collateral requirements on the basis of a typical microeconomic framework; whereas the approach of other works like Eisenschmidt, Hirsch and Linzert (2009), for instance, who analyze the bidding behavior of banks participating to the ECB's main refinancing operations, tends to focus on the microstructure of the central bank funding market.

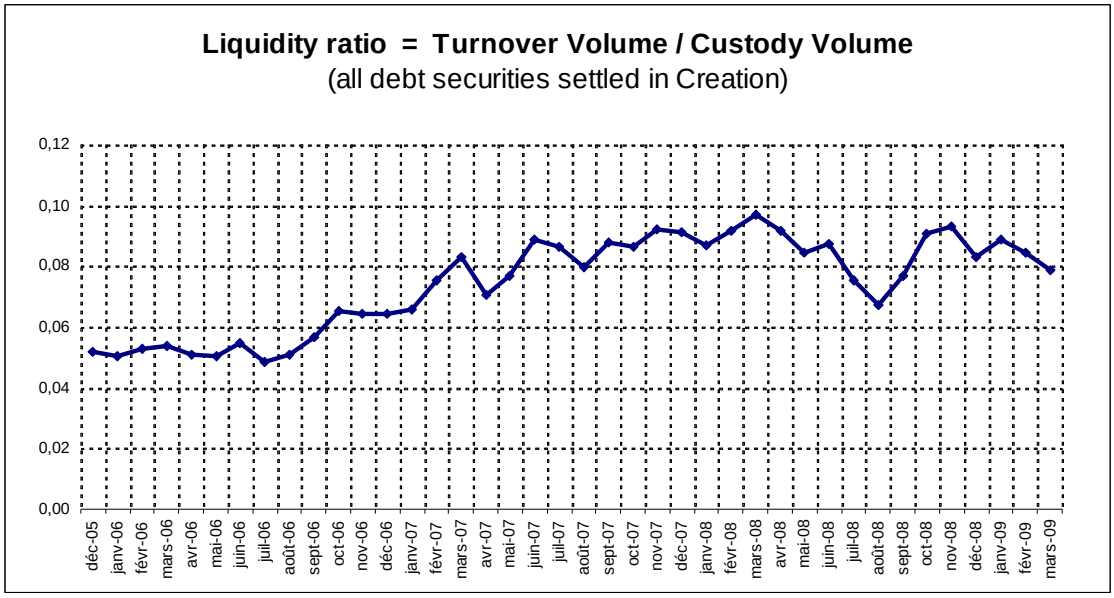
financial market liquidity as “the growth rate of repurchase agreements”, the latter being identified as the main funding source currently used by banks to adjust their leverage. Even more interesting from our point of view, Adrian and Shin (2008) verify the existence of a strong correlation between bank balance sheet growth – via the repo market – and the easing and tightening of monetary policy. Thus, when monetary policy is loose, the stock of repos grows rapidly (and market liquidity is high), while when monetary policy is tight, repo growth is slow or negative (and market liquidity declines).

2.2 The development of the ICSDs as ‘collateral processors’

The conclusions of Adrian and Shin suggest a key of interpretation when we observe the historical business data of Clearstream Banking S.A., the Luxembourg ‘international central securities depository’ (ICSD). In accordance with other public sources[15], Clearstream volumes on settlement and custody show that the activity in the international debt market kept evolving at a fast growth rate until last year[16]. When we compare the two series for settlement and custody in Euro nominal value, we notice that until March 2008 the growth of settlement activity tended to exceed the increase of deposits in custody. In other words, debt assets’ ‘turnover ratio’ or ‘liquidity ratio’ – here defined as the proportion between the turnover and the custody volume of a certain set of securities settled in Clearstream over a specified period of time (one month) – has persistently increased for quite a long time, even after the outburst of the subprime crisis (see Chart 2).

[15] See the BIS statistics on international debt securities, including time series which are sufficiently extended to identify long-term patterns (http://www.bis.org/statistics/secstats.htm).
[16] Notice that a very large majority of business at Clearstream ICSD concerns fixed-income assets, whereas much smaller fractions relate to equities and investment funds.

Chart 2. Liquidity ratio for all debt securities in Clearstream ICSD (source: author's computations on Clearstream data)

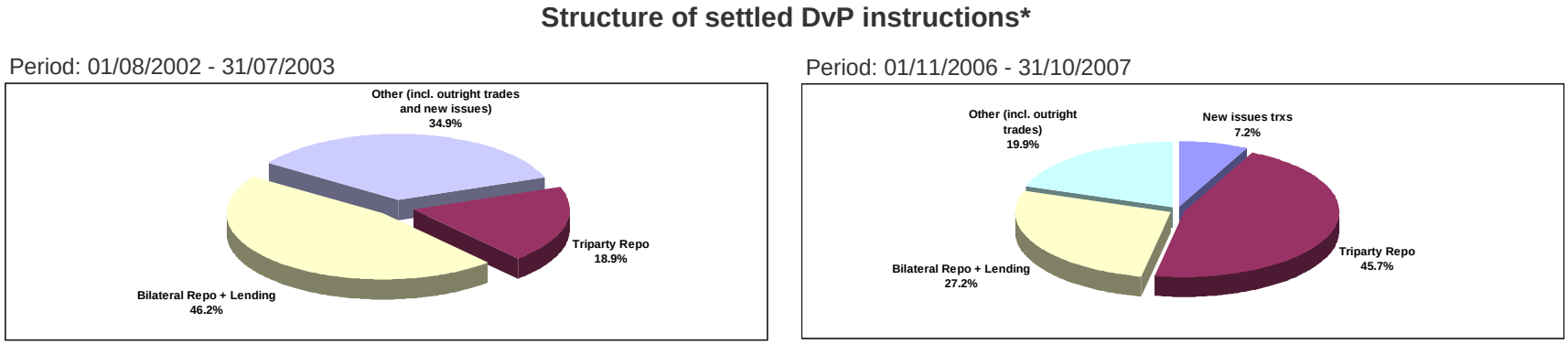


A major reason for this trend is the increasingly extensive utilization of debt securities as collateral, either for repos or for settlement at Clearstream[17]. Chart 3 proves this: it presents the relative composition of a set of large-value 'delivery-versus-payment' (i.e. sale) instructions settled in Clearstream, over the periods 01/08/2002-31/07/2003 and 01/11/2006-31/10/2007, respectively, split by type of customer activity (i.e. outright trades, repos, etc)[18].

[17] In a securities settlement system offering 'delivery-versus-payment', collateral might be needed to provision a purchase without having cash, i.e. to obtain a cash advance by the settlement system in order to finalize the settlement of the transaction *before* the effective payment of the cash by the buyer (or before notice of the payment is received by the cash agent of the settlement system itself, in case of settlement in a domestic market). Normally, most of this credit is granted by the settlement system to its customers intraday.

[18] Notice that the diction 'Triparty repo' in the picture is an abbreviation for 'Triparty repo and collateral management'.

Chart 3. Relative composition of large-value DvP instructions settled in Clearstream



* Nominal value > 100 million USD, CBL and CBF-I

Source: author's computations on Clearstream data.

Compared to four years earlier, triparty repos settled in Clearstream in 2006-2007 had grown by more than seven times (+807%), up to represent nearly half of all the transactions with a nominal value above 100 million USD. Overall, the chart for 2006-2007 evidences a very high number of transactions linked to repos and collateral management, either triparty (45.7% of the total) or bilateral (27.2%)[19]. Indeed, in 2006-2007 the total percentage of transactions related to repos and collateral management summed up to nearly 73% (it was 65.1% in 2002-2003), whereas outright trades and new issues, taken together, were at 27.1% only (versus a percentage of 34.9% in 2002-2003). The accelerating trend in favour of the collateralization of the money market was not only a peculiarity of Clearstream's environment. According to the figures published in the ICMA European Repo Market Survey of December 2008[20], the repo market globally grew at an average rate of 19% per annum between 2001 and 2007.

Thus, we can conclude that the growth of the repo market until the summer 2007, as evidenced by data from both Clearstream and ICMA, was mainly related to a twofold transformation of the money market:

a) *a quantitative change due to the effects of securitization and bank balance-sheet stretching[21], and*

b) *a qualitative change linked to the progressive collateralization of the money market lending activity[22].*

A third factor that could explain the steady development of the repo market in Europe until the emergence of the crisis concerns the ECB's prominent use of repos for its open market operations: the relatively broad collateral requirements of the ECB might have indirectly stimulated the further growth of interbank repos by relaxing the collateralization standards in the money market[23]. Among other, all these reasons explain the important business development experienced by financial market infrastructures offering added-value services to repo market participants: just as the ICSDs, in general, and Clearstream, in particular.

When we use the data from Clearstream and ICMA to validate the conclusions of Adrian and Shin (2008), this test provides us with mixed results. Indeed, we could infer that Adrian and Shin are right when they associate repo growth and business cycle: the size

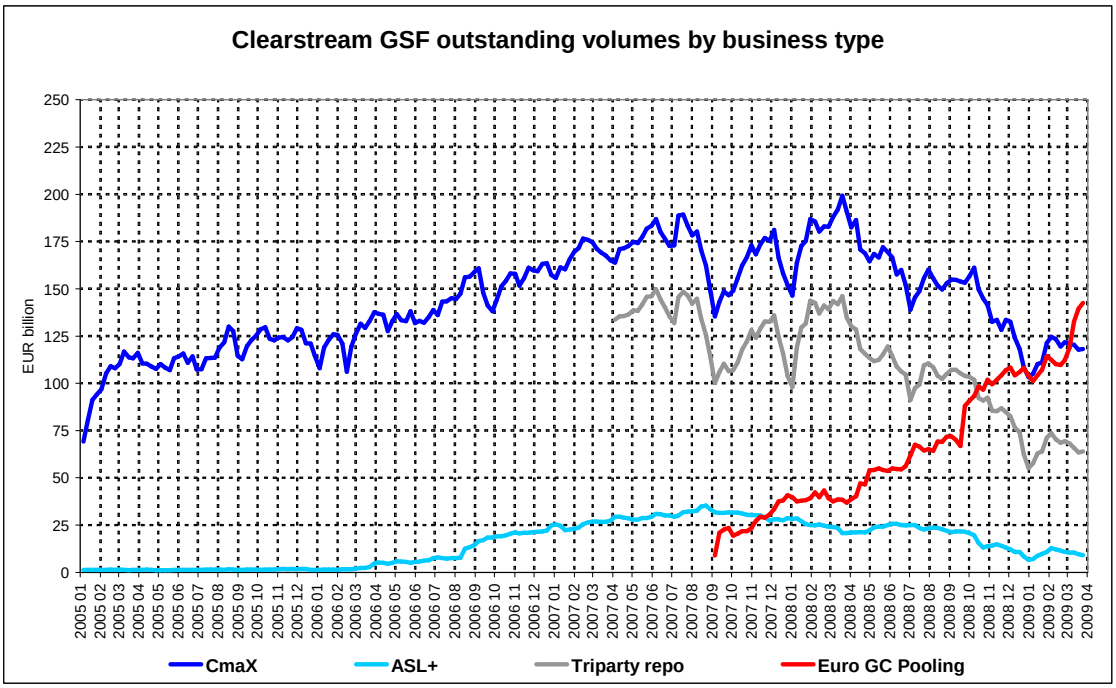
[19] Notice the inverted proportions between triparty and bilateral repos, whose percentages in 2002-2003 were 18.9% and 46.2% of the total, respectively.
[20] Number 16, published in February 2009. See the related chart later in Section 4.1.
[21] In another recent paper, Adrian and Shin (2009) identify a primary reason for the emergence of the subprime crisis in the excessive growth of bank leverage related to securitization (see in particular pp. 6-7).
[22] See the previous Section.
[23] See later Section 4.4 for some statistical data related to the settlement turnover of different classes of structured assets in Clearstream before and after the beginning of the crisis. Thus, central bank collateral requirements might serve to indicate the 'fiat collateral' standards in the interbank market. See also Appendix 1 for another example, following the outburst of the subprime crisis.

increase of the repo market during the period 2001-2007 has certainly its roots in the mechanism described by Adrian and Shin (2008, 2009); whereas, on the other hand, the volume decrease started in summer 2007[24] seems to prove the effects of deleveraging and the overwhelming bank balance-sheet problems started with the onset of the subprime crisis. However, Adrian-Shin's inferences on the link between repo market growth and quality of monetary policy are not confirmed at all by our data: in effect, until the summer 2007 the monetary policy of the major central banks in Europe (the ECB but also the Bank of England, for instance) was not considered particularly 'accomodative'[25]; while the current extra-'soft' stance has not been accompanied by a substantial volume recovery in the European repo market up to now, as we can observe in the charts above.

The key point is that, in the framework of Adrian and Shin (2008), the short-term rate targeted by policymakers is not only a mere signal, but a key price variable in itself as well as a determinant of liquidity: it is the variable which defines the price of credit made available to the banking sector by the central bank, and, as such, it is considered as the main (only?) transmission belt between the goals of monetary policy and the interbank market. By contrast, in the context of the current crisis we have observed that bank decisions on leverage are actually constrained by another critical variable: collateral availability, which defines the maximum quantity of credit that bank borrowers can demand from a central bank[26] or a repo lender. Chart 4 is emblematic: it shows how banks in Clearstream, over the past two years, have gradually but constantly abandoned the use of triparty repos as an interbank market funding tool, in parallel with embracing Euro GC Pooling as a collateral management product supporting the central bank refinancing channel[27]. Interestingly, "the collateral framework [of the ECB] has been broad enough to ensure that central governments bonds, the only asset class that could still be used as collateral in inter-bank repo markets, have not been absorbed at a large scale by the Eurosystem as collateral"[28]. In other words, it seems that this move from the secured segment of the money market towards central banking funding has been mostly dictated by the broader collateral eligibility criteria of the ECB, compared to the post-Lehman standards of the repo market: thus, many banks have taken advantage of that source of funding where collateral requirements are relatively 'softer'[29].

[24] See again the Clearstream charts shown earlier in this section, and the ICMA chart later in 4.1.
[25] At the end of 2007, the policy rate of the ECB was still at 4 percent (it would have even raised further in the later months), while at the BoE it was 5.5 percent.
[26] In the case of a central bank, this does not need to be the same as the maximum quantity of credit offered via its refinancing facilities (e.g. tenders for short-term funding and other open market operations).
[27] Notice that Euro GC Pooling mainly relates to assets in custody in Clearstream Banking AG, the German domestic CSD settling in central-bank money and directly connected with the Bundesbank, whereas Triparty repo volumes comprise assets that are mostly held in Clearstream ICSD, settling only in commercial-bank money (though directly linked to the BcL).
[28] Corrigan and de Terán (2007), p. 181.
[29] About the crowding-out effect of central bank intervention vis-à-vis the interbank market, see later in Section 4.2.

Chart 4. Clearstream Global Securities Financing volumes by business line (source: Clearstream)



Indeed, the current crisis has clearly shown that collateral availability might constitute a real constraint for banks' capacity of accessing liquidity when needed. Central banks have gradually taken consciousness of the importance of this issue over the course of the crisis, and in 2008 first the Fed (in March), then the Bank of England (in April), and ultimately the ECB (in October, after a U-turn decision, following Lehman's collapse) adopted more flexible collateral eligibility criteria. Notice that this observation does not entirely compromise the validity of Adrian-Shin's conclusion on the existence of a link between monetary policy and interbank market development: simply, the transmission mechanism may be different. Therefore, in the next chapter we will define the theoretical framework for a correct analysis of this mechanism.

3 Monetary policy and the credit channel

In order to illustrate the role of collateral in monetary policy, and how such a role has evolved over the course of the current financial crisis, compared to 'normal' times, we need to begin from a thorough re-examination of the monetary transmission mechanism. In fact, the traditional view – commonly accepted in many papers and textbooks – on the channels through which monetary policy achieves its targets, is overly simplified and

generally inadequate to catch the significance of the events which have taken place since the summer of 2007 until today[30]. Moreover, in the traditional representation of monetary policy, collateral as a discriminatory factor which allows banks' access to funding, either from central banks or via interbank markets, does not play any role. This is in apparent contrast with what has been observed in reality over the course of the last two years.

To treat this issue in a systematic way, we need first of all to provide a schematic representation of the traditional view of the monetary policy transmission mechanism. Based on a criticism of the elements which are missing in this traditional scheme, we will then provide a slightly more sophisticated model of interpretation, suitable to explain the functioning of both conventional and unconventional (or unorthodox) monetary policy.

3.1 The traditional view of monetary policy transmission

We will start from a general formulation of the monetary policy transmission mechanism, which will try to abstract as much as possible from the controversy between post-Keynesian monetary theory and neoclassical monetarism on the issue of the endogenous vs. exogenous nature of the money supply function[31].

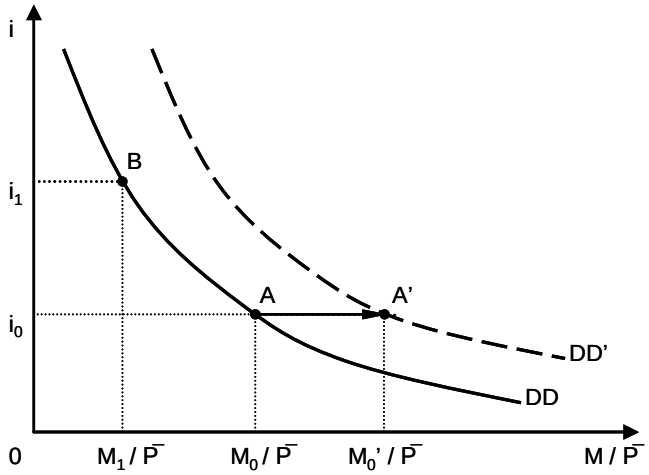
A typical textbook approach to modeling monetary policy focuses on the assumption of a direct link between interest rate and money supply stock. That is, a higher interest rate can only be associated with a given, lower level of money supply stock and vice versa[32].

The inverse, quasi-deterministic[33] relationship between the two variables implies that a central bank cannot set the level of one variable independently from the level of the other: e.g. pegging the interest rate at a certain level implies giving up central bank's control over the quantity of money supply. So, if the money demand schedule shifts to the right due, for example, to a revenue increase, the central bank should rise the money supply stock (e.g. via an increase of the monetary base) by a certain specific amount in order to leave the interest rate unchanged.

The chart below illustrates this concept.

[30] E.g. 'unconventional' monetary policy measures (Bini Smaghi, April 2009) are inexplicable on the basis of such traditional models.
[31] For an exposition of the theoretical debate on the nature and role of the money supply in the monetary policy transmission, see for example Palley (2008).
[32] See Dornbusch-Fischer's treatment of this topic, for instance.
[33] Our typical approach concedes that the variability of the money multiplier over time prevents the central bank from being able to predict and determine the money supply stock with a perfect degree of correctness.

Chart 5. Money demand and interest rate in a 'classical' framework



Given the money demand schedule DD, the central bank will have to provide an amount of money supply stock equal to $M_0/\bar{P}$, if it wants to attain an interest rate level of i_0, and an amount of money supply stock equal to $M_1/\bar{P}$, if it wants to attain an interest rate level of i_1.

In case of a shift of the money demand to DD', under the assumption that the central bank's target remains the interest rate level i_0, then the central bank will be forced to increase the money supply up to $M_0'/\bar{P}$.

To complete the framework of the traditional approach to monetary policy, we need to introduce a money supply schedule in our picture. In the classical framework, such a money supply schedule is defined by a money supply function, SS, which can be reduced to the product of two factors, 1) the monetary base[34], MB, and 2) the money multiplier[35], MM, such that

$$SS = MB \times MM \quad .$$

[34] The total amount of a currency that is either circulated in the hands of the public or in the commercial bank deposits held in the central bank's reserves. According to its traditional definition, the monetary base comprises only coins, paper money, and commercial banks' reserves with the central bank.

[35] The money multiplier explains the increase in the amount of cash in circulation generated by the banks' ability to lend money out of their depositors' funds. When a bank makes a loan, it 'creates' money, as the loan is supposed to become a new deposit from which the borrower can withdraw cash to spend. This 'money-creating' power is based on the 'fractional' reserve system, under which banks are required to keep at hand only a portion of their depositors' funds. The rest may be converted into loans, thereby increasing the available cash by a factor that is a multiple of the initial deposit. Thus, the money multiplier indicates the maximum amount of new demand-deposit money that can be created by a single initial currency unit of excess reserves.

The next chart includes the money supply schedule, SS, into the previous picture. Notice that the money supply curve, SS, is an increasing function of the market interest rate, i, and is drawn for a given level of the monetary base, MB. The positive slope of the SS curve reflects the fact that with higher interest rates banks prefer to hold less central bank reserves, which, in turn, implies a higher value of the money multiplier, MM. Notice also that for sufficiently high interest rates the SS curve becomes vertical, as excess reserves tend to zero, so that banks are supposed not having funds to lend further, in spite of an interest rate variation at the margin.

Chart 6. The determination of money stock and interest rate in a 'classical' framework

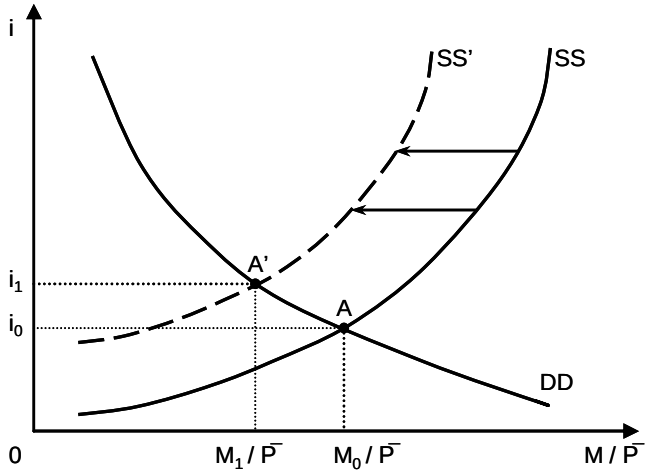


Chart 6 shows what happens when the SS curve shifts to the left: supposing the money demand curve remains unchanged, the equilibrium point will move from A to A', corresponding to a higher interest rate level, i_1, and a lower money stock, $M_1/\bar{P}$. A parallel shift of the money supply curve to the left might be caused, for example, by an exogenous shock reducing the value of the money multiplier, MM, *ceteris paribus*, or by a decrease of the monetary base, MB.

Unfortunately, while providing an easy and intuitive explanation for the money supply mechanism, this scheme incorporates a number of (over-)simplifications.

1) First of all, this general model assumes that a central bank can perfectly control both interest rates[36] *and* the money supply stock, so that a given change in one of the two (sets of) variables (which are assumed as interchangeable as an instrument of monetary policy) automatically determines the value of the other. Especially the events of the last two years, however, have clearly shown that this is not the case:

[36] Notice that the interest rate in the model discussed above can be assumed as a proxy for the whole set of interest rates relative to different financial markets.

the two variables – though often appearing correlated – are not linked by a deterministic relationship or, in other words, they are linked via an intermediate ring of a chain which does not appear in this elementary scheme.

2) In reality, the model does not even explain *how* a central bank can control the whole set of market interest rates, when, in reality, it can only exert its control on the central banks reserves or central bank lending/funding rate.

3) As for the money supply stock, the last twenty-five years have seen central banks prioritizing interest rate setting to money supply stock setting: the reason being that an intermediate objective in terms of money supply stock would probably lead to a sub-optimal outcome[37], other than being much more difficult to attain.

4) Also, when we look at the events of 2007-2009, the model presented above does not provide any hint at the role of banks' collateral availability and/or collateral eligibility criteria in the monetary policy transmission mechanism. Nonetheless, over the past two years, monetary policy measures adopted by the ECB and other central banks in the occasion of particularly stressful events (e.g. following Lehman's collapse) have focused on collateral eligibility criteria – or other equivalent measures – as a major component of such a set of measures.

In the attempt to fill out these gaps, the next Section will present a slightly more sophisticated approach to the monetary policy transmission mechanism. In our proposed model, able to interpret the events of the biennial 2007-2009, collateral eligibility criteria (or other equivalent measures, now included in the concept of *credit easing*) play a critical role in order to make central banks' monetary policy strategy really effective.

3.2 A correct framework to model the implementation of monetary policy

According to Disyatat (2008), a correct modeling of the implementation of monetary policy by modern central banking should not interpret the amount of credit granted to the banking sector as a tool for interest rate setting. Indeed, the link between reference rate and central bank balances is only *indirect*, while the mechanism utilized by central banks for implementing monetary policy is the opposite of what is usually assumed in the neo-classical monetary theory[38].

[37] See Palley (2008) and Lavoie (2008) – inter alia – for a discussion, mainly based on the effects of the monetary policy strategy adopted by Fed between the late Seventies and the early Eighties.

[38] Based on the observation of current central bank practice, Disyatat (2008) focuses on the link between key interest rate (the 'policy signal') and central bank balances as the result of the utilization of various 'instruments' (open market operations, standing facilities, reserve requirements, rate of remuneration on reserves, etc.). By doing this, Disyatat correctly identifies a negative proposition, namely, the lack of direct causality between key interest rate and central bank credit volume. While we believe that this point is correct, what is missing is an alternative,

In truth, this criticism is not new: in the academic debate on monetary policy, all the post-Keynesian schools start their analysis from this point, namely, by the assumption of an endogenous money supply function. The critical point here concerns the role of credit for the money supply formation. Post-Keynesian endogenous money theory emphasizes that the link between the financial and the real sectors "runs predominantly from credit to money to economic activity. The important feature is that credit is placed at the beginning of this sequence. This contrasts with conventional representations that place money first, as reflected in the typical money multiplier story of many textbooks, in which bank deposits are said to create loans"[39].

The origins of the post-Keynesian endogenous money theory go back to Kaldor's (1970, 1982) critique of monetarism. It is significant, however, that already in 1959 the conclusions of the second Radcliffe Report[40] indicated that the velocity of circulation of money is unstable, so that a) central banks control interest rates, but have only a very indirect control of money aggregates, and b) overall, monetary policy has only a moderate effect on inflation, which depends on many other factors[41].

Given this theoretical background, the analysis we develop is based on a classical Walrasian approach of multi-market equilibrium. We provide the following representation of the monetary transmission mechanism, in lieu of the one described in the previous paragraph.

a. The central bank selects a 'policy signal'[42] (to formally express the stance of monetary policy) by fixing a reference rate, or a system of reference rates; e.g., for the ECB the main reference rate is linked to a) the marginal lending facility rate (equal to the main reference rate *plus* a spread), and b) the marginal deposit facility (equal to the main reference rate *minus* a spread).

b. The reference rate(s) affects the whole system of multiple rates that are used by banks to a) lend to the rest of the economy (corporate borrowers, individuals etc.), and b) borrow/lend in the interbank sector (e.g. money-market, repo, security lending etc.). Such a system of multiple rates is critically related to the degree of reliance by banks on the lender of last resort, namely, the central bank.

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positive proposition: Disyatat only describes a generic supply function for central bank balances (p. 4), but without completing his framework with a corresponding demand function. The only hint at a demand function for central bank balances refers to its claimed inelasticity, due to some "exogenous" or "autonomous" factors ("such as changes in the treasury balance [government deposits] or the public's demand for currency that are not controlled by the central bank but affect the supply of reserves directly"). Nonetheless, this explanation is not satisfactory in our view, as it neither fills the 'hole' in his framework, nor allows identifying an alternative transmission mechanism for monetary policy (besides the simple description of what central banks do).

[39] Palley (2008), p. 2.

[40] In May 1957 a committee chaired by Lord Radcliffe was set up in the U.K. to make recommendations to the government about the working of the British monetary and credit system.

[41] Lavoie (2008).

[42] See Disyatat (2008), p. 3.

c. Adrian and Shin (2008) have shown that a major source of funding for banks is represented by the interbank market, in particular via repo trades. In normal times, the interbank short-term rates closely follow the pattern of the reference rate. This happens because banks know that, in normal times, the supply of central bank funds is always sufficient to satisfy their demand, *at the reference rate*[43]. When this is not the case, however (cfr. below), tensions in the interbank market (due to an excess of demand for funds) determine an increased differential between the interbank short-term rates and the policy rate (e.g. between the EONIA rate and the reference rate of the ECB).

d. Thus, as Disyatat correctly affirms, *the main function of central bank's open market operations is to satisfy the banks' demand for liquidity, given a certain level of the reference rate, so to avoid any turbulence in the interbank market (by smoothing interbank rate volatility)*[44]. In the words of Disyatat, "somewhat paradoxically, the ability to detect a liquidity effect [by monetary policy operations] is greater the *less* effective is the central bank's liquidity management"[45].

In terms of graphical analysis, our model considers three markets:

1. a market for central banks funds or balances;
2. a market for interbank funds (money market);
3. a market for bank lending to all the other sectors of the economy.

3.2.1 Central bank funds

We suppose that this market is characterized as follows.

- The 'price' variable (on the *y*-axis) is represented by the central bank reference rate. We assume that such a price can be exogenously fixed by the central bank, which can then modify it at its convenience[46].

[43] This is not the same as saying that banks could borrow *whatever amount* from the central bank at the reference rate: rather, it means that individual banks' demand for central bank funds is relatively small, so that it can always be fully satisfied, in spite of the limits imposed to the overall supply of central bank balances.

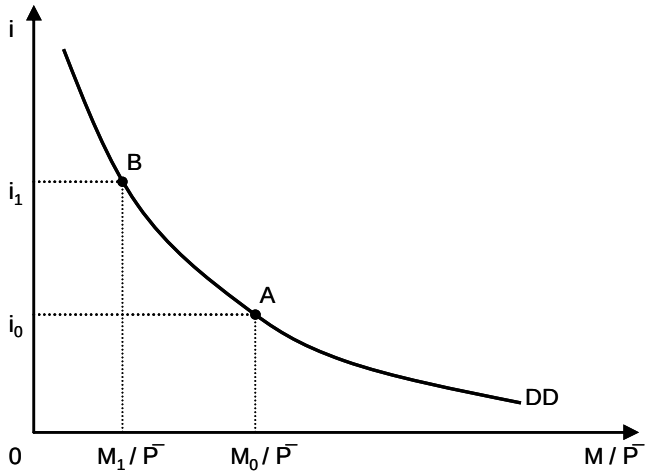
[44] Disyatat (2008), p. 6. Notice that in our model we accept Disyatat's point of view that "*open market operations are not used to set interest rates*. This fact is evident in the ability of many central banks such as the Bank of England and the ECB to maintain interest rates close to target on a daily basis while conducting open market operations only once a week. In fact, before 2003 the ECB used to announce its policy decisions on a Thursday, with immediate impact on interest rates, while weekly operations were conducted on Tuesdays. Thus the ECB was able to routinely move market rates without undertaking *any* open market operation. Moreover, in certain circumstances market rates can move even before the announcement of a policy change. […] Thus not only can interest rates move towards the new target without the central bank needing to undertake any operations, but they can move even without a policy announcement!".

[45] Ibid., p. 12.

[46] Notice that this is quite a simple approximation of the *modus operandi* of a central bank. For example, the ECB sets three different rates at the same time: 1) the reference rate, 2) the

- The 'quantity' variable (on the *x*-axis) is given by the amount of central bank funds which is demanded by banks for each level of the reference rate. We suppose that the banks' demand function has a negative slope, as a higher interest rate will – *ceteris paribus* – diminish the real sector's demand for bank loans and, in turn, the banks' demand for central bank funding. The quantity variable can also be modified by the central bank at its convenience, provided that it gives up its control on the price variable (i.e. the interest rate).
- In fact, the central bank can only set one of the two variables (i.e. either price or quantity) as an intermediate objective of monetary policy at any given time: analogously to what we have described in Section 3.1, if the central bank sets a certain interest rate, then it will have to take the corresponding amount of central bank funds as given (post-Keynesian view); vice versa, if the central bank fixes the amount of funds it wants to grant to the banking sector, then it will have to accept the corresponding price (interest rate) determined by demand (monetarist view). For example, the central bank cannot target at the same time a reference rate equal to i_0 (point A) and a quantity of money equal to $M_1/\bar{P}$ (point B), as appear in the chart below.

Chart 7. The demand for central bank funds



marginal lending rate for banks' refinancing operations (which is at a premium), and 3) the marginal deposit rate (which is at a discount). The premium and the discount for the lending and the deposit rate, respectively, can be modified independently, and so they are also part of the ECB's monetary tool kit.

Notice that in Chart 7 a supply schedule is not explicitly shown: as the shape of the supply curve in this market depends directly from the specific procedures of central bank tenders, we keep this issue out of consideration for the moment[47].

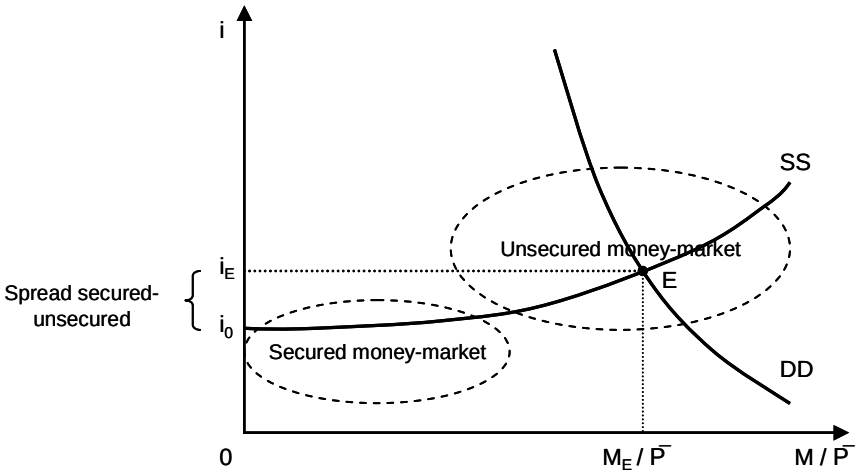
3.2.2 Interbank funds (money market)

In this market, private-sector financial institutions trade short-term deposits and other interbank funds. We know that the biggest part of such trades relate to the money market (maturities up to 12 months), either secured (e.g. repos and other collateralized transactions) or unsecured (e.g. the market for overnight banks deposits).

- The price variable (*y*-axis) is in this case related to the set of interest rates that are quoted in the interbank market. That is, we refer here to a range of prices, rather than at only one. Lower rates relate to collateralized transactions – for which the credit and counterparty risk is reduced, so that the money supply schedule in this section can be assumed nearly flat – while higher rates relate to unsecured transactions. Indeed, in the right-hand section of the chart the money supply curve increases somewhat its slope, encompassing a wider range of interest rates as a reflection of counterparty-specific credit risk.
- The quantity variable (*x*-axis) refers now to the overall (cumulative) volume of funds traded in the interbank market, for each level of the interbank interest rates.
- The chart below shows the equilibrium point, *E*, jointly with other interesting characteristics of this market. First of all, *E* is placed in the 'unsecured money-market region': that is, we suppose that unsecured lending/borrowing activity is at the margin, as quite more costly for banks, even in 'normal' times. Secondly, as the emphasis of our analysis is on a short-term view of certain market unbalances linked to monetary policy transmission, we suppose that the money demand, DD, is rather inelastic, especially in its upper part[48]. An important implication of this assumption is that the 'secured-unsecured'[49] spread is fundamentally dependent on the slope of the money supply curve: we will show later how important this is in the context of the impact analysis of collateral eligibility criteria on the monetary transmission mechanism.

[47] Later, when we describe the events following Lehman's default, we will provide a graphical illustration of how the ECB has changed its MRO tender procedures as of October 2008.
[48] We will see later that this hypothesis was validated by the events of fall 2008.
[49] E.g. in the euro area one of the most used indicators is the Euribor-Eurepo spread (see for instance the ECB's Euro Money Market Study 2008, pp. 30-31).

Chart 8. The money market equilibrium



3.2.3 Bank lending to all the other sectors

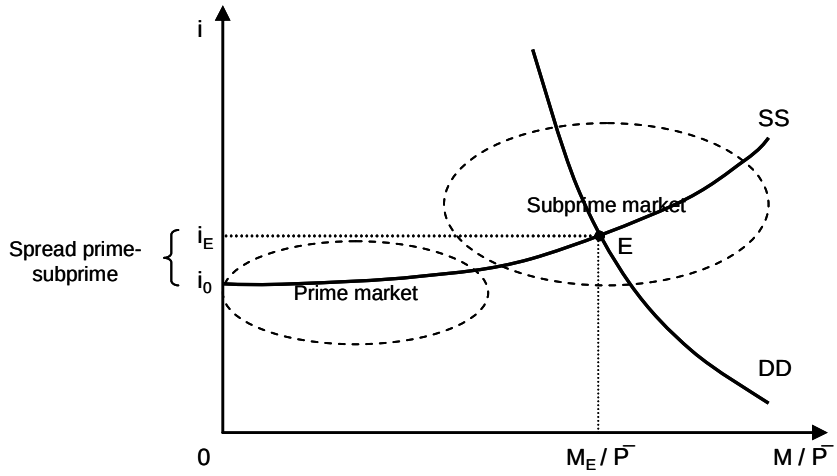
The third market that we consider in our analysis is the market for funds lent from the banking sector to the rest of the economy.

- Here, the price variable (*y*-axis) represents the set of interest rates at which the banks lend to all the other sectors. As for the previous case, we refer to a range of prices, which banks apply to borrowers with different credit standings (prime, subprime, etc.). In our model, we assume that the shape of the money/credit supply curve in this market reflects the shape of the corresponding curve in the interbank market: indeed, the underlying assumption is that the banks' credit supply schedule in this market is a direct reflection of the 'easiness' by which banks achieve funds in the previous two markets (see the *SS* curve in Chart 9).
- As for the quantity variable (*x*-axis), here it refers to the overall (cumulative) volume of credit granted by banks to all the other sectors, for each level of the interest rate.
- We derive an equilibrium point, *E*, at the cross between the money demand and the money supply curve. Notice that not only the money supply, *SS*, but also the money demand, *DD*, reflects the shape of the corresponding curve in the interbank funds market: the reason being, as before, that in a short-term prospective like the one we adopt, the demand function is relatively inelastic to changes in the interest rate[50].

[50] Based on past ECB analyses, we know that the time lag for the transmission of monetary policy impulses in the euro-area is about two years, somewhat more than in the U.S., probably due to the incidence of certain rigidities affecting production input factors (labor, *in primis*).

Therefore, also in this case interest rate spreads are crucially influenced by the slope of the money/credit supply curve.

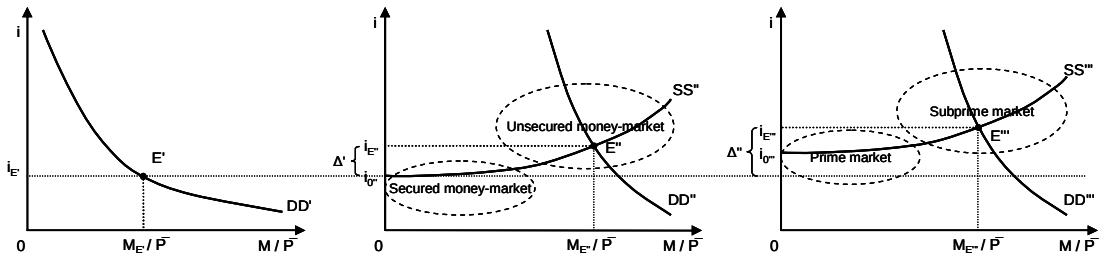
Chart 9. The bank lending market equilibrium



3.2.4 The overall picture

We can now provide the *vue d'ensemble* on the combination of the three markets. Chart 10 describes the relationships across them in terms of interest rate links and related spreads.

Chart 10. The relationship between central bank fund market, interbank market, and bank lending market



The first chart on the left represents the market for central bank funds, which is where open market operations take place. This market is strictly linked to the money market (or interbank market), here represented in the middle. We can suppose that under normal

market conditions the spread differential, Δ', between the rates of the two equilibrium points, E' and E'', is relatively stable (i.e. its volatility is low) and small.

The third market, the one on the right side, is the bank lending market. Also in this case, we suppose that under normal conditions the spread differential, Δ'', between the reference rate, E', and the subprime lending rate, E''', is relatively stable and not excessively wide.

Materially, we assume that the transmission belt between the bank lending market and the previous two markets is given by the provision of money/credit. That is, banks finance their immediate changes to the provision of credit in the bank lending market via two alternative short-term funding channels: central bank funds and interbank (money market) funds. In this way, two further underlying assumptions are that

a) banks are liable to a maturity mismatch between the average duration of their (more long-term) assets in the bank lending market and the average duration of their (more short-term) liabilities in their funding markets;

b) deposits are not considered as a useful source for banks needing to adjust the volume of their liabilities to the volume of their assets in the very short-term, given a high level of deposits resiliency (normally, depositors do not shift suddenly their funds from one bank to another, except under very special circumstances like a bank run).

As a consequence, taken the third bank funding source, i.e. deposits, as fixed, in our model the quantity of money/credit supplied in the bank lending market, $M_{E'''}/\bar{P}$, is the resultant from the quantities of money/credit collected in the previous two markets, $M_{E'}/\bar{P}$ and $M_{E''}/\bar{P}$. That is, we suppose that funds obtained from the central bank can be a substitute for funds achieved in the interbank market, and vice versa.

As already mentioned in 3.2, we assume that the main function of central bank open market operations is to ensure the effectiveness of the use of the reference rate as a monetary policy tool or, in other words, to ensure that the operational targets, Δ' and Δ'', have relatively low size and volatility. In fact, these two conditions are required in order for the central bank to pass its interest rate stimuli to the economic system in an effective way. In statistical terms, this means that, independently on a change of the policy rate, $i_{E'}$, the first two moments of the distributions of Δ' and Δ'' should remain relatively small and stable.

Finally, we need to underscore that in our model the macroeconomic effects of a change in the reference rate are not taken into consideration, such effects being supposed to fully deploy in a longer time period, compared to the very short-term horizon assumed in our analysis[51], as well as to be uncertain from the point of view of the central bank

[51] See the previous note.

balance-sheet. Indeed, ultimately, a change in the reference rate impacts the volume of central bank's credit to the banking sector only indirectly, via the following channels:

a) the induced change in the money/credit demand of the real sector to the banks[52], which in turn affects the credit demand of the banking sector to the central bank;

b) the induced change in the amount of bank deposits, which in turn affects the amount of reserves that banks need to hold with the central bank[53].

Thus, both channels seem to influence the bank demand of central bank balances, though into opposite directions: lower central bank reference rates would push the real sector to borrow more from banks – which in turn would need to borrow more from the central bank – and to hold a lower amount of banks deposits – which in turn would determine a lower amount of central bank reserves demanded for regulatory reasons.

4 A model to explain the ECB's response to the crisis

We have now set up a theoretical framework to describe what happened in the aftermath of Lehman's failure, and explain the rationale of the monetary and collateral policy measures which have been taken by the ECB and other central banks afterwards.

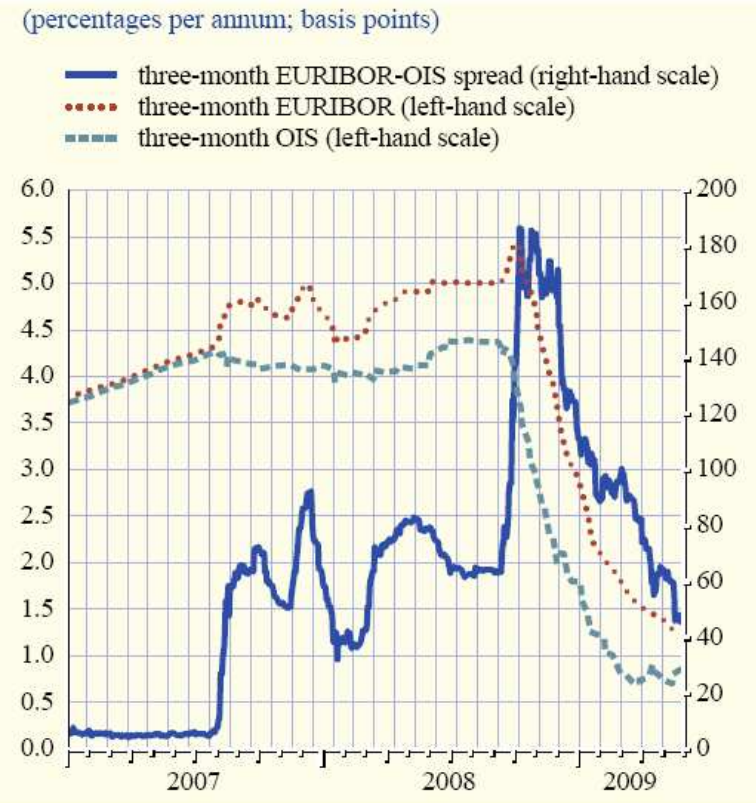
4.1 The Lehman shock

The starting point of our interpretation of the events that occurred in September-October 2008 is the interbank money market. We know that – starting from the 'black' Monday of September 15th – the unsecured money market virtually shut down, with the unsecured vs. secured three-month rate spread which went up over 350 basis points for the U.S. dollar in the first week of October, while for the euro an analogous rate differential arose up to 180 basis points (see Chart 11; more charts related to different maturities – overnight, one month, etc. – for both EUR and USD rate differentials are reported in Appendix 2).

[52] This implies that the slope of the DD"' curve in the bank lending market would decrease to adapt to the new market conditions.

[53] Presumably, the DD' curve in the central bank funds market would shift to the left or right, depending on the direction of the interest rate change, which in turn would affect the amount of deposits that the public would like to detain, and therefore the amount of needed bank reserves.

Chart 11. Euribor-OIS spread (source: ECB, July 2009a, p. 77)



Such a crash in the unsecured lending segment has been interpreted as due to a generalized crisis of confidence: fears of another Lehman-style default, jointly with other factors such as increased funding liquidity risk[54], kept these rates abnormally high for several weeks, and only recently, following the repeated implementation of 'unconventional' monetary policy measures by central banks, unsecured money markets have recovered a condition of relative 'normality'.

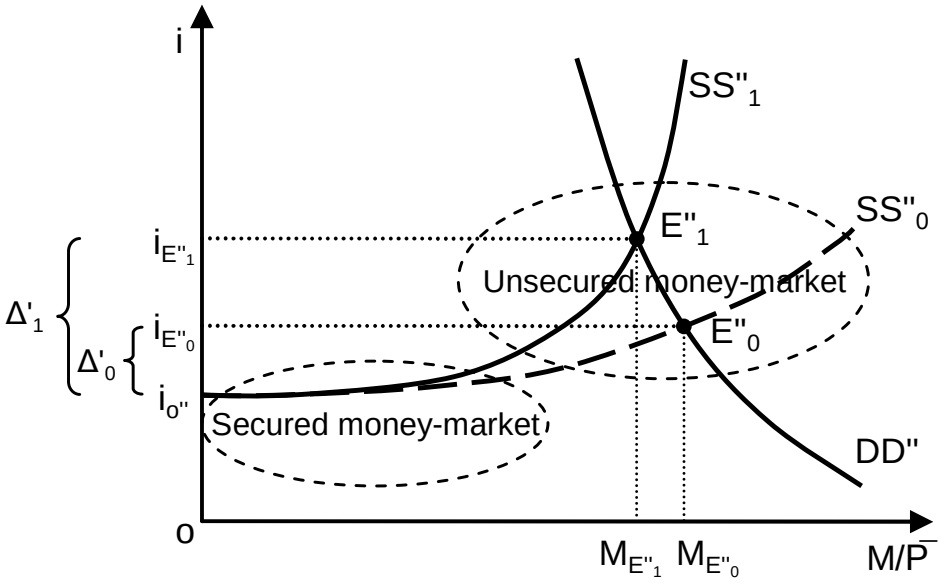
While the specialized press has mostly looked at the unsecured money market rates (LIBOR, EURIBOR, etc.) as indicators of a trust crisis and heavy difficulties in the banking sector, perhaps the same attention has not been dedicated to the 'secured' segment of the money market activity. Indeed, while the related rates (e.g. EUREPO) have not shown the same signs of sufferance as the corresponding unsecured money market rates (for obvious reasons, as credit risk in the 'secured' segment is somewhat

[54] Eisenschmidt and Tapking (2009) present a model which refers to the funding liquidity risk of lenders as a theoretical explanation for levels of money market rates which cannot be explained by higher credit/counterparty risk alone.

attenuated by the presence of collateral), nevertheless, business statistics from ICMA-International Repo Council (IRC) as well as triparty repo data from Clearstream[55] indicate that volumes have sensibly decreased also in this part of the interbank market[56]. This occurrence is particularly important, though often neglected in the public debate on the effects of the crisis, as repos are today the main funding source for banks which need to adjust their leverage[57].

When we put these events in the framework of the model described in the previous section, we can graphically represent their impact on the interbank market as follows.

Chart 12. The Lehman shock on the interbank market



In the picture above, we have represented the Lehman shock in the interbank market as a steepening of the money/credit supply curve, from $SS"_0$ to $SS"_1$, vis-à-vis a demand schedule that remains fundamentally unchanged. That is, for each level of the interest rates, the quantity of funds that the banking sector is willing to lend to itself is now substantially lower. Notice that this lending contraction affects mainly the unsecured segment, namely, that part of the interbank market which is more liable to changes in the

[55] See later in this Section.

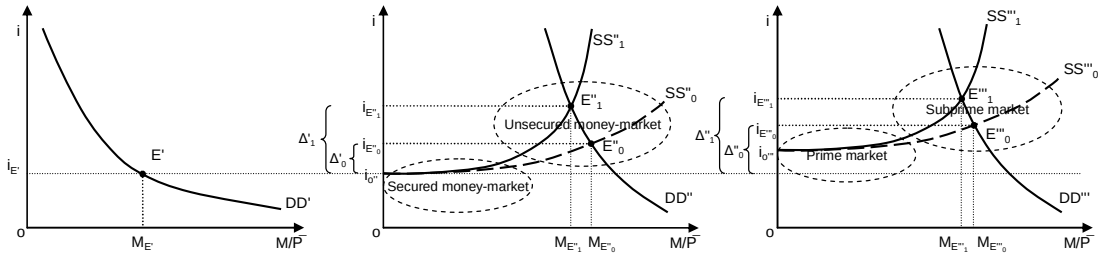
[56] Among the possible reasons, we need to mention the imposition of higher collateral haircut and the refusal to accept structured assets as collateral, which have both reduced the volume of available collateral for repo transactions. Recently, Acharya *et al.* (2009) have presented a model which provides an endogenous reason as to how market for short-term, secured borrowing could experience a sudden freeze, in spite of collateral entailing little credit risk. Such a reason is linked to possible changes in investors' rational expectations.

[57] Adrian and Shin (2008). See later in this chapter for more details on this.

risk attitude of banks, because of a lesser protection against borrowers default. Indeed, we could define the unsecured lending, mainly composed of overnight interbank deposits, as the 'sub-prime' segment of the interbank market. On the other hand, in the secured segment, the presence of prevalently 'good' collateral dominates the lenders' decisions, though a certain negative effect is also visible in this part of the supply curve[58]. Notice also that in the presence of an inelastic demand schedule the effect of the adjustment impacts primarily the price (i.e. the interest rate) rather than the quantity (i.e. the lent volumes).

Chart 13 below includes the effects on the other two markets in our model, *ceteris paribus*, that is, before considering any reaction by the central bank(s). An obvious consequence of the more binding bank funding constraint concerns the higher cost of money for the real sector (last chart on the right), in spite of a stable central bank reference rate, $i_{E'}$: also in this case, a demand rigidity in the very short term implies that the cost of the adjustment is mainly born by the price (the interest rate) rather than the quantity (lent amounts). Moreover, also in this case a higher degree of lenders' risk aversion implies a steepening of the supply curve which – in turn – affects especially the marginal or subprime lending. This explains why central banks rushed to take some counterbalancing measures in October 2008: to avoid, first of all, that the credit crunch in the interbank market could cascade its full effects down on the real sector. This would have had dramatic consequences in particular on loans related to those structured products from which the current crisis originated.

Chart 13. The overall impact of Lehman's failure



It is important to stress that the change enclosed in the picture above underlies a paradigm change in the manner of interpreting and modeling the effects of monetary policy. Until August 2007 the money/credit supply curve in the interbank market was

[58] The fact that a loan is guaranteed by collateral does not imply that the lender is completely protected against credit risk, as a credit shock might anyway affect the worth of the same collateral. Moreover, there exist some costs related to the handling, screening (collateral management costs) and, eventually, the liquidation of collateral (transaction costs); the value of such costs – especially transaction costs in case of a liquidity shock – is not exactly known by the lender *ex-ante*.

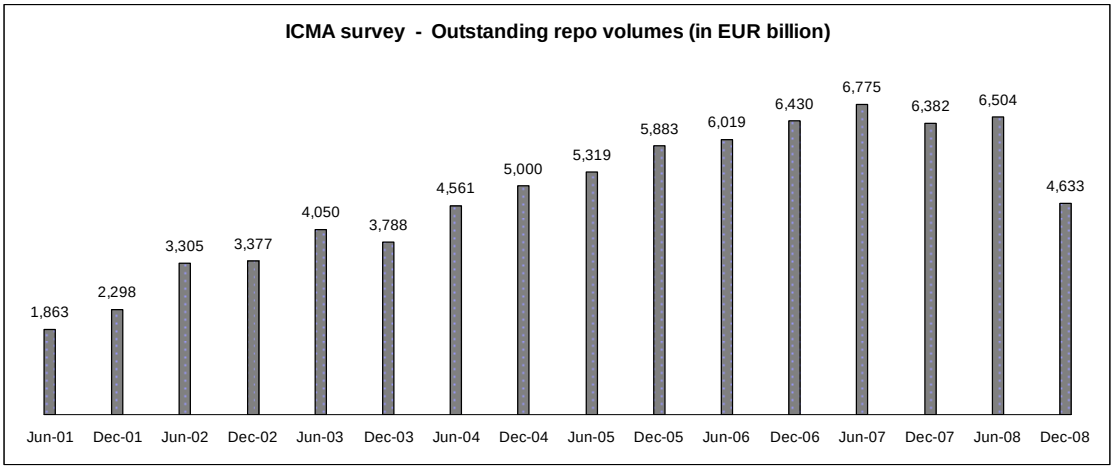
nearly flat: banks had plenty of liquidity for lending and, thanks to the benefits of securitization, they could easily package and turn illiquid assets (e.g. mortgages and other retail loans) into highly-rated securities. In turn, such securities could be either sold – often, at a profit versus the real value of the underlying package of loans – or otherwise used as high-quality collateral in bank repurchase agreements and/or central bank funding. The perversity of this mechanism is at the very heart of the current crisis, and compounds the effects of securitization[59], lack of regulatory control, an excess of risk appetite (largely due to too-low-for-too-long interest rates), and cross-border capital flow imbalances. Put in our framework, this mechanism has allowed banks, during the so-called 'Great Moderation' period, to use repos and other interbank lending instruments as a nearly unlimited source of financing[60]. A basic implication of a nearly-horizontal supply schedule in the interbank market was that the monetary policy transmission mechanism was really similar to the one described by the different post-Keynesian monetary theories: the amount of credit/money was ultimately determined by the demand, whereas central banks had no control on the money supply and could only target interest rates as an intermediate objective of monetary policy.

With the outburst of the subprime crisis, in August 2007, the slope of the supply curve in the money market started to increase, jointly with the rate spreads between secured and unsecured lending: in our model this is represented by the spread Δ'_0 in the central part of Chart 13. Earlier, Chart 11 provided a spectacular evidence of the solution of continuity in the time series of Δ'_0 for EUR. Until August 2007 the secured-unsecured spread had remained below 10 basis points for quite a long time, with a standard enclosed between 6 and 7 basis points for EUR and slightly more (up to 8-9 bps) for USD[61]. As of August 2007, such spreads have suddenly 'jumped' by roughly 10 times and have continued to increase up to over 100 bps in the weeks preceding Lehman's default in September 2008. When this occurred, the secured-unsecured differentials made a new jump – see the shift of the interbank supply curve from SS''_0 to SS''_1 – this time much bigger than in August 2007: the 3-month USD spread touched a level above 360 bps in October 2008, whereas its EUR equivalent arrived to over 180 bps, meaning the quasi-paralysis of the interbank market, at least in its unsecured segment[62].

[59] The link between securitization and bank leverage is accurately described in Adrian and Shin (2009), pp. 6-7.
[60] See Adrian and Shin (2008), among others.
[61] These spreads – calculated on a 3-month maturity – are very similar to the analogous spreads between 12-month Euribor/Libor and Overnight Index Swap rates (see in Appendix 2).
[62] In the words of Bernanke in his speech in front of the U.S. House of Representatives' Budget Committee on 20 October 2008: "The financial turmoil intensified in recent weeks, as investors' confidence in banks and other financial institutions eroded and risk aversion heightened. Conditions in the interbank lending market have worsened, with term funding essentially unavailable. Withdrawals from prime money market mutual funds, which are important suppliers of credit to the commercial paper market, severely disrupted that market; and short-term credit, when available, has become much more costly for virtually all firms. Households and state and local governments have also experienced a notable reduction in credit availability".

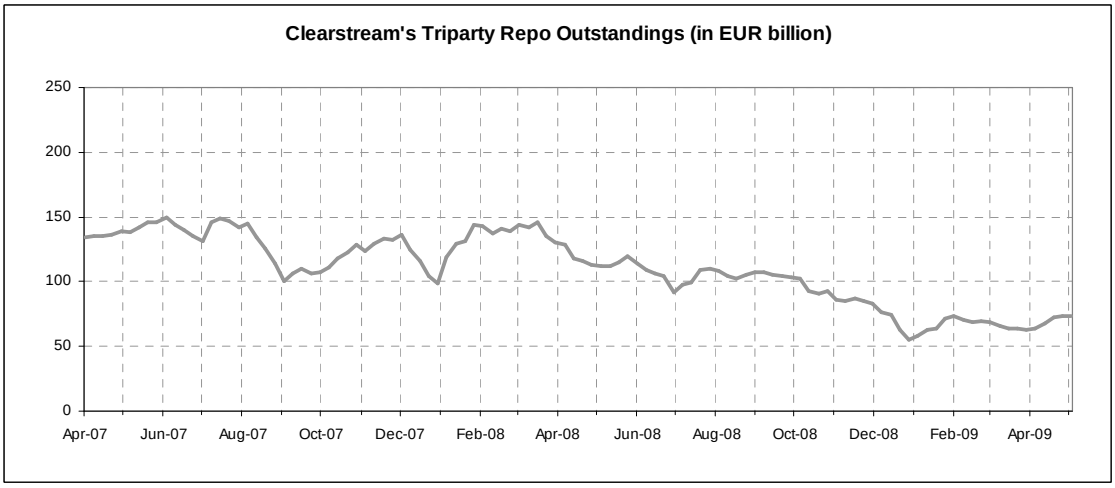
As for the secured compartment of the money market, survey data from ICMA-IRC offer another impressive proof of how seriously the turmoil affected the banking sector. Chart 14 shows that the total value of repo contracts outstanding on the books of the 61 institutions who participated in the December 2008 survey was EUR 4,633 billion, compared to EUR 6,504 billion in June 2008 (-28.8%) and the peak of EUR 6,775 billion reached in June 2007 (-31.6%).

Chart 14. Outstanding repo volumes, 2001-2008 (source: ICMA, 2009)



Indeed, this was the most severe reduction in the headline number since the ICMA survey began in 2001, reflecting the acceleration of de-leveraging by banks after the collapse of Lehman Brothers. This trend is even more accentuated when we look at the outstanding volumes of Clearstream's Triparty Repo business over the past two years.

Chart 15. Clearstream's Triparty Repo volumes (source: Clearstream)



In this case the headline number shows a much stronger decrease from the peak of 149.8 billion EUR in June 2007 down to 55.2 billion EUR at the end of December 2008 (-63.2%). Afterwards, volumes slightly recovered, and they were at a level of 72.9 billion EUR in the first week of May 2009 (equal to +32.2% from the beginning of 2009). This partial recovery is probably a sign of a certain normalization of market conditions, also thanks to the set of policy actions taken by central banks to encourage the flow of credit. Therefore, it is time now to look more in detail at the content, the objectives and the outcome of such policy actions, following the collapse of Lehman Brothers. In our analysis, we will focus in particular on the monetary policy performed by the ECB starting from October 2008. We will provide the rationale, from the point of view of the economic theory, for some of the major monetary policy measures taken by the ECB in its attempt to contain the crisis. We will see how, among such measures, the enlargement of collateral eligibility criteria was probably a *conditio sine qua non* to make the ECB's course of actions really effective.

4.2 The reaction of the ECB in October 2008

Before looking in detail at the set of actions taken by the ECB, we need to hint at the Eurosystem's operational framework until October 2008, so to illustrate some basic elements of it in the context of our model. A detailed description of the Eurosystem's operational framework is included in the ECB publication on "The implementation of monetary policy in the euro area" (November 2008), which integrates the volume "The monetary policy of the ECB", issued in 2004.

Roughly speaking, we can identify two different periods as to describe the action of the ECB since the start of the turmoil[63]. The first period, going from the outburst of the crisis in August 2007 until the Lehman's collapse in September 2008, was characterized by a more intensive use of the monetary policy tools already adopted by the ECB in the past, in order to supply additional liquidity to the banking system with the aim of countering excessive deviations of very short-term rates from the policy rate. Thus, two major measures taken by the ECB, without fundamentally altering its operational framework, were the following[64].

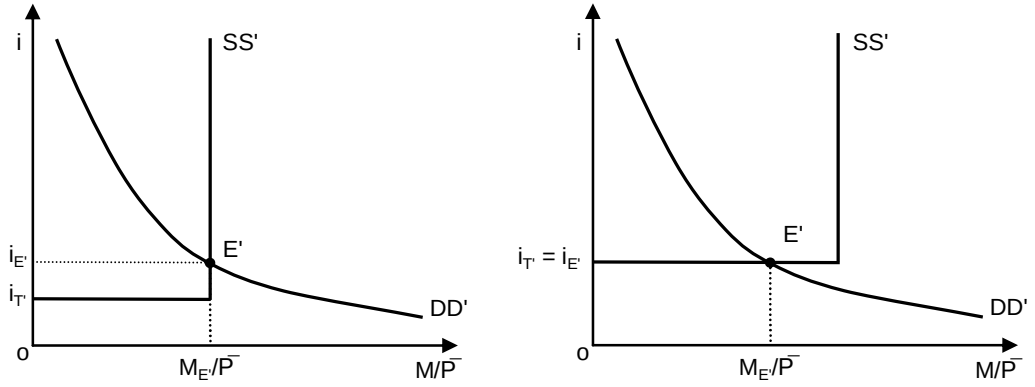
a) The conduction of supplementary longer-term refinancing operations (LTROs) with maturities of three months, and later also six months. The share of this type of operations versus the total Eurosystem's refinancing almost doubled from 33% on average in the first half of 2007 to 61% in the first half of 2008.

[63] This section is mainly based on the article appeared in the ECB Monthly Bulletin, July 2009, titled "The implementation of monetary policy since August 2007", pp. 75-89. See also the speech of Trichet (July 2009).
[64] See ECB (July 2009a), pp. 78-80, for more details.

b) The provision of additional liquidity via the typical short-term (usually, 1-week) main refinancing operations (MROs) through a different allotment pattern during the course of the reserve maintenance period[65].

Leaving out the technical details of these two measures, we can schematically represent the provision of liquidity to the banking system in the period until September 2008 as for the charts below[66].

Charts 16a-b. A representation of the ECB's provision of liquidity via variable-rate tenders with limited allotment



In the two figures above, the supply curve, SS', is composed of two segments: the horizontal segment corresponds to the minimum bid rate in MROs, i.e., the target rate that signals the Eurosystem's monetary policy stance; while the vertical segment corresponds to the total amount of liquidity to be allotted, based on the estimated liquidity needs of the banking system for the period until the day before the settlement of the next MRO[67]. In practice, between June 2000 and September 2008 MROs were conducted as variable rate tenders using a multiple rate procedure. This means that different allotments of credit were granted by the central bank along that portion of the demand curve, DD', to the left of the point, E'. Notice that, historically, Chart 16a represented the normal case, in which the marginal rate, $i_{E'}$, was slightly above the minimum bid rate, $i_{T'}$, whereas the total amount to be allotted was effectively distributed. Indeed, a few cases of 'underbidding' (i.e. when the aggregate of all bids submitted in the tender is lower than the total amount to be allotted), represented by Chart 16b, were

[65] Ibid.
[66] We consider here the scheme of a typical MRO.
[67] The net amount of liquidity to be supplied by the ESCB to credit institutions was estimated on the basis of two elements: "autonomous factors" (mainly, the sum of banknotes in circulation plus government deposits minus net foreign assets) *plus* bank reserves (ECB, 2004, pp. 85-89).

relevant only until March 2004, when the ECB Governing Council decided to adjust its operational framework to prevent such occurrences[68].

The second period of reference, with regard to the monetary policy actions of the ECB, starts in October 2008, following the financial turmoil due to Lehman's collapse in September, and involves a more radical change in the ECB operational framework whose effects are still ongoing. A detailed analysis of all the measures taken by the Eurosystem would require too an extensive treatment and is out of the objective of this study[69]. Nevertheless, following Trichet (July 2009), we can distinguish between 'standard' or 'conventional'[70] measures – essentially, in the form of interest rate changes – and 'non-standard' or 'unconventional' measures – what Trichet defines as "the 'toolkit' for the ECB's policy of enhanced credit support"[71]. The ECB took both types of measures, starting in October 2008. In particular, the ECB's policy of 'enhanced credit support'[72] is mainly founded on five building blocks:

i. Unlimited provision of liquidity through fixed rate tenders with full allotment;

ii. Enlargement of collateral eligibility criteria for Eurosystem's monetary policy operations;

iii. Lengthening of the maturities of the Eurosystem's refinancing operations (up to one year, starting on 23 June 2009);

iv. Provision of liquidity in foreign currencies (particularly in US dollars) via foreign exchange swap operations;

v. Outright purchases of covered bonds.

[68] Specifically, these changes – aiming at preventing rate change speculation in the course of a maintenance period from provoking underbidding – concerned 1) the timing of the start of the reserve maintenance periods, and 2) the shortening of the MROs maturity to one week (ECB, 2004, p. 81).

[69] As mentioned, two useful summaries are in ECB (July 2009a) and Trichet (July 2009). In addition, see the speech of Bini Smaghi (April 2009), also for an analysis of the mutual relationship and classification of different actions taken by different central banks.

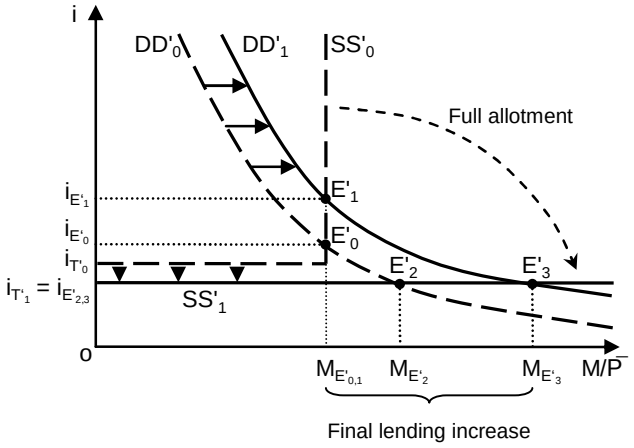
[70] The appellation 'conventional'/'unconventional', commonly used in the financial press, can also be found in Bini Smaghi (April 2009), where we read that "unconventional measures can be defined as those policies that directly target the cost and availability of external finance to banks, households and non-financial companies" (p. 3).

[71] P. 8. In turn, Bini Smaghi (April 2009, p. 4) classifies 'non-standard' or 'unconventional' measures into 'quantitative easing' ("affecting the level of the longer term interest rate of financial assets across the board, independently of their risk") and 'credit easing' ("to affect the risk spread across assets, between those whose markets are particularly impaired and those that are more functioning"). Willem Buiter (2008) operates a similar classification in terms of 'quantitative' versus 'qualitative' easing, based on the impact on the central bank balance-sheet. Cfr. also Meier (2009) for a thorough review and classification of different measures of unconventional monetary policy (pp. 10-17).

[72] According to the Trichet's definition, "enhanced credit support constitutes the special and primarily bank-based measures that are being taken to enhance the flow of credit above and beyond what could be achieved through policy interest rate reductions alone" (p. 10).

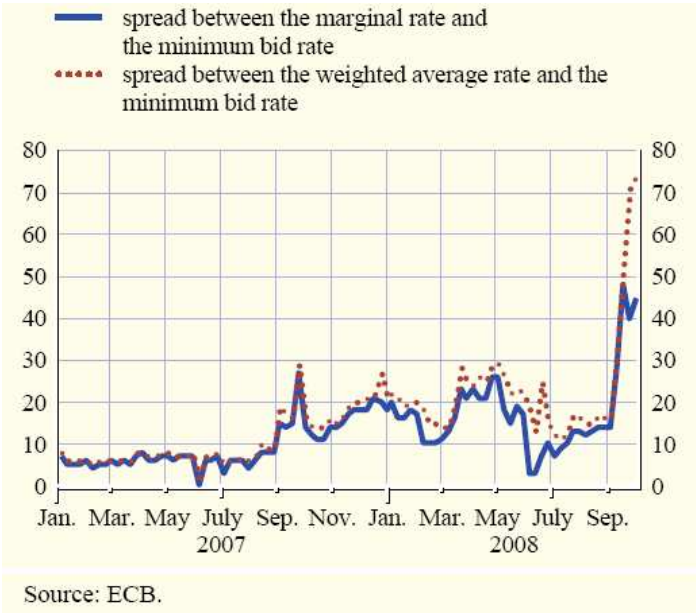
At the heart of the ECB's revised policy, the combination of standard measures (namely, interest rate lowering) and enhanced credit support's building block one (unlimited provision of liquidity through fixed rate tenders with full allotment) is particularly relevant for us, and can be graphically represented as in Chart 17.

Chart 17. A representation of the major changes to the ECB's monetary policy operational framework in October 2008



The chart shows that, following the Lehman's shock and a consequent harshening of interbank market conditions, the demand for central bank funding increased, so that the demand curve shifted from DD'_0 to DD'_1. The official figures from the ECB prove that such augmented liquidity needs provoked, in turn, an increase of the marginal rate above 40 basis points – from $i_{E'_0}$ to $i_{E'_1}$ in our picture – while the average MRO rate even stood at more than 70 basis points above the minimum bid rate (see the chart on tender spreads here below).

Chart 18. Tender spreads (source: ECB, July 2009a, p. 80)



Source: ECB.

Such elevated spreads were an obstacle to the effectiveness of monetary policy transmission at a time when the ECB wanted to maintain the availability of credit for households and companies at accessible rates. Indeed, the stimulus effect of a decrease of the ECB reference rate (the minimum bid rate) would have been completely offset by higher money market spreads, had the central bank not guaranteed an unlimited provision of liquidity to the banking sector.

Therefore, on 8 October 2008 the ECB Governing Council announced the switch, as of 15 October 2008, to a fixed-rate tender procedure with full allotment in MROs, in which banks' bids would be satisfied in full at the fixed MRO rate[73]. On the same date, the key reference rate was cut by half a percentage point, down to 3.75%. In our model, these two measures are jointly represented by the simultaneous lowering and flattening of the money/credit supply curve, from SS'_0 to SS'_1.

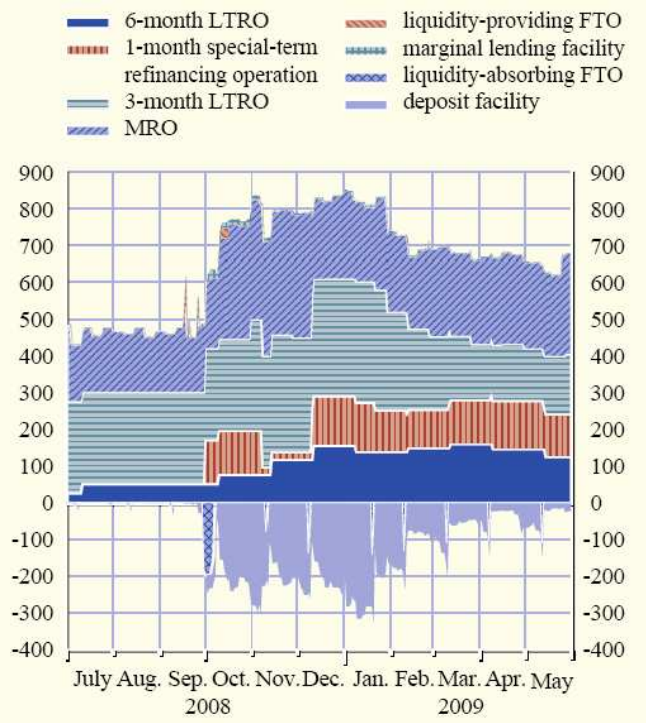
As a first explanation of the further significant extension of the central bank balance-sheet that started in October 2008[74], notice that, due to the upward shift of the demand

[73] With effect from 30 October 2008, this tender procedure was also applied to all LTROs, including regular and supplementary operations, as well as the special-term refinancing operations with a maturity of one maintenance period.

[74] "Between the end of June 2007 and the end of April 2009, the [Eurosystem] balance sheet increased by about EUR 600 billion, and had reached EUR 1.51 trillion which is equivalent to 16% of the nominal GDP in the euro area" (Papademos, 2009, p. 3). Much of this increase occurred after September 2008, as "between the end of June 2007 and the end of September 2008, the balance sheet of the Eurosystem increased only moderately by about 100 billion euro" (ibid., p. 2), i.e. by 11%, vis-à-vis an increase of 65% for the whole period July 2007-September

curve, at the new equilibrium point, E'_3, the final volume of credit lent to banks is much higher than if the demand curve would have remained in the same position, i.e. with an equilibrium point at E'_2. Also in this case, the economic theory is fully supported by the empirical data presented by the ECB, showing that the volume of credit granted by the ECB nearly doubled, compared to the average level before October 2008 – see Chart 19.

Chart 19. Provision of refinancing, broken down by maturity (EUR billions; source: ECB, July 2009a, p. 84)



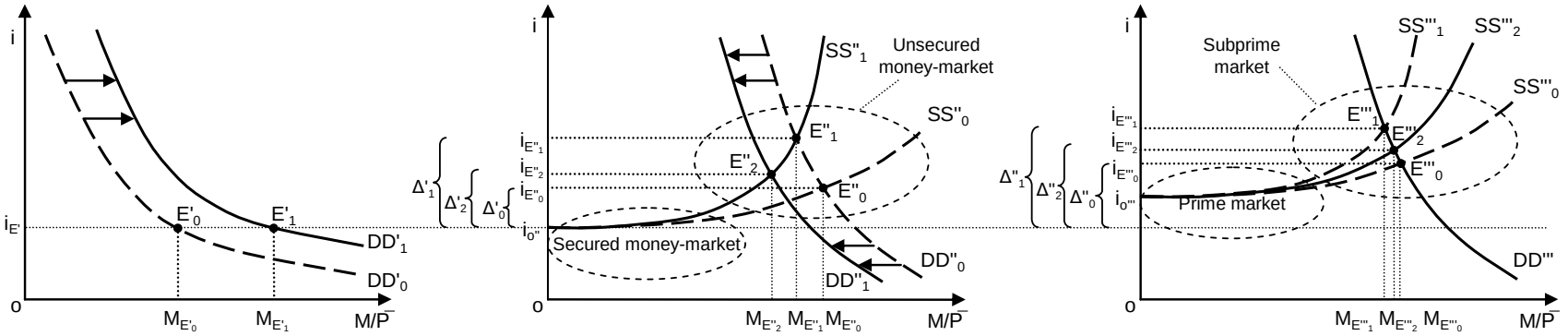
Source: ECB.

Overall, the measures taken by the ECB in Q4 2008 were successful, and allowed to avoid a complete gridlock of the interbank market at the end of last year. By satisfying banks' demand for liquidity, the Eurosystem has favored the resetting of more normal conditions and lower spreads in the money markets, even if this has probably come at the cost of a further contraction of private lending volumes, especially in the unsecured segment (crowding-out effect).

2008. Latest data show a stabilization or even a moderate retrenchment: "by the end of August 2009, the simplified balance sheet of the Eurosystem stood at around €1,500 billion" (Stark, 2009, p. 2).

Chart 20 reassesses the relationship between central banking funding and the other markets for credit *post* September 2008, in the context of our theoretical framework. It shows how the combination of lower central bank refinancing rates and unlimited provision of liquidity, through fixed-rate tenders with full allotment, positively affected the equilibrium conditions in the interbank market and, ultimately, in the bank lending market.

Chart 20. The Lehman shock and the effects of the ECB monetary policy measures taken in October 2008



The first figure on the left is a simplified version of Chart 17, the central bank funding market *post* Lehman. A critical knot is the link between this market and the interbank market (the figure in the middle). Remember that, in our model (Section 3.2.4), we have assumed that banks can freely substitute between central bank funds and interbank funds[75]. A major implication of this assumption is that the demand functions in these two markets are strictly connected, as for any two gross substitutes[76]. Indeed, we could make an analogy with two communicating vessels, where the provision of liquidity on one side tends to spill over to the other side, until a uniform level of liquidity is achieved on both, independently on the capacity (that is, the volume) of each recipient. In our model, this 'uniform level' is achieved via time-consistent adjustments of the spread between interbank rates on unsecured and secured lending, Δ'.

Thus, given a certain volume of overall liquidity needed by the banking system for funding purposes and a certain level of the interest rates, the provision of unlimited credit in one market automatically tends to limit or contain the demand in the other. Looking back at Chart 20, this means that the adjustment of the equilibrium quantity from $M_{E'_0}$ to $M_{E'_1}$ in the central bank funding market helped to reduce the pressure in the interbank market by pushing the demand curve backward from DD''_0 to DD''_1. A new equilibrium in the interbank market was finally achieved at E''_2, given by the combination ($M_{E''_2}$, $i_{E''_2}$). Notice that this new equilibrium corresponds to a level of the secured-unsecured lending spread, Δ'_2, which is still above the original spread, Δ'_0, but much lower than the crisis level, Δ'_1. Once again, the official data from the ECB support this theory – see earlier Chart 11, showing the Euribor-OIS spread between January 2007 and May 2009.

It is important to recognize that this 'normalization' of the secured-unsecured lending spread was achieved by the ECB at the cost of a further contraction of credit volumes in the interbank market: the shift from $M_{E''_1}$ to $M_{E''_2}$ in our model. That is, in the attempt of minimizing the impact of the financial crisis on the real sector, the Eurosystem's provision of refinancing has de facto largely substituted market-based borrowing in the interbank market, up to crowd out further interbank activity in order to reduce money

[75] Historically, banks refinancing with the Eurosystem have never faced a reputational issue, similar to the 'stigma' related to discount window borrowing in the U.S. In addition, a very large number of counterparties have always been able to take part in the Eurosystem's refinancing operations. "Even before the crisis, 1,700 counterparties fulfilled all relevant criteria. This number was higher at the time than for the other major central banks. Following the changes to our operational framework in October 2008, this number rose further. Currently 2,200 credit institutions in the euro area have the opportunity to refinance themselves with us, and for most of the remaining 4,300 credit institutions it would not be problematic to become eligible. For example, in March 2009, 750 counterparties actually made use of this opportunity, compared with 450 in July 2007" (J.-C. Trichet, "The financial crisis and the ECB's response so far", Keynote address at the Chatham House Global Financial Forum, New York, 27 April 2009).

[76] In reality, an analysis of the degree of substitution between central bank funding and interbank funding at the level of the Eurosystem should consider the role of the 'corridor', that is, two additional prices in the central bank funds market: the marginal deposit rate and the marginal lending rate. See ECB (July 2009a), pp. 85-86, for empirical evidence of how changes in the corridor impacted volumes in the interbank market, in the aftermath of Lehman's collapse.

market spreads[77]. This has gone to the extent that some analysts have spoken about a role of 'lender of first resort', currently, for the ECB in Europe[78].

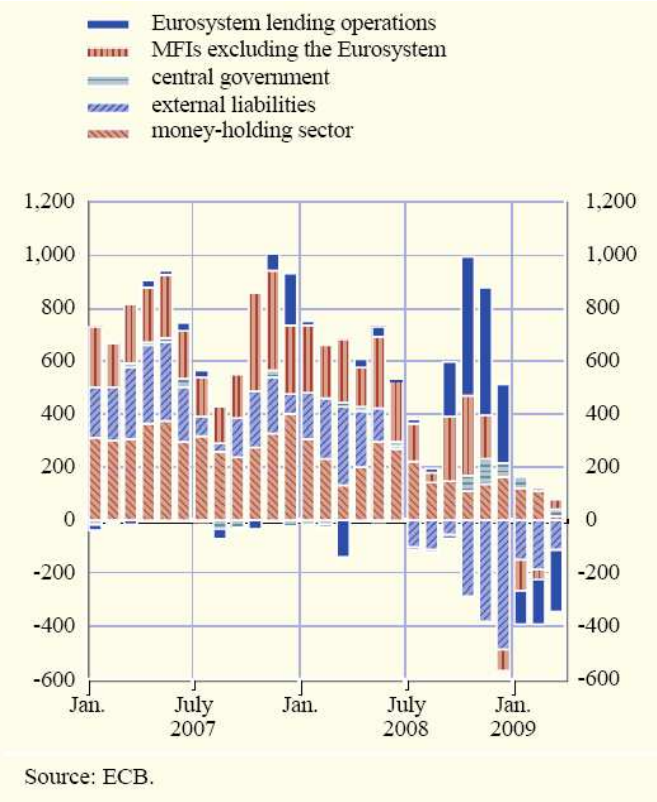
The prominent role of the Eurosystem as a major funding source for euro area credit institutions in Q4 2008 is clearly evidenced by Chart 21, based on ECB official data[79].

[77] The existence of a crowding-out effect vis-à-vis the interbank market, linked to the central bank's direct provision of liquidity, is proved both theoretically (Heider, Hoerova, and Holthausen, 2009), and from an empirical point of view (Brunetti, di Fillippo, and Harris, 2009, though their dataset extends only until 1 April 2008).

[78] Cfr. anecdotic evidence reported in McCaw (2009): "As the turmoil in global financial markets continues to affect financial institutions around the world, it is increasingly evident that the asset repurchase facilities provided by central banks have become a lifeline for banks struggling to raise capital in the current climate. In a market devoid of its traditional investor base, originators and arrangers of securitization transactions within the Eurozone have come to rely heavily on the European Central Bank's (ECB) asset repurchase or "repo" facility which allows (among other assets) ABS to be used as collateral for funding. In contrast to the various U.S. facilities designed to restart the U.S. securitization market, the ECB facility is intended to allow financial institution holders of ABS access to short-term finance at (until recently) attractive rates, and has led increasing numbers of originators to structure, issue and retain their "own-name" ABS specifically for the purpose of accessing the ECB's repo facility. Unsurprisingly, originators have flocked to the ECB in droves with newly-issued ABS over the past two years as funding conditions have deteriorated, creating a de facto "lender of first resort" position for the ECB within Europe. […] Despite the threat of greater scrutiny of ABS collateral by the ECB in future, the prospects for a return to more traditional, investor-funded transactions are, in the present market, slim. With around 95% of all 2008 European securitization issuance used as collateral for ECB repo purposes, there appears to be little appetite to test the public market, either on the buy or sell-side".

[79] Cfr. also Section 2.2 to see how settlement turnover and collateral management activity in Clearstream are today driven by the offer of Euro GC Pooling, a collateral management and pooling service which is largely used by Clearstream customers to support their refinancing operations with the Eurosystem.

Chart 21. Funding sources of euro area credit institutions by counterpart sector (three-month flows; EUR billions; source: ECB, July 2009a, p. 87)



Source: ECB.

While this was the lesser evil in a very difficult contingency at the end of last year, the ECB and other central banks do not consider such an extensive funding intermediation as a 'natural' role for themselves, so that a solution to this issue will be an integral part of their exit strategy in a medium-term prospective. Indeed, the primary objective of the ECB's intervention in October 2008 was not to replenish liquidity directly in the interbank market; rather, to preserve the integrity of the monetary transmission mechanism and, by doing this, the supply of credit to the real sector "at accessible rates"[80]. This effect is

[80] In the words of Trichet (July 2009, p. 10): "Our first and primary concern was to maintain the availability of credit for households and companies at accessible rates. The new fixed rate full allotment tender procedure was designed to ensure the effectiveness of monetary policy transmission at a time when borrowing through interbank transactions had become abnormally elevated for many financial institutions". Notice that this statement clearly contradicts those who assume that "the primary motivation for ECB intervention is to improve liquidity in the interbank market" (Brunetti et al., 2009, p. 20): as a consequence, Brunetti et al.'s conclusions in terms of policy prescriptions for central bank intervention ("the central bank should focus on providing interbank loan guarantees or direct asset purchases rather than simply injecting capital into the system", pp. 3 and 25) lose much of their validity when considered in the light of the ECB's asserted scope in *that* particular circumstance.

evident in our model when we look at the third graph (the bank lending market) in Chart 20: the beneficial effect of the ECB's set of measures on banks' liquidity ultimately induced a new, rightward shift of the money/credit supply curve, from SS'''_1 to SS'''_2, with a new equilibrium at E'''_2, in correspondence of a lower interest rate and a greater credit supply, compared to the phase of acute stress. Latest data from the ECB seem to confirm that this is what effectively occurred[81].

Finally, from the point of view of the theoretical debate, the quality and the extent of the 'paradigm change' to which we referred in section 4.1, are now clear. The thorough inversion of roles between central bank refinancing and interbank market was such that, while the money/credit supply curve in the interbank market has now become nearly vertical – at least in its upper section (unsecured money market) – the same curve in the central bank funds market has, on the contrary, become completely horizontal. That is, overall money supply is today critically conditioned by the decisions of the central bank (which, on the other hand, has decided for the moment that its money supply should be purely demand-driven). Thus, the collapse of Lehman and the related decision by the U.S. authorities not to save the bank, have suddenly thrown us in the ideal world assumed by Milton Friedman at the heart of his theory. This sounds paradoxical for two categories of people in particular: 1) post-Keynesian theorists, who have now certainly won the war waged in the past 30 years, but whose world – for which they have been fighting – has vanished in the very same moment in which they have realized their victory; 2) central bankers, who fancy the 'good old times' in which they had to think twice on nothing more than the price at which selling their 'product', and now dream of an exit strategy leading back to the 'untroubled' world of post-Keynesians[82].

[81] Other than the interest rate trends shown in ECB (July 2009a), p. 87, and the "Euro area MFI interest rate statistics" for June 2009 (stating that "most average MFI interest rates on new loans further decreased"), see also the results of the latest ECB's "Euro area bank lending survey", July 2009. There, we can read that "in the second quarter of 2009 the net percentage of banks reporting a tightening of credit standards applied to loans and credit lines to enterprises broadly halved, to 21%, compared with 43% in the first quarter of 2009 and down from the high level seen in the third and fourth quarters of 2008. All factors contributed to the decline in the net tightening of credit standards, but particularly supply-side factors, such as banks' access to market financing and banks' liquidity position. […] For the third quarter of 2009, euro area banks expect a further lowering of the net tightening of credit standards for loans to enterprises" (p. 1).

[82] Taken from a commentary of W. Münchau appeared on FT.com on 26/07/2009: "Before 2007, independent central banks would have had no problem presenting credible exit strategies. They would have pointed to their inflation target, and how they would use their medium-term inflation forecast or some other analytical framework to ensure that the price level would remain on a stable trajectory. The financial markets would have mostly agreed with the central bank's decision on interest rates, give or take a quarter point. That is simply not the case any longer. There are two big problems that need to be considered. One is the commercial banking system. This is more of an issue for the Europeans than the Americans, given the European governments' inability to resolve the difficulty of continued bad debts. If the European Central Bank, for example, decided to exit tomorrow by raising interest rates, the likely consequence would be a banking meltdown. A credible monetary exit strategy, in Europe at least, would read like a suicide note. The other problem, which is more troublesome for the US than the eurozone, is fiscal policy. As James Hamilton, professor of economics at the University of California, San Diego, pointed

4.3 The role of collateral eligibility criteria

We are now ready to look at the role played by collateral requirements in the context of the current crisis. Recall from the previous section that the enlargement of collateral eligibility criteria for monetary policy operations was the second building block of the ECB's policy of 'enhanced credit support' in the aftermath of Lehman's collapse. "To ensure that collateral did not constitute a constraint after the introduction of the fixed rate procedure with full allotment, the first element of the measures announced on 15 October was a temporary expansion of the list of assets eligible as collateral"[83].

Specifically, "as of 22 October the rating threshold for marketable and non-marketable assets was lowered from "A-" to "BBB-", with the exception of asset-backed securities, for which the threshold of "A-" remained unchanged. Since that same date the Eurosystem has accepted debt instruments issued by credit institutions which are not listed on a regulated market, but are traded on certain non-regulated markets recognised by the ECB. Furthermore, subordinated marketable debt instruments, which are protected by an acceptable guarantee and fulfil all other eligibility criteria, may also be used as collateral. Since 14 November the Eurosystem has also accepted marketable debt instruments issued in the euro area and denominated in US dollars, pounds sterling and Japanese yen, provided that the issuer is established in the European Economic Area"[84].

As a result, "the marketable assets added at the end of 2008 to the list of eligible collateral amounted to a volume of around €870 billion, or about 7% of the total amount of eligible marketable assets. They accounted for around 3% of the total marketable collateral posted by counterparties. Moreover, a significant amount of non-marketable assets, mainly credit claims (i.e. bank loans), became eligible when the rating threshold was lowered to 'BBB-'"[85]. Overall, the total value of all the Eurosystem-eligible assets "is currently €12.2 trillion, equivalent to 130% of the GDP of the euro area"[86].

As already said, this enlargement of collateral requirements was a necessary condition to ensure the effectiveness of the other monetary policy actions of the ECB. Indeed, too binding collateral eligibility criteria might have represented a serious bottleneck vis-à-vis the central bank's attempt to pump considerable volumes of liquidity into the banking system in a very short time frame. Chart 22 illustrates this rationale, in the context of our model.

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out in a recent analysis […], the direction of US debt, combined with the intermingling of monetary and fiscal policy, is inconsistent with the goal of long-term price stability".

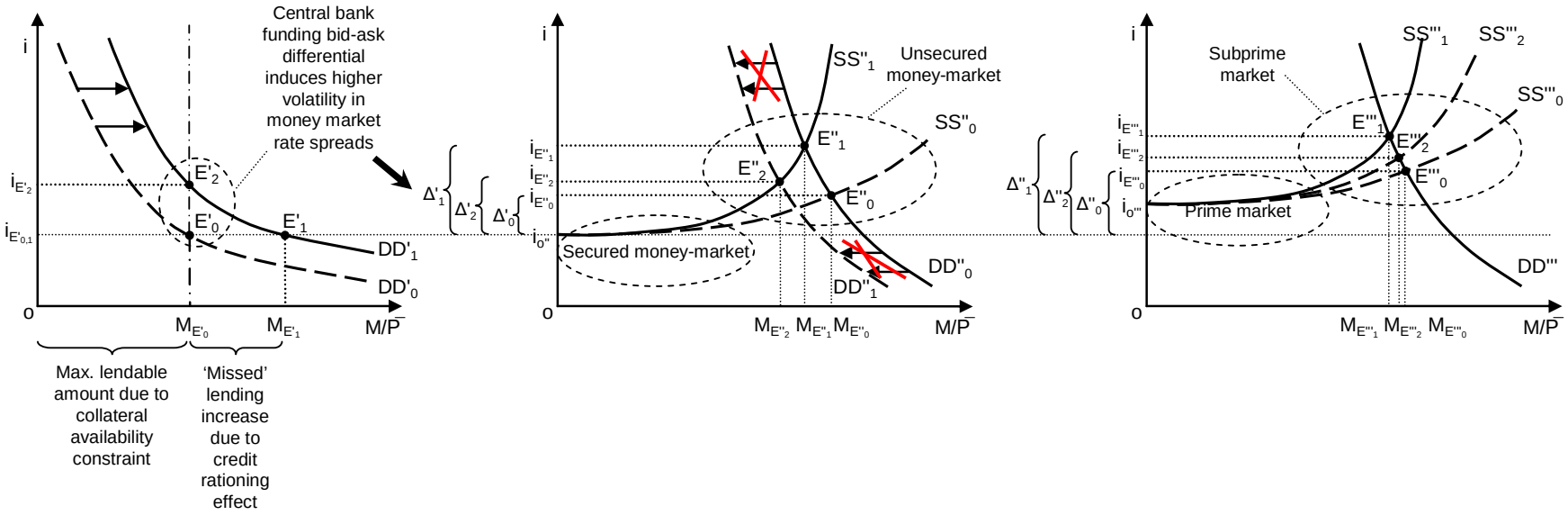
[83] ECB (July 2009a), p. 82.

[84] Ibid. See also ECB (May 2009), p. 25, for a more detailed list of changes to the Eurosystem collateral framework.

[85] ECB (July 2009a), p. 82.

[86] Trichet (July 2009), p. 11.

Chart 22. Monetary policy effects of a collateral bottleneck



In the figure on the left (central bank funding market), we suppose that the collateral held by banks for central bank refinancing operations is just sufficient to cover an amount of borrowing equal to $M_{E'_0}$. This means that, in the presence of an incremental shift of the demand from DD'_0 to DD'_1, even with an unlimited provision of central bank refinancing through fixed rate tenders with full allotment, banks would never be able to borrow more than the quantity $M_{E'_0}$, due to the lack of proper collateral. Notice that, for $M_{E'_0}$, banks would be willing to pay, at the margin, a much higher interest rate, $i_{E'_2}$, than the fixed-rate offered by the central bank, $i_{E'_{0,1}}$. A typical case of credit rationing would follow, whereas the distribution of liquidity among individual banks would depend on their access to central bank refinancing, which, in turn, would depend on each bank's availability of proper collateral. The abnormal bid-ask spread in the central bank fund market would immediately translate into a newly rising demand in the money market by those banks having limited or even no access at all to central bank refinancing; ultimately, this would bring up a credit crunch for the real sector.

In graphical terms, this is visible in the second and third sections of Chart 22. In the second section (interbank market), the demand curve would *not* shift to the left, from DD''_0 to DD''_1, in spite of the unlimited provision of central bank liquidity with full allotment. The disparity in the distribution of liquidity among banks would exacerbate money market spreads both in terms of average values (rising up to Δ'_1) and in terms of their dispersion across different transactions (volatility). *That is, the benign impact of central bank's unlimited provision of liquidity through fixed rate tenders with full allotment, would be, at the limit, completely impaired by too binding access conditions (due to a compelling collateral constraint) for certain banks*. Even worst, such banks may probably be the same ones needing liquidity most urgently, as the bad quality of their balance-sheet and, jointly, of their asset (i.e. collateral) portfolio might have already prevented them from recurring to other funding sources. These problems in the banking sector would finally pass to the real sector, as the money/credit supply curve would not recover from its acute-stress position, SS'''_1, in the right-hand chart (bank lending market), so that a credit crunch could not finally be averted.

In order to fully understand the central bank's rationale for enlarging collateral requirements, we need to make a further consideration. In the previous Section, we have already hinted at the crowding-out effect of a central bank fund market with fixed-rate, unlimited liquidity provisioning, especially vis-à-vis the unsecured segment of the interbank market. In spite of the ECB's adoption of softer collateral criteria, this substitution did not leave banks indifferent in terms of collateral needs. In the unsecured money market, collateral requirements are zero: having to replace this funding source with central bank refinancing has certainly exacerbated banks' 'hunger' for central bank-eligible collateral. The ECB's outright purchases of covered bonds as an additional measure of enhanced credit support could then be interpreted as an effort to stimulate new issues in an asset class which provides an important source of collateral in the repo market (see later in this chapter).

In conclusion of this Section, it is opportune to remark the usage that the ECB and other central banks have made of collateral eligibility criteria at the acme of the financial crisis. Indeed, central banks actions in this area have been driven primarily by concerns about monetary policy, besides financial stability. The ECB adopted wider collateral requirements with the main objective of ensuring the effectiveness of other both conventional and unconventional monetary policy actions, in the first instance. Thus, *collateral requirements were essentially used as an instrument of monetary policy*[87]*, as a necessary condition to preserve the monetary policy transmission mechanism in the presence of a steep money/credit supply curve in the interbank market*. Notice that this factual role of collateral requirements as monetary policy enabler goes somewhat beyond their original nature of 'administrative' tool to manage counterparty risk in monetary policy operations.

On the other hand, from a financial stability point of view, broader collateral eligibility criteria certainly contributed to facilitate the access to short-term credit and to alleviate the liquidity needs of those banks that were most struck by the turmoil, therefore lessening the risk of possible bank defaults with a potential impact also in terms of systemic risk. It was a fortunate occurrence that, in the harsh contingency of October 2008, monetary policy and financial stability both required to maneuver the collateral requirements tool into the same direction. Whether this is still the case in a medium- to long-term prospective is an issue that will be analyzed in detail in the following chapter.

4.4 Why covered bonds?

As we have seen in Section 4.2, the fifth building block of the ECB's policy of enhanced credit support initiated in October 2008 concerns the outright purchase of covered bonds. On 7 May 2009, the Governing Council of the ECB decided to directly purchase up to 60 billion EUR of euro-denominated covered bonds issued in the euro area, to be conducted in both the primary and the secondary markets. The purchases have started

[87] This idea is in contrast with the common view on collateral eligibility criteria as an instrument used mainly for financial stability purposes, even if sometimes bringing implications for monetary transmission. See for instance the recent paper of Meier (2009), stating incidentally that "central banks' decision to relax collateral requirements for repurchase operations is generally not meant to provide targeted stimulus, but reflects an attempt to keep the conventional policy framework – secured short-term lending to banks at the policy rate – operative even as banks run out of standard collateral" (p. 7). This assertion is someway mitigated by the successive statement, saying that "despite this difference in intent, the effects of financial stability interventions are sometimes similar to those sought by unconventional monetary policy. For instance, acceptance of certain private securities as collateral can reduce liquidity premia, much like the unconventional monetary tool of outright security purchases".

in July 2009, and are expected to be fully implemented by the end of June 2010 at the latest[88].

In principle, the main purpose of this initiative was to strengthen a source of longer-term funding for European banks, beyond the standard maturities of ECB's refinancing operations[89]. By allowing banks to manage the maturity mismatch between their assets and liabilities, covered bonds purchases complement the liquidity management measures of the previous four building blocks of the central bank's enhanced credit support. According to the official statements of the ECB, two main reasons ultimately underlie its decision to intervene in this specific market.

"First, […] in the euro area measures to support the flow of credit to the non-financial sector need to operate first and foremost through banks. Covered bonds were a major source of funds for banks in the euro area before the intensification of the financial crisis last autumn, when the covered bonds market virtually shut down. The [ECB] Governing Council came to the conclusion that the Eurosystem could help to revive this market, in terms of liquidity, issuance and spreads, by engaging in outright purchases of covered bonds.

Second, covered bonds are different in nature from the various asset-backed securities that became so popular before turning sour with the financial crisis. Importantly, covered bonds do not involve the transfer of the credit risk implied by underlying assets from the issuer to the investor. The credit risk stays with the originator, preserving the incentives for prudent credit risk evaluation and monitoring. […] Covered bonds are incentive compatible while many asset-backed securities were not, at least not in the way the concept was implemented before the crisis. […] Given that the financial crisis clearly exposed the dire consequences of the imprudent evaluation of credit risk, the usefulness of more conservative asset classes such as covered bonds, which have proved to be safe assets over a long time, is obvious"[90].

Thus, the ECB intended to signal a strong commitment and support in favor of the banking sector, while preserving the integrity of its approach to financial stability and sound risk management practices. In reality, a third fundamental reason – not made explicit by the ECB up to now – to support the covered bonds market is probably linked to the *privileged role of covered bonds as collateral assets in money market transactions*. The two charts below, showing the historical liquidity ratios for different

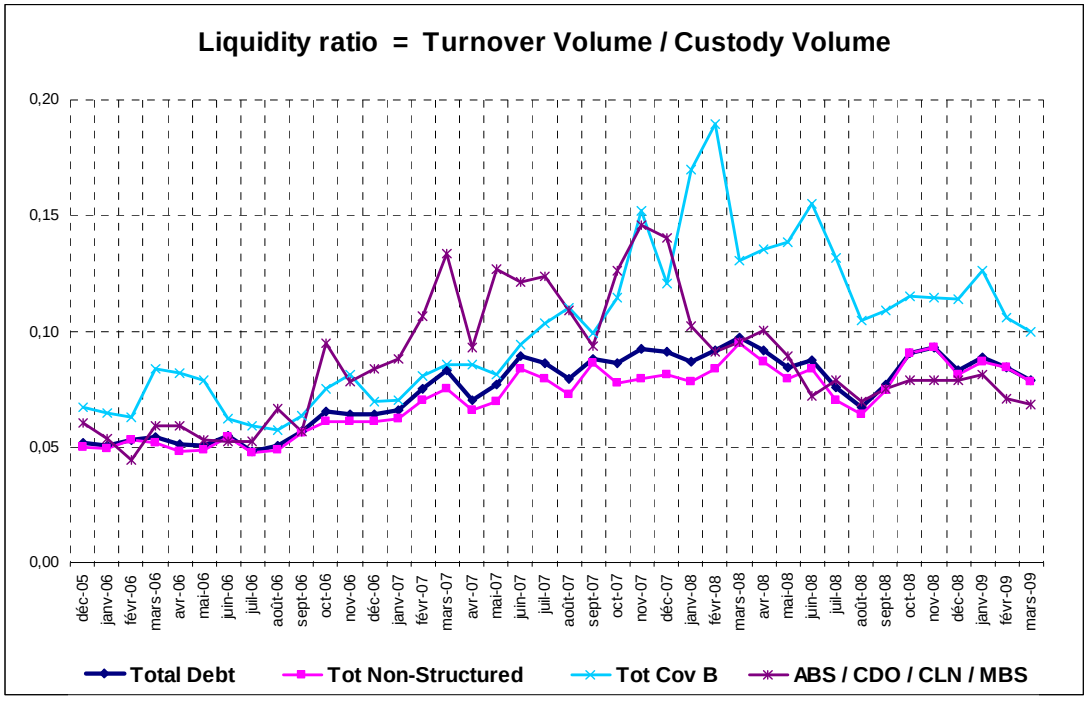
[88] As of 28 August 2009, the Eurosystem had purchased eligible covered bonds with a total nominal value of 9,482 million EUR, of which 2,110 million EUR was accounted for by purchases in the primary market and the remaining 7,372 million EUR by purchases in the secondary market (source: Monthly reports on the Eurosystem's covered bonds purchase programme, July 2009 and August 2009).

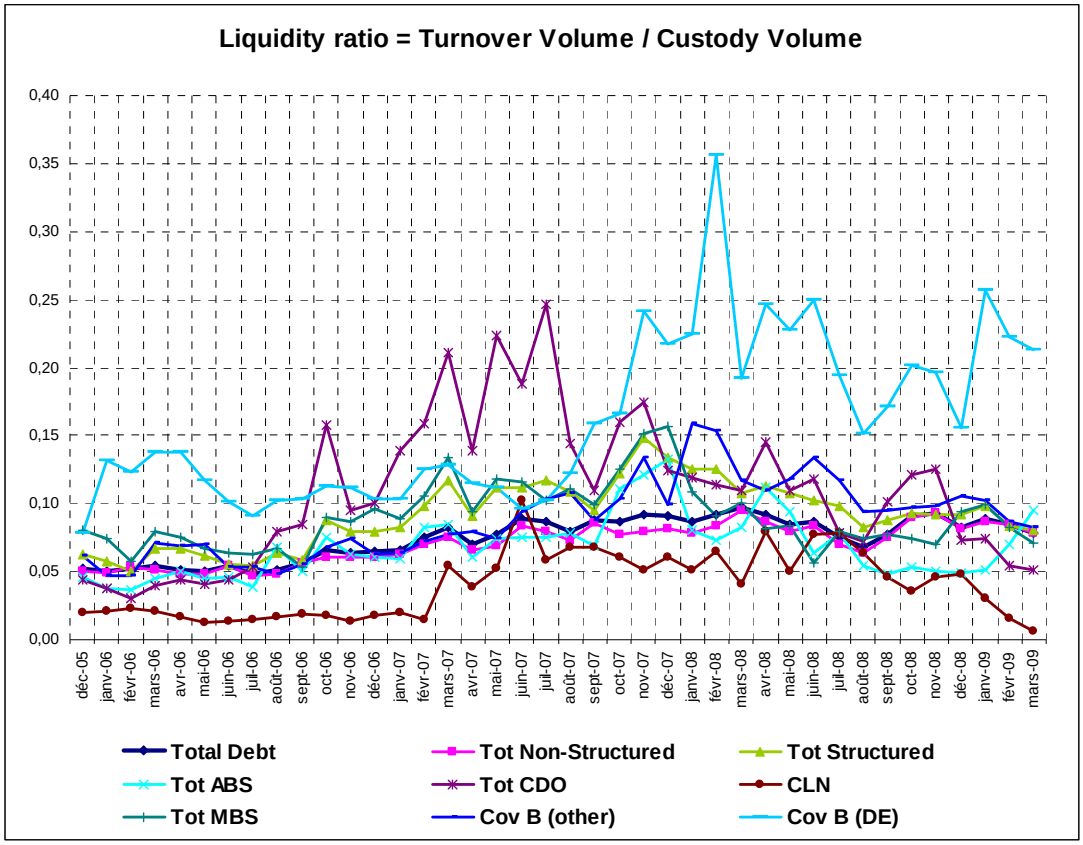
[89] It is significant that this measure was taken by the ECB in parallel to the adoption of longer-term refinancing operations with a maturity of up to 12 months, starting on 23 June 2009 (third building block of ECB's policy of enhanced credit support).

[90] Trichet (July 2009), pp. 11-12.

classes of structured assets as well as for the total volume of debt securities settled in Clearstream, provide a strong piece of evidence in favor of this hypothesis.

Charts 23a-b. Liquidity ratios for different classes of debt securities in Clearstream ICSD (source: author's computations on Clearstream data)





As in Section 2.2, a 'liquidity ratio' is here defined as the ratio between the turnover and the custody volume of a certain set of securities settled in Clearstream over a specified period of time (in our case, one month). It is a relative measure of turnover (assumed as a proxy for liquidity), linked to settlement activity, allowing us to compare "the frequency by which financial institutions at Clearstream 'mobilize' their securities holdings" (our definition of 'liquidity'). As we know that a major part of the settlement activity in Clearstream is related to repos and collateral management (cfr. Chapter 2), liquidity ratios provide us, therefore, with an indirect measure of the relative usage of different asset classes as collateral.

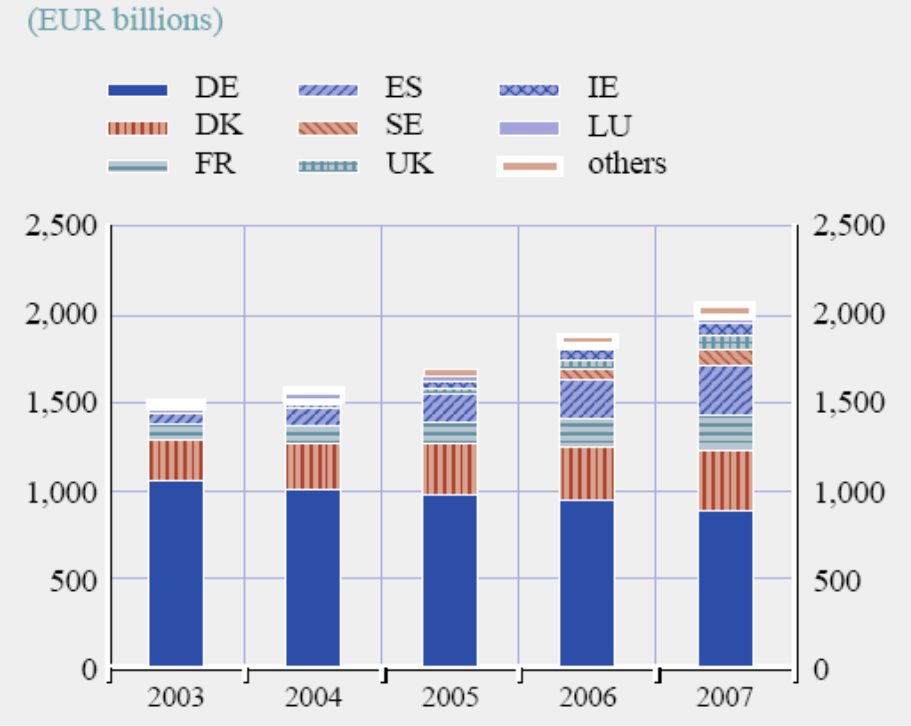
The patterns shown in the two charts above provide us with many interesting indications that we can summarize as follows.

i. First, we notice that covered bonds have followed different patterns of liquidity compared to other structured products: in particular, starting from January 2008, their use as collateral has significantly excelled the use of all the other classes of structured products, as well as of debt securities in general.

ii. Especially German covered bonds (*Pfandbriefe*) manifested an exceptionally intensive usage already before the Lehman crisis (September 2008). More in general, between December 2005 and March 2009 German covered bonds have

always been more liquid than covered bonds issued in other European countries. This might be only partially due to the presence of a high percentage of German institutions in Clearstream's customer base: indeed, the ratio between German and non-German covered bond deposits held in Clearstream has historically been much lower than the ratio between German and non-German covered bonds outstanding in Europe, as reported by the ECB (see Chart 24). Instead, the recent high levels of activity in German covered bonds at Clearstream should be related to the fast growth of settlement volumes linked to the Euro GC Pooling service (see again in Chapter 2).

Chart 24. Covered bonds outstanding in Europe (long term), 2003-2007 (source: ECB, May 2009, p. 9)



Source: European Covered Bond Council.

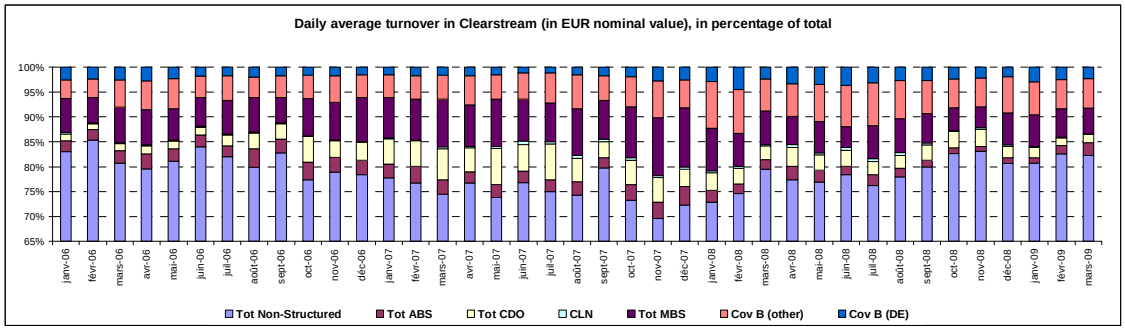
iii. Finally, starting from October 2008, the liquidity of structured assets other than covered bonds has remained substantially below the average liquidity of non-structured debt securities[91]; quite obviously, the usage of more 'problematic'

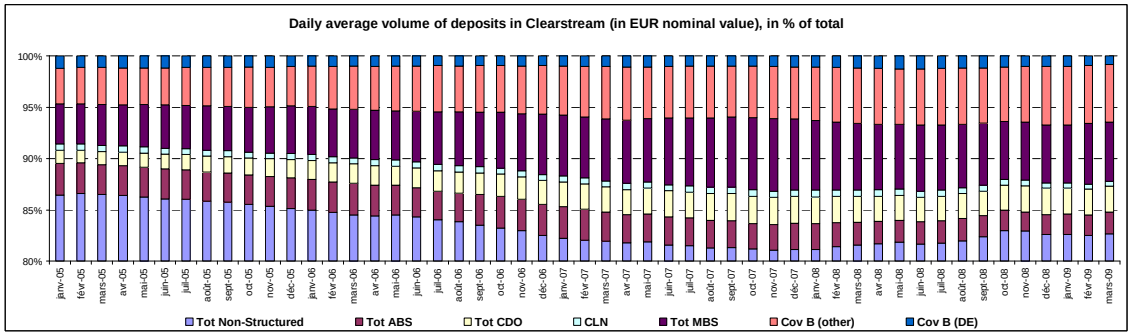
[91] In Clearstream, this residual class of non-structured debt is very large and includes both international issues (e.g. Eurobonds) and domestic issues, including Govies, commercial papers, and many others.

assets, like credit-linked notes (CLN) and collateralized debt obligations (CDO), has now shrunk to very low levels, so that their liquidity in the interbank market has nearly completely dried up[92].

Charts 25a-b complete the information on structured assets activity received from Clearstream. They graphically show the historical series of daily average turnover and daily average volume of deposits in the Luxembourg ICSD, in relative percentage of total debt assets. Our calculation of the liquidity ratios for the structured assets in Clearstream is based upon such time series.

Charts 25a-b. Daily average turnover and daily average volume of deposits in Clearstream ICSD, in percentage of total debt securities





Additional data from the ECB complement our analysis of covered bonds as collateral, and allow us to achieve the 'full picture' on this issue.

i. *In primis*, jumbo and traditional covered bank bonds are the class of private-sector securities collateral for which the smallest number of banks, among those interviewed by the ECB's Banking Supervision Committee (BSC), have signaled an increase in haircuts since the beginning of the crisis. Only 13.9% of banks included in the BSC survey experienced an increase in covered bonds collateral

[92] Notice also that CDOs were very intensively used in the months preceding the outburst of the subprime crisis (August-September 2007).

haircuts demanded in interbank operations, that is, the same percentage as for agency debt instruments, and much less than for any other class of private-sector securities used as collateral. This occurred in spite of the fact that up to 27.8% of respondent banks experienced some kind of constraint related to the usage of covered bonds (see Table 1).

Table 1. Summary statistics on constraints on collateral in interbank operations (source: ECB, May 2009, p. 23)

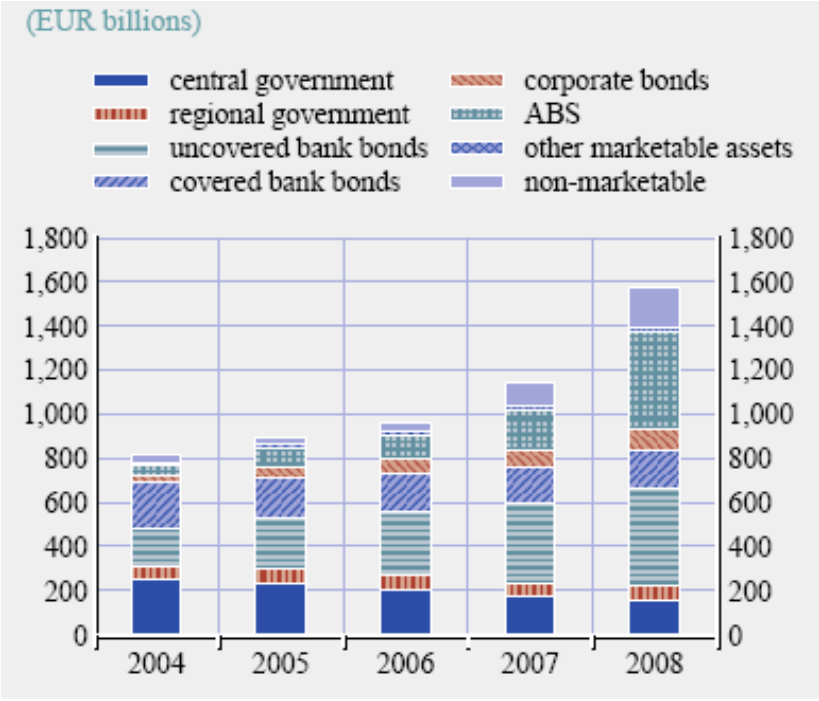
(percentages)

	Did your institution experience constraints for a specific type of collateral?			Number of banks which mentioned an increase in haircuts
	Yes	No (or not active)	No answer	
Central government debt instruments	19.4	52.8	27.8	2.8
Local and regional government debt instruments	22.2	36.1	41.7	5.6
Jumbo and traditional covered bank bonds	27.8	30.6	41.7	13.9
Agency debt instruments	19.4	38.9	41.7	13.9
Supranational debt instruments	16.7	41.7	41.7	11.1
Credit institution debt instruments	27.8	27.8	44.4	22.2
Debt instruments issued by corporate and other issuers	33.3	25.0	41.7	27.8
Asset-backed securities	33.3	27.8	38.9	25.0

Source: BSC survey.
Note: Percentage of total surveyed banks.

ii. *In secundis*, we notice that the usage of covered bonds as collateral posted by banks in Eurosystem credit operations has only slightly increased since the beginning of the crisis, whereas in relative terms – i.e., compared to other classes of collateral – it has somewhat decreased (see Chart 26). This is in sharp contrast with the trend followed by other classes of structured products (e.g., ABSs and uncovered bank bonds), whose usage has increased quite a lot; instead, the relative reduction of covered bonds goes in parallel with the analogous relative reduction of other high-quality types of collateral, like Govies and other public-sector securities. The rationale for this is quite simple: given the broader collateral eligibility criteria of the central bank, compared to what is normally accepted as collateral in the interbank market, most banks prefer to pledge their lowest-quality collateral for central bank refinancing, while keeping their best-quality collateral – covered bonds included – for money market operations, or even as a buffer in case of sudden, unpredicted liquidity needs.

Chart 26. Composition of collateral posted or used for Eurosystem credit operations expressed as a share of total (yearly averages; source: ECB, May 2009, p. 26)



iii. *In tertiis*, as reported in the ECB Monthly Report on the Eurosystem's Covered Bond Purchase Programme, July 2009, "activity in the [covered bonds] primary market had come close to a standstill since September 2008, while issuance of covered bonds increased significantly in May 2009, just after the Eurosystem announced its decision to purchase euro-denominated covered bonds" (p. 1). In the light of what we have seen above, increasing covered bonds issuance implies increasing banks' endowment of collateral assets especially used for interbank lending. Moreover, the ECB's statement just confirms that the rise in Clearstream's covered bonds liquidity ratios was not related at all to any new issues activity. Finally, "since the announcement of the covered bond purchase programme, covered bond spreads have narrowed significantly […], reflecting increased investor demand for these instruments. […] In recent weeks, new issues of covered bonds have also tended to be oversubscribed. After issuance, the spreads of the new covered bonds have tightened by between 10 and 15 basis points (when comparing the covered bond spread in the secondary market with the spread at issuance). Also in the secondary market, most covered bond spreads have narrowed to differing degrees, depending on the issuer and the maturity". The importance of narrowing spreads for covered bonds as collateral is

obvious: it means increasing the collateral value of such securities, that is, once again, banks' endowment of collateral.

Based on all the elements that we have considered in this Section, we can conclude that *one of the primary reasons for the ECB's choice of purchasing covered bonds (perhaps the most important one, even if not explicitly stated) was to support banks' endowment of collateral for interbank lending*[93]. By reviving – in terms of liquidity, issuance and spreads – a market of bank-issued, high-quality assets especially used as collateral for secured interbank lending, the ECB has optimized its direct intervention, with the final goal of re-setting the interbank activity at pre-crisis levels as soon as possible. Indeed, this seems to confirm that the ECB's 'exit strategy' from its unconventional monetary policy appears today indissolubly linked to a full recovery of the normal functioning of the interbank market.

As a final remark, notice that the Eurosystem's outright purchases of covered bonds underlie a twofold financial support to the banking sector: on one hand, covered bonds *liabilities* are a major source of long-term funding for banks; on the other, banks use covered bonds *assets* as collateral, mainly for (cheaper) interbank lending. For how long the Eurosystem should continue to pursue this policy of implicit subsidization of the banking sector in the name of its mandate on financial stability remains an open issue, independently on the timing of the interbank market's recovery.

5 The problem of 'optimality' in central banks' collateral policy

In the previous chapter we have seen how collateral requirements have played a pivotal role in the formulation of the ECB's response to the crisis, in particular after the Lehman's default. A critical point concerns the possible use of collateral eligibility criteria for two different purposes: as a tool of unconventional monetary policy – under a 'macro' view – as well as a risk management tool in central bank's open market operations – under a 'micro' perspective. Thus, it is now time to analyze the scope for collateral policy prescriptions, given these two different dimensions of central bank activity and the necessity to bridge them in terms of collateral policy. Seven policy propositions summarize the main results of our analysis, and will be illustrated through this chapter.

But, first of all, we need to make a step back and show some factual elements related to the collateral question during the subprime crisis (i.e., between Q3 2007 and Q3 2008): we will see how the importance of collateral for monetary policy was known to central banks well before the outburst of the Lehman crisis, which explains how the ECB

[93] Of course, this does not exclude, rather, it strengthens the motivation that "covered bonds were a major source of funds for banks in the euro area before the intensification of the financial crisis" (Trichet, July 2009, pp. 11-12).

reacted quickly to change its collateral policy in October 2008, in parallel with or even in advance of the implementation of other 'enhanced credit support' measures.

5.1 Collateral policies and bank behavior during the subprime crisis

In the light of our conclusions on the monetary policy role of collateral requirements, a major implication is the following.

Proposition 1: *Ultimately, central bank's collateral eligibility criteria are at least as important as the short-term rate when we want to define the degree of ease of a given monetary policy*.

This is true today, in the presence of a steep money/credit supply curve in the interbank market combined with a horizontal supply curve in the central bank funds market, but it was also true in the post-Keynesian world that came to an end in September 2008, namely, in the presence of an endogenous (nearly-flat) money/credit supply curve in the interbank market. Recall from Chapter 2 that Adrian and Shin (2008) have proved that the growth rate of the repo market is closely related to the degree of tightness of monetary policy. In terms of transmission mechanism, Adrian and Shin assign a major role to the policy rate as a key price variable for collateralized lending/borrowing, so that the growth of repo volumes would be directly affected by the policy rate. In reality, as stressed by Disyatat (2008), the terms of access to borrowing are likewise important[94]: collateral requirements *in primis*. The key point here is that the collateral eligibility criteria established by central banks for monetary policy open market operations drive also the standards for collateral requirements in the secured money market and, therefore, the growth of repo activity itself: both the business increase experienced at the ICSD's in the 10 years before the Lehman's collapse, and the way in which the ICSDs themselves have adjusted collateral eligibility criteria for their 'special lending'[95] and triparty repo services, seem to support this idea.

Indeed, we could push this rationale up to infer that the ECB, over the course of the subprime crisis, might have deliberately used the short-term rate as a catchpenny for showing its exclusive dedication to the inflation-rate target, while in reality its monetary policy was much less tight than what people commonly believe. Among other, this seems to be proved by data on corporate borrowing in the euro-area: in February 2008, for instance, at a time when the ECB policy rate was still at 4 per cent (it would have

[94] Disyatat (2008), p. 2: "Central banks […] can set the quantity as well as the terms on which they [= the central bank funds] are provided. This provides the basis for the crucial role of market expectations in determining where interest rates lie […]. Standard conceptualizations of monetary policy implementation focus narrowly on central banks' control over the quantity of money whereas in practice it is the terms on which it is available that plays the primary role in influencing interest rates".

[95] I.e., that lending activity not finalized to solve customers' settlement problems.

been even raised by further 25 basis points in July 2008) and the overall annual HICP inflation was 3.3 per cent (it would have increased up to 4 per cent in June-July 2008), lending to businesses in the euro-zone was still growing at an annual rate of 14.8%, the highest since the launch of the Euro in 1999. The fact that the ECB and the Fed took different views on interest rates during the first year of the crisis[96] could then be partially explained, apart from obvious considerations on the different timing of the two business cycles, also in the light of different collateral policies – more restrictive the Fed, less the ECB – pursued by the two central banks until March 2008, at least. In the U.S., the Fed focused immediately on its interest rate policy, as problems affected the real economy (e.g. household mortgages) from the beginning. However, the Fed did not substantially act on collateral until March 2008[97]. In Europe, where collateral requirements at the beginning of the crisis were much less stringent and policy rates were not manoeuvred down by the central bank until the Lehman's crash, public opinion's focus on interest rates might have helped to keep inflation expectations under control, especially in countries (like Germany) where collective contracts renewals were under discussion, and in the wake of an upswing of the business cycle.

In any case, it is undoubtful that the Eurosystem's broader collateral eligibility criteria served a lot to avoid a credit crunch in the Euro area, at least until the Lehman shock took place. An additional factor that certainly compounded banks' hunger for collateral was the large number of rating downgrades since the start of the turmoil, affecting the collateral value of many structured assets and other debt securities. It is remarkable that the reaction to the 'collateral' issue by other monetary authorities outside the Euro-area was not immediate: when we consider two other major central banks, namely, the Fed and the Bank of England, we observe that after the outburst of the subprime crisis, they acted quickly to increase substantially the supply of credit in the attempt to alleviate persisting tensions in the interbank market. However, it took until March-April 2008 for them to follow the ECB in the adoption of less stringent collateral requirements for monetary policy operations[98], after realizing that the bottleneck was probably more on the demand side or, better, on the *terms* of their offer of credit to the banking system.

At the Eurosystem level, even before the latest revision in October 2008, which has further expanded the list of eligible assets (see Section 4.3), the 'revised collateral

[96] See FT.com 09/04/2008, "Focal distance – Why two top central banks are taking different views", by Ralph Atkins and Krishna Guha.

[97] On 11 March 2008, the Fed launched its Term Securities Lending Facility [TSLF] programme, under which primary dealers can exchange federal agency-backed mortgage-backed securities and high-quality private label residential and commercial MBS for Treasuries from the Fed for a term of up to 28 days. This measure aims to support the smooth functioning of the financing markets for collateral and provides term liquidity for primary dealers.

[98] See the previous note. Until March 2008 the Fed accepted only Treasuries, federal agency debt, and mortgage-backed securities issued or fully guaranteed by federal agencies. Recall that the Fed's action on collateral in March 2008 was part of a package of measures aimed at providing additional liquidity to the markets (see FT.com 17/03/2008, "Fed cuts bank rate to boost confidence", by Demetri Sevastopulo). For the BoE, see below in this Section.

framework'[99] already followed very broad criteria in terms of collateral eligibility: many privately-issued debt securities were normally accepted, including ABS', MBS', and both covered and uncovered bonds[100]. In 2008, for instance, only around 10% of the collateral effectively used on average for temporary operations with the Eurosystem was composed of government bonds[101], while the major two categories by volume were ABS (28%) and uncovered bonds (slightly less than 28%, see earlier Chart 26). Between August 2007 and August 2008, such favourable conditions for central bank refinancing allowed several banks in Europe to mitigate liquidity pressures: by securitizing their illiquid (mostly mortgage) loans, these financial institutions created debt securities which were not actually traded in the market (they were not priced at all) but only used as collateral for refinancing operations with the Eurosystem. According to Moody's, lenders issued a record 53 billion Eur of structured debt securities in the fourth quarter 2007; yet, almost none of the securities was placed on the open market: rather, most were sent directly to the ECB for use in repo operations[102]. Especially Spanish and Dutch banks took advantage of the propitious refinancing conditions offered by the ECB[103]. Thus, it does not surprise that the extent and the potential dangers stemming from re-packaging and securitizing illiquid loans by European banks needing collateral for their financing operations with the Eurosystem were very much a source of concern for members of the ECB Governing Council well before the enlargement of collateral requirements in October 2008[104].

[99] At the beginning of 2007, the ECB moved from a two-tier collateral system (in which some assets were limited to use as collateral in specific countries) to a single list, which now defines all the assets eligible as collateral throughout the Eurosystem. Although the list comprises two distinct asset classes – marketable and non-marketable assets – no distinction is made between the two classes with regard to 'quality', so that they are equally eligible for various types of Eurosystem monetary policy operations. The same assets can also be used as underlying assets for intraday credit. To ensure that the two asset classes comply with the same credit standards, a Eurosystem credit assessment framework has been established, relying on four different credit assessment sources: external credit assessment institutions; national central banks' inhouse credit assessment systems; counterparties' internal ratings based systems; and rating tools from third-party providers. A wide variety of structured products is accepted by the Eurosystem as collateral in this context.

[100] Such broad collateral eligibility criteria were not so much a historical happenstance, rather they came out of the necessity to harmonize and mediate across the different collateral criteria applied in the Eurosystem, so to establish a level-playing-field across the different Countries in the Euro-zone.

[101] Notice that Govies accounted for more than 50% of all the eligible assets.

[102] Evans-Pritchard (2008).

[103] Ibid. See also the FitchRatings Report: "The Role of the ECB: Impact of Increased Liquidity on European Financial Markets and Banks", 7 May 2008.

[104] In a speech at the meeting of the International Capital Market Association in Vienna, on 15 May 2008, BcL Governor Yves Mersch affirmed that the type of collateral being accepted was "a matter of high concern", and that the ECB was "looking very hard at whether there is not a specific deterioration of collateral" which the central bank is accepting in return for funds (as reported by Davis et al., 2008). Interestingly, the thesis that banks were exploiting the ECB's efforts to unblock the frozen funding markets by using its liquidity scheme to offload growing volumes of risky assets was scaled down by the Spanish ECB Executive Board member José Manuel González-Páramo a few days later. In an interview with the Financial Times on 25 May

A further aspect linked to the collateral policy of the ECB during this period concerns the use of the Eurosystem funding facilities by global players financing their customers outside the Euro area – something we could define as 'central bank funding arbitrage'. Apparently, some major investment banks profited from emergency ECB funding by acting as brokers to funnel billions of euros to UK's banks and building societies[105]. The usage of Eurosystem liquidity by non-Euro-zone banks (especially the ones in the UK) acting as go-betweens to provide smaller non-Euro-zone lenders with an alternative funding source to the more restrictive (in terms of collateral policy and/or liquidity provision) home central banks was later confirmed by the rating agency Fitch[106], and remains nowadays a cause of deep worries for the authorities in charge of the implementation of the Eurosystem's monetary policy in a country like Luxembourg[107]. Not unexpectedly, in April 2008 the Bank of England finally joined the ECB and the Fed and enlarged its collateral acceptance criteria, thanks to the adoption of a "special liquidity scheme", by which UK banks were able to offload high-quality AAA-rated mortgage-backed securities (issued before the end of 2007) for Treasury bills for a one-year period, renewable for a total of three years[108].

In conclusion of this Section, we should notice that a by-product of the ECB sticking to its broad collateral eligibility criteria during the subprime crisis, is that it limited an excessive stiffening of collateral standards in the secured segment of the money market. In turn, this seems to have partially countered the interbank business decrease due to the sum of the depressive impact of the subprime crisis and the crowding-out effect of the central banks' direct provision of liquidity to the banks. That is, *by keeping its collateral acceptance criteria unchanged, the ECB also contributed to keep the repo market alive*. The relatively slight drop in the repo volumes recorded by ICMA and Clearstream until September 2008 seems to confirm this view (see Charts 14-15).

2008, he said that in his view the banking system was in no way becoming addicted to the ECB liquidity, while banks "are now behaving a little bit different than they were behaving before August 2007, but the reasons behind that are quite obvious to everyone" (Atkins and Davies, 2008).

[105] Sibun and Aldrick (2008).

[106] See again FitchRatings (2008).

[107] Recall, for instance, the collateral losses suffered by the BcL after the failure of the three Icelandic banks in Luxembourg during the Lehman crisis.

[108] Financial Times 21 April 2008, "Bank of England unveils debt-swap scheme", by Chris Giles. Differently from the ECB, the BoE put in place somewhat stiffer conditions for the banks to use the new facility – a mix between a temporary purchase of assets and a loan – as its stated goal was to sort out the overhang of difficult-to-sell assets on banks books rather than subsidize new lending. Thus, to avoid the use of new assets, only securities on banks' books at the end of 2007 are eligible for the BoE's "special liquidity scheme".

5.2 The interaction between collateral policy and interest rate policy

5.2.1 The ECB's 'exit strategy'

One major challenge for the ECB and other central banks worldwide in the second half of 2009, concerns the necessity of identifying an *exit strategy* from the enhanced credit support measures implemented since the Lehman's collapse. In a recent speech[109] the ECB President, Jean-Claude Trichet, stressed the importance of unwinding such measures "once conditions return to normal"[110]. In the words of Trichet, "an exit strategy is not identical to a particular course of action. Rather, it lays out a framework and set of principles to govern actions in the face of circumstances in whatever form they take"[111]. Based on the theoretical framework that we have described in the previous chapter, in this Section we will then derive some prescriptive conclusions about the future collateral policy of the Eurosystem. We will show how these conclusions relate to the announced criteria that should guide the ECB's exit strategy from the unconventional monetary policy undertaken starting from October 2008.

According to Trichet, the ECB will found its exit strategy on four main cornerstones[112]:

i. the link to the monetary policy strategy, with "the primary objective of securing price stability in the euro area over the medium and longer term"[113];

ii. the ECB's reputation for swift and decisive action when it is required (consistent behavior);

iii. the forward-looking initial design of the measures, that was chosen to facilitate a smooth exit, when necessary;

iv. the technical and institutional ability to act, in terms of both *a)* technical capability and suitable operational framework, and *b)* institutional capability and independence.

While the first two cornerstones do not present a particular problem from our point of view, the results of our previous analysis cast some shadows on the possibility of the ECB to pursue an exit strategy based on the third, and especially on the fourth criterion. In particular, *there may exist some binding constraints on the ECB's ability to "choose the way in which interest rate action could be combined with the unwinding of the non-standard measures"[114], more specifically, with the (re-)tightening of collateral requirements*. The key point is clarified by the following proposition.

[109] Trichet (September 2009).
[110] Ibid., p. 1.
[111] Ibid., p. 4.
[112] Ibid., pp. 5-7.
[113] Ibid., p. 8.
[114] Ibid., p. 7.

Proposition 2: *Given the current role of collateral requirements for the monetary policy of the Eurosystem, interest rate policy and collateral policy should not be set independently one from the other*[115]*; instead, they should be steered jointly in the light of monetary policy and financial stability considerations*.

In what follows, we will show two examples:

1. the case of an (early) re-tightening of collateral eligibility criteria, given the same level of interest rates, and in the absence of a recovery of the interbank market;
2. the possible raise of the policy rate above the minimum rate compatible with price stability, on the basis of financial stability considerations.

5.2.2 The monetary policy impact of an early collateral policy reversal

In Section 4.3 we discussed the role of softer collateral eligibility criteria vis-à-vis the monetary policy of the ECB and its transmission mechanism. We showed why relaxing collateral requirements was a primary condition to ensure that banks could effectively take advantage of the central bank's unlimited credit provision (see Chart 22). Recall the ECB's acknowledgement that "to ensure that collateral did not constitute a constraint after the introduction of the fixed rate procedure with full allotment, the first element of the measures announced on 15 October [2008] was a temporary expansion of the list of assets eligible as collateral"[116]. Our two main conclusions were that:

1. the benign impact of central bank's unlimited provision of liquidity through fixed rate tenders with full allotment, might be, in principle, completely impaired by too binding access conditions related to a compelling collateral constraint;
2. therefore, the ECB is now using collateral requirements as an instrument of monetary policy with the ultimate goal of preserving the monetary transmission mechanism in the presence of a steep money/credit supply curve in the interbank market.

The next proposition generalizes these two statements, and provides the rationale for Proposition 2 above.

[115] Apart from the quotation of Trichet (September 2009) mentioned above, see also the recent speech of Bini Smaghi (September 2009), affirming that "the exit from the non-standard measures is likely to be linked to the state of the financial markets, and in this respect can partly be disconnected from the interest rate policy. Given the design of the non-standard instruments implemented by the ECB, the exit from those instruments can take place before or after the interest rate decision, without major effects on it. However, if at the time of the exit a number of financial institutions are still addicted to central bank liquidity, the transmission channel of monetary policy might be impaired" (p. 3). Notice the already significant change of position, compared to earlier this year, when Bini Smaghi said that "non-standard measures that aim mainly at restoring the orderly functioning of money markets, such as supplementary longer-term refinancing operations or an extended menu of eligible collaterals, might have to be rolled back before interest rates are increased again" (Bini Smaghi, April 2009, p. 10).

[116] ECB (July 2009a), p. 82.

Proposition 3: *In a neoclassical framework (i.e. with a steep interbank money/credit supply curve), broader collateral eligibility criteria may be necessary for a more expansive monetary policy. Depending on the banks' effective endowment of collateral assets, collateral requirements may then result at least as important as the policy rate for a smooth working of the monetary transmission mechanism: they may be a pre-condition for the efficacy of a lower policy rate*.

It is clear that, *ceteris paribus*, the same conclusions are still valid today or anytime in the future. That is, without a recovery of the interbank market and a less steep interbank credit supply curve, a return to more stringent collateral eligibility criteria would imply a liquidity strangling for those banks with a lower-quality collateral asset portfolio and less alternative funding sources. In turn, this would exacerbate money market spreads and, ultimately, compromise the provision of bank credit to all the other sectors. Therefore, in the light of the results of our analysis, the assertions that "there is no pre-determined sequence between a change in interest rates and unwinding of non-standard measures"[117] and that "the exit from those [non-standard] instruments can take place before or after the interest rate decision, without major effects on it"[118] should probably be mitigated. This leads us to enunciate the next proposition about the ECB's exit strategy.

Proposition 4: *From a monetary policy prospective, unwinding the current collateral policy measures should require the occurrence of at least one of the three following pre-conditions:*

1. *a recovery of the unsecured interbank market, thanks to a less steep interbank money/credit supply curve*[119]*;*
2. *a broadening of the banks' endowment of collateral for secured central bank and/or interbank borrowing*[120]*;*
3. *a previous or at least simultaneous rise of the policy rate:* this parallel trigger of collateral policy and interest rate policy would reverse the analogous joint actions undertaken by the ECB in October 2008, and is treated in the next Section.

5.2.3 Optimal collateral requirements and policy rate in the long term

The scenario just outlined puts in question a major assumption in modern central banking: that a central bank should steer its interest rate policy in the light of price stability considerations only. In principle, the answer to this question seems straightforward: for example, "the [ECB] exit strategy for the interest rate policy will be

[117] Trichet (September 2009), p. 7.
[118] Bini Smaghi (September 2009), p. 3.
[119] In turn, this would underlie a recovery of trust: "ultimately market activity relies on the confidence and trust of market participants themselves" (Trichet, September 2009, p. 6).
[120] The rationale behind the ECB's purchase of covered bonds seems to move into this direction; see earlier, Section 4.4.

defined on the basis of the primary objective: price stability. In this respect, financial stability can only be a secondary objective. If it were given the same priority as price stability, the latter would obviously be compromised"[121]. However, if we suppose that

a) the target of the collateral requirements tool is in terms of financial stability only, and

b) lower collateral requirements – compared to the optimal level which is required to achieve the financial stability target – are a pre-condition for the efficacy of the 'optimal' policy rate (as determined on the basis of a price stability target only),

then we end up in a conundrum[122].

We have finally reached the 'heart' of the problem related to setting 'optimal' collateral requirements. In another part of this study (cfr. Section 4.3) we said that it was a fortunate coincidence that, at the acme of the turmoil in October 2008, both monetary policy and financial stability considerations required collateral requirements to move into the same direction (namely, towards a loosening of the criteria). Unfortunately, this short-term view, though correct, is liable to change in a medium- to long-term prospective. Indeed, we should consider that a relaxation of collateral eligibility criteria always implies a sacrifice of the major *raison d'être* of collateral in monetary policy operations: to protect the central bank against the credit risk of its counterparts.

Proposition 5: *Using the collateral policy tool for other than its original risk-management target might be the lesser evil in crisis times, but in the long-term (i.e., under 'peacetime' conditions) it is definitely questionable under many points of view:* in primis*, because a higher risk profile may compromise the consistency of the monetary policy target as well as the same central bank independence;* in secundis*, because it may push the central bank outside its legal mandate (besides being morally unacceptable and politically inopportune);* in tertiis*, because it may raise moral hazard issues in terms of bank managers' behavior, without really solving banks' most structural problems*.

To understand the first point, we need to consider that, *ultimately, what determines the potential for inflation is the amount of risk the central bank takes on in its balance-sheet, not the mere size of the balance-sheet itself*. That is, when we look at a central bank balance-sheet, it is not a question of quantity ('how big it is'), rather a question of quality

[121] Bini Smaghi (September 2009), p. 3. See also Stark (2009), p. 4: "our interest rate decisions are guided exclusively by our assessment of risks to price stability". Notice that the principle 'one tool for one target' – a restrictive version of the so-called 'Tinbergen rule' that 'there should be at least as many policy tools as the number of policy targets' (see later in this Chapter) – has a mathematical justification: an optimization problem can only be solved (i.e., having a unique solution) with certainty if the number of variables (tools) is equal to the number of equations (targets).

[122] To continue the line of reasoning from the previous note: in this case we have introduced an additional constraint in our optimization problem. This requires now the solution of a system of three equations in two variables – the third equation (in which both variables are present) being the constraint. Because the number of equations is greater than the number of variables, a solution to this problem may not exist at all.

('how it is'). Indeed, it seems that size can be controlled and managed quite easily today, thanks to a wide range of both conventional and unconventional monetary policy instruments whose use can be smoothly reversed if needed[123]; however, the same cannot be said for potential damages from an excess of risk-taking. This does not show up immediately when we refer to a central bank: an institution that, by definition, 'cannot fail'. However, several large-scale, unpredicted losses could ultimately force a central bank to either (explicitly or implicitly) 'monetize' its liabilities – therefore increasing the risk of inflation – or, in alternative, to recur to Treasury financing – that would imperil its credibility and independence from the political sphere[124]. Nonetheless, balance-sheet size becomes also important when it comes to affect the amount of risk taken on by the central bank[125]. Notice that different types of risk may co-exist at the same time: credit risk (e.g., due to acceptance of insufficient or inadequate collateral), liquidity risk (e.g., due to the necessity of selling illiquid collateral assets), but also interest rate risk (e.g., due to a maturity mismatch between central bank assets and liabilities)[126].

A second argument that may make 'too soft' collateral requirements, though justified by monetary policy efficiency reasons, a questionable option for a central bank in the long-term, concerns its legal mandate. In particular, *keeping collateral requirements abnormally loose during peacetime may configure an implicit subsidization of the banking system[127]. In the case of the Eurosystem, this would almost certainly be outside its legal mandate in terms of financial stability, as defined by art. 105 of the EC Treaty*. While the definitions of 'too soft collateral requirements' and 'wartime'/'peacetime' are liable to a certain margin of subjectivity, it is relevant that the latest public interventions by members of the ECB Executive Board have stressed that "it is not the central bank's

[123] See the argumentations presented by Dudley (April 2009 and July 2009b, mainly focusing on the interest paid on excess reserves as a tool to avoid an excessive creation of credit by banks), Kohn (April 2009), and Bini Smaghi (April 2009), among others.

[124] See in particular the conclusions of Stella (2008), p. 23: "Central bank financial strength is positively associated with good policy performance. Financially weak central banks generate losses which undermine macroeconomic stability and call into question the credibility of their policies". In fact, central banks need also taking into account "the reputational risk related to the possible criticism of 'squandering taxpayer money'. […] Undertaken by the central bank, loss-making operations could weaken political support for its independence and erode the legitimacy of its policy mandate" (Meier, 2009, p. 19).

[125] In the words of Dudley (July 2009b), pp. 6-7: "the Federal Reserve is taking on some interest-rate risk in terms of its balance sheet. The excess reserves have an overnight maturity. These liabilities are being used to purchase longer-term assets. In principle, if short-term interest rates were to move up very sharply, the cost of funding could eventually exceed the return on the Fed's assets. The bigger our balance sheet, the greater the amount of interest-rate risk we are assuming".

[126] Ibid. See also Bini Smaghi (April 2009), p. 12, and Meier (2009), p.19, who speaks of 'market risk'. Indeed, interest rate risk and market risk refer to the same source of risk (a variation of the interest rate at the time of re-financing liabilities/selling assets, respectively, but linked to changes into opposite directions).

[127] At the end of Section 4.4 we have seen that also other enhanced credit support measures, in particular the Eurosystem's outright purchases of covered bonds, are subject in principle to the same criticism.

task to continue providing liquidity to financial institutions which are not able to stand on their own feet, once the turmoil is over. It is the responsibility of the supervisory authorities, and ultimately of Treasuries, to address the problems of these addicted banks as soon as possible, through recapitalisation and restructuring, as appropriate, and to ensure that all banks in their jurisdictions can stand on their own feet even without the central bank's facilities"[128]. Moreover, this issue underlies the moral and political question – very topical, indeed – of whether it is acceptable for the Eurosystem (and ultimately for the European tax-payer) to take on the cost of banks' credit and systemic risk.

Finally, a third argument against too soft collateral requirements in the long-term, concerns the possibility that, *in the effort to stabilize the banking system and avoid further bank failures, the current collateral policies may actually favor the* status quo*, without really helping banks to solve their structural problems in terms of balance-sheet cleaning, durable funding sources and recapitalization*[129]. Rather, the current collateral policies would just prize the moral hazard of those bank managers who took advantage of their risky positions, before the crisis, and of the benignity of the central bank, nowadays.

Because of the reasons illustrated above, *inter alia*, *we cannot exclude that a central bank, under special circumstances, may be pushed to use the policy rate as a tool to address the financial stability target, besides the price stability target*. Thus, if we assume that collateral eligibility criteria

a) cannot stay at an unsustainably low level for too long (because of financial stability considerations), and

b) cannot be the bottleneck of the interest rate policy transmission mechanism (because this would render a sub-optimal result in terms of monetary policy),

then the only alternative is to set the policy rate at an equilibrium point which is consistent with the actual level of available collateral[130]. *Ultimately, this point of*

[128] Bini Smaghi (September 2009, p. 3). On the same tone, Trichet (September 2009, p. 6) affirms that "financial institutions ultimately need to stand on their own two feet".

[129] See FT.com 07/09/2009, "Europe's banks face questions over funding", by Anousha Sakoui. Among other reasons, this might contribute to explain why bank lending still continues to shrink, one year after Lehman's collapse: cfr. FT.com 13/09/2009, "Lending in Europe continues to shrink", by Patrick Jenkins. Concerning the risks in terms of perverse incentives, stemming from the current monetary policy stance, see also the recent speech of Stark (2009): "To sum up the monetary policy considerations: the monetary policy measures and non-standard measures taken during the financial crisis have been effective in alleviating funding concerns of banks. But we need to be aware that, if the measures are maintained for too long, there can be negative side effects. Both central bank and fiscal measures may contribute to weaken the incentives for banks to clear troubled assets from their balance sheets and to monitor their credit risk carefully. This, in turn, may reinforce the very problems that currently impair the functioning of the financial system" (p. 5).

[130] This would permit to the central bank to avoid tensions in the interbank market, which would compromise the monetary transmission mechanism by making the policy rate not credible for the

collateral policy-interest rate policy equilibrium may lie well above the minimum interest rate compatible with the price stability target. This rationale has one fundamental implication, which is illustrated by the following proposition.

Proposition 6: *In a neoclassical framework that integrates both price stability and financial stability as final policy targets[131], the exclusive assignment of the policy rate tool to the price stability target should not be a dogma*[132].

Notice that this assertion is consistent with the view that "there is a need to reconsider also the possible role of monetary policy (interest rate setting) in the prevention of liquidity crises"[133], whereas a major implication of our Proposition 1 above is that collateral policy would have a primary impact on the so-called 'risk-taking channel' of monetary policy[134]. Finally, the problem described in this Section has many points in common with the 'zero floor' issue that central banks had to face in the last months[135]: one lesson of the current crisis is that, in the presence of a 'floor' to the price of credit (not necessarily the 'zero floor'!), central banks have several 'unconventional' tools, other than the policy rate, to stimulate the provision of credit to non-bank sectors[136]. *Thus, one or more of these unconventional tools might be combined and adapted to complement the policy rate (which would still remain as the primary tool) in order to address price stability, even at a rate level well above zero*.

Clearly, the more or less intensive use of such unconventional tools has important implications in terms of the intermediation role played by the banking system: for example, central bank's direct purchases of securities issued by non-bank corporations unavoidably entail bank disintermediation[137]. On the other hand, the choice about how

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real sector (because its spreads vis-à-vis bank lending rates would abnormally increase, both in absolute terms and in volatility).

[131] Based on our previous analysis, the expression 'neoclassical framework' underlies the existence of an exogenous money/credit supply or, more specifically, a steep money/credit supply curve in the interbank market.

[132] Again, this assertion can be fully justified in mathematical terms. If we assume a number of instruments (variables) equal to the number of targets (equations), *a priori* it does not matter which instrument is assigned to a specific target. Notice that the acknowledgement of a certain degree of interdependence among different (conventional and unconventional) monetary policy instruments is now starting to permeate the latest statements by some ECB executives. In the words of Stark (2009), p. 4: "The interest rate instrument and the size and maturity composition of our liquidity-providing operations are instruments that can be used independently of each other, *but only to a certain extent and not continually for different purposes*. Specifically, concerns about funding support must not come to dominate monetary policy considerations".

[133] Borio (2009), p. 14.

[134] Borio and Zhu (2008).

[135] Recall the conclusions of the recent Fed staff analysis, assessing that the right policy rate in the U.S. would be *minus* 5 percent: "Fed staff separately estimated what size and type of unconventional operations, including asset purchases, might provide this level of stimulus" (FT.com 27/04/2009, "Fed study puts ideal US interest rate at -5%", by Krishna Guha).

[136] Again, see Meier (2009) for a review of such tools.

[137] Actually, a trend towards disintermediation is already emerging out of the post-crisis scenario in Europe. Taken from Financial News Online, 21/09/2009 ("Europe set for new junk bond era", by Duncan Kerr): "The European junk bond market is set to take a more central role in the way

much an economic system should be intermediated by banks is, ultimately, a political decision that should be addressed by Governments: if banks have to continue to play the game, they need to be in healthy financial conditions. Eventually, it is up to the Treasuries "to address the problems of these addicted banks as soon as possible, through recapitalisation and restructuring, as appropriate, and to ensure that all banks in their jurisdictions can stand on their own feet"[138]. Central banks can only follow the mainstream. Their independence is best guaranteed if they closely adhere to their technical role; this should focus on the unconditioned choice of the best mix of tools in order to pursue their institutional objectives, given the resource distribution decided by politics.

5.3 Countercyclical collateral policy: time-consistency and asset bubbles

Before concluding this chapter, it is opportune to spend some words about one particular aspect of the collateral requirements usage, which compounds the importance of this instrument from a macroeconomic point of view. We refer in particular to the possible role of collateral eligibility criteria as a countercyclical tool available to central banks in their quality of 'lenders of last resort'. The peculiarity of this role stems out of mere financial stability considerations, that is, it is not a device appositely set up for monetary policy purposes. Two questions related to a time-consistent implementation of collateral policy throughout the business cycle are implicated: a first issue is linked to the extent by which central banks' practical implementation of collateral policy includes the acceptance of 'risky' assets; whereas a second issue relates to a proper evaluation of the collateral margins applied to those assets.

As for the first point, what we said in the previous Section about the long-term risks of a 'soft' collateralization (i.e., a virtual undercollateralization) should not be confused with an obligation for central banks to lend only against the 'best' collateral: there is here a problem of time-consistency in a central bank's collateral policy, which has some

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sub-investment grade-rated companies are funded, moving it closer to its larger, more mature US counterpart for the first time. Capital constraints on banks, which have forced them to curb new lending to the corporate sector, have already led to a surge of more than EUR 8 billion worth of new junk bond issuance in the past five months, reawakening a market that had effectively been closed since the summer of 2007. Bankers and investors expect issuance to rise quickly as companies increasingly use the capital markets to fund themselves and refinance debt as an alternative to the private bank market, potentially causing a substantial shift in the traditional corporate financing landscape in Europe, which would align it more with the US high-yield market. […] 'The recent turmoil in the banking sector will only push more funding away from the banks and to the bond markets.' […] (T)his 'rediscovery of the public capital markets' was reminiscent of the early stages of the US high-yield market in the 1980's, which 'developed as a source for raising large amounts of capital that banks, then less levered, lacked the capacity to provide'. […] Barclays Capital estimates the European junk bond market will grow from EUR 100 billion to EUR 150 billion by year-end 2012".

[138] Bini Smaghi (September 2009), p. 3.

analogies with the analogous time-consistency problem in monetary policy. In a recent speech given earlier this year, the Deputy Governor of the Bank of England, Paul Tucker, explains this issue as follows[139].

"If, in an attempt to induce banks to hold truly liquid assets, the central bank were to declare that it would lend against only the highest-quality collateral, the banking system would know that those assets could be converted into money in all circumstances. But if an otherwise solvent bank gets into trouble and still faces a liquidity problem after taking all of its eligible high-quality assets to the central bank, the authorities face a choice between letting it fail through a lack of liquidity or lending against a wider class of assets. Their choice will turn on an assessment of the trade off between, on the one hand, the risk of financial instability today that could flow from immediate bank failures and, on the other hand, the risk of financial instability in the future that may flow from the central bank being seen to protect banks from their mistakes. […] If during peacetime a bank judges that its failure would be likely to cause widespread systemic distress, it will probably conclude that the central bank's collateral policy will, during wartime, be relaxed, leading it to choose to hold less of the highest-quality eligible assets than otherwise. Crucially, the central bank may then, after all, not be able to stick to its declared collateral policy, just as the bank suspected. In other words, *a central bank policy of lending against only the best assets is likely to prove time inconsistent when it comes to the crunch*[140]".

What is even more relevant, in the context of the topic treated in this Section, is that *a central bank policy of lending against a wider range of assets is likely to be less prone to procyclicality*, due to two main reasons. First, because banks would have more opportunities to recur to central bank liquidity when needed: the current crisis has proved how critical this access becomes during 'wartime'. Clearly, the final implication is a lower risk of bank failures and, therefore, a smoothening of the downward trend during 'bad' times. Second, because central bank collateral eligibility is supposed to significantly improve liquidity, prices and commercial repo haircuts of the assets in question, not only in 'peacetime', but also during 'wartime': thus, the liquidity position of the financial institutions holding those assets would be better-off, independently on the particular phase of the business cycle[141]. Ultimately, this rationale gives some merits to the broad collateral eligibility criteria already adopted by the ECB before the start of the crisis[142].

Having said about the advantages of a collateral policy accepting a broader range of assets (including some more 'risky' assets), a clear distinction has to be made between

[139] Tucker (2009), p. 4.
[140] Underscored italic of the author.
[141] Remember from the previous chapter that the secured segment of the money market was relatively less affected by the crisis, compared to the unsecured segment.
[142] …besides being consistent with Bagehot's dictum that central banks should lend against "everything which in common times is good 'banking security'" (p. 205 of the 1999 paperback reprint of Bagehot [1873], "Lombard Street" in the Wiley Investment Classics series, as quoted in Tucker [2009], p. 4).

'acceptance' and 'proper evaluation' of a risky asset. In principle, any asset which has some worth could be accepted as collateral, provided that its effective collateral value reflects the risk of depreciation between the time of acceptance (or of possible default of the collateral giver [cash borrower], in case margin calls are applied) and the time of possible liquidation of the asset itself. *Therefore, if a central bank wants to expand its list of eligible assets (and we have just seen that this presents clear advantages), it should then be able to properly estimate and 'charge' the risks incurred by accepting lower-quality assets*[143]. In practice, this calls for an adequate estimation and continuous re-pricing of the collateral margins or 'haircuts' applied by the central bank. While this principle is today generally accepted in collateral policy, its material application is certainly not easy. Notice that a more risky collateral asset implies not only a higher price volatility, but also a higher valuation risk for the collateral receiver. As a consequence, a haircut tends to increase much more than proportionally compared to the related risk spread, because it reflects the value-at-risk of the asset, given a high level of confidence, rather than the asset's *average* value. Ultimately, this explains why 'too' risky assets are not accepted as collateral.

Especially in the course of a liquidity crisis like the one occurred in the past months, when many market prices could no longer be observed, haircuts are normally to be raised, based on theoretical price valuations that, among other, aim to unbundle liquidity risk from other sources of risk (e.g. credit and market risks). This generalized haircuts increase in times of distress tends to exacerbate the cycle, by further reducing banks' collateral portfolios and, ultimately, banks' ability to refinance. *In order to reduce this procyclical impact, a sound haircut policy should include the use of asset price historical data over a complete cycle and/or stress-test ('wartime') scenarios to estimate proper haircuts in 'peacetime'*. Besides being methodologically more correct from a risk management prospective, this approach would reduce the chances of an upward revision of the haircuts during turmoil periods, so to avoid dangerous procyclical effects that would accentuate systemic risk in times of liquidity strains[144].

Directly linked to the adoption of 'cycle-neutral' haircuts, a related issue concerns the possible use of *haircuts changes as a tool to target asset price bubbles*. Indeed, latest views from executives of the Fed as well as the Bank of England seem to hint explicitly at this possibility. For example, the President and CEO of the Federal Reserve Bank of New York, William C. Dudley, recently affirmed that "this crisis should lead to a critical reevaluation of the view that central banks cannot identify or prevent asset bubbles, they can only clean up after asset bubbles burst. […] If one means by monetary policy the instrument of short-term interest rates, then I agree that monetary policy is not well-suited to deal with asset bubbles. But this suggests that it might be better for central

[143] Recall the fundamental distinction that we made in 5.2.3 between size and riskiness of a central bank balance-sheet, and their implications for the primary objective of price stability.
[144] See also the analogous conclusions of the joint Working Group of the Financial Stability Forum and the Committee on the Global Financial System about (April 2009).

bankers to examine the efficacy of other instruments in their toolbox, rather than simply ignoring the development of asset bubbles. […] If existing tools are judged inadequate, then central banks should work on developing additional policy instruments. […] For example, we might give a systemic risk regulator the authority to establish overall leverage limits or *collateral and collateral haircut requirements* across the system. This would give the financial authorities the ability to limit leverage and more directly influence risk premia and this might prove useful in limiting the size of future asset bubbles"[145].

As for the BoE, earlier this year Deputy Governor Tucker had already said: "Haircuts are kept under review, and the Bank reserves the right to alter them, including on outstanding transactions. Looking ahead, the Bank aims to *take into account structural and cyclical changes in financial conditions*. In the future, the Bank might, for example, increase haircuts during 'peacetime' if liquidity in the secondary market from a particular type of collateral became impaired; or if the Bank concluded that, *as the upswing of a credit cycle developed, risk was plausibly becoming underpriced and so was not properly reflected in the valuations of instruments it was accepting as collateral*. Whether or not that would be enough of itself quell a cycle is obviously uncertain; but it would help to protect us against risk and would give a signal. [] *In short, haircut policy matters*"[146].

5.4 An integrated approach

To summarize the major conclusions of this chapter, we could say that, ultimately, monetary policy and financial stability share a large part of the same toolbox: therefore, an optimal solution requires considering the joint effects of each tool on both the final objectives of monetary policy (i.e., price stability) and financial stability[147]. In fact, price

[145] Dudley (July 2009a), pp. 3-4; italic of the author. Notice that this position vis-à-vis asset bubbles marks a 180-degree inversion by the Fed, compared to the Greenspan's era. Indeed, the new position seems to underlie a different monetary interpretation of asset bubbles, which are no longer seen – most of all – as outbursts of investors' irrational exuberance (the investors' 'animal spirits'). Instead, bubbles could be interpreted as the manifestation of a saving excess capacity that concentrates on certain asset classes: the resulting price rises might someway be underweighted in the standard panel indicators (e.g. CPI) used by central banks to target inflation. Therefore, if central banks do not want to raise rates, because this would depress economic activity in other sectors, then they should adopt other quantitative, tightening measures: for example, via asset-based reserve requirements (as proposed by Palley, 2008), or just via flexible collateral requirements, namely, by imposing higher haircuts on those assets that are overpriced. Finally, from a financial stability prospective, central banks should always take asset bubbles into good account and verify whether they are an indicator of more serious problems or imbalances in the financial sector.

[146] Tucker (2009), p. 7; italic of the author.

[147] As an example, it is relevant to provide here the Bank of England's punctual statement of its goals in terms of financial stability: "To reduce the cost of disruptions to the liquidity and payments services supplied by commercial banks. The Bank does this by balancing the provision of liquidity insurance against the costs of creating incentives for banks to take greater risks, and subject to the need to avoid taking risk onto its balance sheet" (Tucker, 2009, p. 15).

stability and financial stability are two equations of the same system; thus, finding an optimal solution (roots vector) for the use of each tool implies

1. taking account of both equations simultaneously, and
2. no pre-defined assignment of any tool (variable) to a specific target (equation).

Regarding the first point, again Deputy Governor Tucker says that "while not explicitly directed to managing day-to-day monetary conditions, those wider measures [i.e., the range of market operations and facilities available to central banks to reduce the economic costs of severe disruptions to the financial system] absolutely must, nevertheless, be constructed to be consistent with, and supportive of, monetary policy"[148]. As for the second point, it is worth to recall here some of our conclusions from Section 5.2.3: for example, price stability may not be enough in order to allow for a low policy rate, as the latter should be also consistent with the existing collateral framework. Thus, in general, it is sub-optimal to assign *a priori* one specific tool to one specific target (e.g., the policy rate to price stability).

Indeed, one byproduct of the current crisis has been the possibility for central banks to develop and test new policy tools 'on the field': among other, this seems to allow central banks to obviate, at least partially, the trade-off between 'micro' and 'macro' implications of collateral policy. Thus, in the future, preserving the monetary transmission mechanism during turmoil should be possible without the cost of an excessive counterparty risk born by central banks in the course of their (extended) monetary policy operations.

With regard to collateral eligibility criteria, we have seen above that, in the current framework, the central bank's determination of the money/credit supply implies that the role of central bank collateral requirements is fundamental from a monetary policy prospective, as they regulate banks' access to credit. Indeed, *central banks should take into account that their collateral requirements are also important from another point of view: they tend to influence collateral eligibility criteria in secured money-market trades and, down the trade processing chain, in clearing and settlement systems*. As a consequence, another major issue arises when such criteria are softened: central banks should consider not only the counterparty risk they directly take on, but also the higher level of systemic risk likely endorsed in such circumstances by security settlement systems (SSSs). *Because of a lower buffer in terms of protection and recovery against counterparty risk when collateral requirements are more relaxed, during these periods it becomes, therefore, even more important to strengthen the oversight activities aimed at an early detection of potential credit and liquidity problems in market infrastructures*. Thus, both the intraday credit granted to SSSs participants and their overall level of settlement activity should be scrutinized and investigated more carefully during turmoil, for example by means of flow analyses and default simulations[149]. Moreover, those

[148] Tucker (2009), p. 2.

[149] The Settlement Simulator tool developed by the Bank of Finland (BoF-PSS2) permits the implementation of settlement flow analyses that can be used for different purposes. So, for

ancillary activities (if any) in which SSSs take a principal-party risk[150], are of particular relevance and should be especially watched by oversight authorities in crisis times.

Finally, central banks should not forget that SSSs and other market infrastructures can offer an insight perspective on certain markets: for example, ICSDs (Clearstream and Euroclear) are a mine of information as for business volumes of participants and instruments traded in the OTC cash markets, the latter being, first and foremost, markets for collateral[151]. This information might result very useful not only for the surveillance of banks and other credit institutions (e.g. in terms of credit and liquidity risks), but also – as we have seen – for central banks to achieve a better understanding of the size and functioning of such markets. In turn, this might provide valuable indications to decide, for instance, on which market addressing a direct intervention in case of unconventional monetary policies focusing on collateral requirements and/or targeting the support of certain assets used as collateral in money market transactions[152].

Proposition 7 below provides a conclusive statement to our analysis, by offering a more general framework for the previous policy Propositions 1-6.

Proposition 7: *It is necessary to adopt an integrated approach*[153] *in twenty-first century central bank decision-making, by relinquishing – if the case – that version of the Tinbergen rule which prescribes the* exclusive *assignment of one policy tool to one policy target only*[154].

The 'neo-classical' world in which we live today makes central banking more difficult than ever, as reality is more complex than ever, and central banks cannot afford any longer to look only into one direction (price stability), using only one instrument (the

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example, from an oversight point of view, such analyses permit the identification and assessment of possible sources of systemic risk, eventually also on the basis of sophisticated investigation methods (e.g. network theory) on the intrinsic structure and consistency of the system. Furthermore, from a liquidity risk prospective, these analyses can help to identify crucial knots and critical players in terms of liquidity risk monitoring at a systemic level: for instance, by assessing the systemic effects in case of default of one of such players.

[150] For example, the special securities lending programs of the ICSDs (like *ASL+* for Clearstream).

[151] See previously Chapter 2.

[152] See the case of covered bonds, Section 4.4.

[153] As for the necessity of integrating financial stability issues into macroeconomic models of monetary policy, see the conclusions of the recent essay of Cecchetti *et al*. (2009). In that vein, the paper of de Walque *et al*. (2009) develops a dynamic general equilibrium model with a heterogeneous banking sector and endogenous default rates, which is suitable to be extended to incorporate different central bank policy instruments as well as their interactions with the interbank market.

[154] In reality, this restrictive interpretation of the more general Tinbergen rule that 'there should be *at least* as many policy tools as the number of policy targets' probably stems from the heuristic approach of Mundell to the problem of the lack of information completeness. Thus, Mundell's solution focuses on the "*principle of effective market classification*, according to which an instrument should be matched with the target on which it exerts the greatest relative influence" (Mundell, 1968, pp. 202), so that policymakers could effectively verify *ex-post* the results of their policy actions.

policy rate). *Collateral policy is no exception. As collateral requirements interact with other policy tools, and ultimately determine an important impact on different policy targets, they should not be steered independently from any relevant instrument and target*.

A final example will give an idea. It has been said that "securitisation worked to concentrate risks in the banking sector. There was a simple reason for this. Banks and other intermediaries wanted to increase their leverage – to become more indebted – so as to spice up their short-term profit. So, rather than dispersing risks evenly throughout the economy, banks and other intermediaries bought each other's securities with borrowed money. As a result, far from dispersing risks, securitisation had the perverse effect of concentrating all the risks in the banking system itself"[155]. Thus, what allowed for banks' over-leverage was ultimately the issuance and trading of overpriced assets (CDOs, MBSs and other structured products). Notice that this way of refinancing among banks themselves was actually 'self-feeding', as based on the same principle of the familiar textbook money/credit multiplier. Indeed, while providing cash to the seller for further lending, a structured asset trade was also providing new collateral to the buyer for further borrowing. Because most of such assets had good credit ratings, and were therefore used as collateral in repos and other money-market transactions, this further contributed to bank over-leverage, generating the *flat*, endogenous money/credit supply that characterized the interbank market until August 2007 (see Section 4.1). As a matter of fact, if the bubble had concerned other financial assets not actually used as money-market collateral (e.g. equities), the effects of its burst on bank balance-sheets and liquidity conditions would have likely been much more limited in size and time, as in previous crises. And if central banks had changed their collateral eligibility criteria and haircuts for structured assets well in advance of August 2007, so to address a level of risk that was "plausibly becoming underpriced"[156], this would have at least sent a clear signal to markets, besides reducing the authorities' risk exposures in the long-term. Here is why central banks' collateral requirements, in general, and haircuts, in particular, are so important, beyond and in addition to the short-term 'micro' view of the single refinancing operations to which they apply. "*In short, haircut policy matters*"[157].

6 Conclusion

This study has shown that the increasingly extensive use of debt securities as collateral, either for repos or in support of banks' settlement activity, drove business growth at market infrastructures like Clearstream until the onset of the crisis. As for the repo market, its growth was mainly related to a twofold transformation of the money market,

[155] Adrian and Shin (2009), p. 6.
[156] Tucker (2009), p. 7.
[157] Ibid.

which a) increased its size due to the effects of securitization and bank leveraging, and b) became more and more collateralized. The Eurosystem's broad collateral requirements for banks participating in its open market operations might have also played a role in this growth, by inducing more relaxed collateralization standards in the interbank market.

Both Clearstream's business volumes and the ECB's official data support the idea that the Eurosystem's provision of credit in the past two years has, *de facto*, largely substituted market-based lending/borrowing in the money market, up to crowd out further interbank activity in order to reduce money market spreads. While this was the lesser evil in a very difficult contingency at the end of 2008, the ECB and other central banks do not consider such an extensive fund intermediation as a 'natural' role for themselves, so that a solution to this issue is predicted to be an integral part of their exit strategy in a medium-term prospective.

From the point of view of the theoretical debate, the current market conditions have imposed a paradigm change, from a post-Keynesian to a monetarist scenario, for interpreting the latest events. Indeed, the thorough inversion of roles between central bank refinancing and interbank market was such that, while the money/credit supply curve in the interbank market has now become quite steep, especially in its upper section (unsecured money market), the same curve in the central bank funds market has, on the contrary, become completely horizontal. That is, overall money supply is today critically conditioned by the decisions of the ECB: the latter, on the other hand, has decided for the moment that its money supply should be purely demand-driven (thanks to the adoption of a fixed-rate full-allotment tender procedure).

The ECB has publicly acknowledged that collateral requirements enlargement was a necessary condition to ensure the effectiveness of other monetary policy actions taken in the aftermath of Lehman's default. Indeed, too binding collateral eligibility criteria might have represented a serious bottleneck vis-à-vis the central bank's attempt to pump considerable volumes of liquidity into the banking system in a very short time frame. A primary reason, *inter alia*, is related to the banks' necessity of replacing previous unsecured money market borrowing – where collateral requirements are zero – with central bank refinancing – where collateral requirements are binding (though to a lesser extent, compared to the current conditions in the secured segment of the money market). Thus, collateral requirements were essentially used as an instrument of monetary policy, as a necessary condition to preserve the monetary policy transmission mechanism in the presence of a steep money/credit supply curve in the interbank market. A major implication is that, *ultimately, central bank's collateral eligibility criteria are at least as important as the short-term rate when we want to define the degree of ease of a given monetary policy* (Proposition 1). This is true today, in the presence of a steep money/credit supply curve in the interbank market combined with a horizontal supply curve in the central bank funds market, but it was also true in the post-Keynesian world that came to an end in September 2008, namely, in the presence of an

endogenous (nearly-flat) money/credit supply curve in the interbank market. On the other hand, from a financial stability point of view, broader collateral eligibility criteria certainly contributed to facilitate the access to short-term credit and to alleviate the liquidity needs of those banks that were most struck by the turmoil, therefore lessening the risk of possible bank defaults with a potential impact also in terms of systemic risk. It was a fortunate occurrence that, in the harsh contingency of October 2008, both monetary policy and financial stability considerations required to maneuver the collateral requirements tool into the same direction.

Another interesting finding that emerges from the analysis of Clearstream business volumes concerns the privileged role of covered bonds (especially *Pfandbriefe*) as collateral assets in money market transactions: in particular, starting from 2008, their use as collateral has significantly excelled the use of all the other classes of structured products, as well as of debt securities in general. Based also on other official data from the ECB, we conclude that one of the primary reasons (even if not explicitly stated) for the central bank's choice of purchasing covered bonds was probably to support banks' endowment of collateral for interbank lending. By reviving – in terms of liquidity, issuance and spreads – a market of bank-issued, high-quality assets especially used as collateral for secured interbank lending, the ECB has optimized its direct intervention, with the final goal of re-setting the interbank activity at pre-crisis levels as soon as possible. Notice that the Eurosystem's outright purchases of covered bonds underlie a twofold financial support to the banking sector: on one hand, covered bonds liabilities are a major source of long-term funding for banks; on the other, banks use covered bonds assets as collateral, mainly for (cheaper) interbank lending. For how long the Eurosystem should continue to pursue this policy of implicit subsidization of the banking sector in the name of its mandate on financial stability remains an open issue, independently on the timing of the interbank market's recovery.

In terms of policy prescriptions, this study proves that *in a neoclassical framework (i.e. with a steep interbank money/credit supply curve), broader collateral eligibility criteria may be necessary for a more expansive monetary policy. Depending on the banks' effective endowment of collateral assets, collateral requirements may then result at least as important as the policy rate for a smooth working of the monetary transmission mechanism: they may be a pre-condition for the efficacy of a lower policy rate* (Proposition 3). Likewise, there may exist some binding constraints on the ECB's ability to "choose the way in which interest rate action could be combined with the unwinding of the non-standard measures" (Trichet, September 2009), more specifically, with the re-tightening of collateral requirements. The key point is that, *given the current role of collateral requirements for the monetary policy of the Eurosystem, interest rate policy and collateral policy should not be set independently one from the other; instead, they should be steered jointly in the light of monetary policy and financial stability considerations* (Proposition 2). Indeed, *as far as broader collateral eligibility criteria are concerned, unwinding this specific non-standard measure should require the occurrence of at least one of the three following pre-conditions: i) a recovery of the unsecured*

interbank market, thanks to a less steep interbank money/credit supply curve; ii) a broadening of the banks' endowment of collateral for secured central bank and/or interbank borrowing; iii) a previous or at least simultaneous rise of the policy rate (Proposition 4): this parallel trigger of collateral policy and interest rate policy would reverse the analogous joint actions undertaken by the ECB in October 2008.

From a financial stability point of view, central banks should consider that a relaxation of collateral eligibility criteria always implies a sacrifice of the major *raison d'être* of collateral in monetary policy operations: to protect the central bank against the default risk of its counterparts. *This sacrifice might be the lesser evil in crisis times, but in the long-term it is definitely questionable under many points of view:* in primis*, because a higher risk profile may compromise the consistency of the monetary policy target as well as the same central bank independence;* in secundis*, because it may push the central bank outside its legal mandate (besides being morally unacceptable and politically inopportune);* in tertiis*, because it may raise moral hazard issues in terms of bank managers' behavior, without really solving banks' most structural problems* (Proposition 5). Because of such reasons, *inter alia*, we cannot exclude that a central bank, under special circumstances, may be pushed to use the policy rate as a tool to address the financial stability target, besides the price stability target. Thus, if we assume that collateral eligibility criteria a) cannot stay at an unsustainably low level for too long (because of financial stability considerations), and b) cannot be the bottleneck of the interest rate policy transmission mechanism (because this would render a sub-optimal result in terms of monetary policy), then the only alternative is to set the policy rate at an equilibrium point which is consistent with the actual level of available collateral. Ultimately, this point of collateral policy-interest rate policy equilibrium may lie well above the minimum interest rate compatible with the price stability target. The key point is that, *in a neoclassical framework that integrates both price stability and financial stability as final policy targets, the exclusive assignment of the policy rate tool to the price stability target should not be a dogma* (Proposition 6). Indeed, this problem has many points in common with the 'zero floor' issue that central banks had to face in the last months: one lesson of the current crisis is that, in the presence of a 'floor' to the price of credit (not necessarily the 'zero floor'!), central banks have several 'unconventional' tools, other than the policy rate, to stimulate the provision of credit to non-bank sectors. Eventually, one or more of these unconventional tools might be combined and adapted to complement the policy rate as an instrument to address price stability, even at a rate level well above zero.

To summarize, today monetary policy and financial stability share a large part of the same toolbox: therefore, an optimal solution requires considering the joint effects of each tool on both the final objectives of monetary policy (i.e., price stability) and financial stability. In fact, price stability and financial stability are two equations of the same system; thus, finding an optimal solution (roots vector) for the use of each tool implies 1) taking account of both equations simultaneously, and 2) no pre-defined assignment of any tool (variable) to a specific target (equation). Finally, what emerges from this picture

is *the necessity of adopting an integrated approach in twenty-first century central bank decision-making, by relinquishing – if the case – that interpretation of the Tinbergen rule which prescribes the* exclusive *assignment of one policy tool to one policy target only* (Proposition 7). Collateral policy is no exception. As collateral requirements interact with other policy tools, and determine an important impact on different policy targets, they should not be steered independently from any other relevant instrument and target.

So, for instance, central banks should consider the possible use of their collateral eligibility criteria as a countercyclical instrument, either by lending against a broader range of assets (provided that they are effectively able to properly estimate and 'charge' the risks incurred by accepting lower-quality assets), or by adopting 'cycle-neutral' haircuts, or – *in fine* – by using haircut changes as a tool to target asset price bubbles. Central banks should also take into account that their collateral requirements tend to influence collateral eligibility criteria in secured money-market trades and, down the trade processing chain, in clearing and settlement systems. As a consequence, another major issue arises when such criteria are softened: central banks should consider not only the counterparty risk they directly take on, but also the higher level of systemic risk likely endorsed in such circumstances by security settlement systems (SSSs). Because of a lower buffer in terms of protection and recovery against counterparty risk when collateral requirements are more relaxed, during these periods it becomes, therefore, even more important to strengthen the oversight activities aimed at an early detection of potential credit and liquidity problems in market infrastructures.

In conclusion, we should notice that, ultimately, the problem of collateral underlies a problem of trust. Until not too long ago, trust was virtually the only form of collateral in many trades and loans. Indeed, the current "credit crunch is, in essence, a breakdown in trust. Between different parties at different times, that loss of trust has been the root cause of the devastating impact felt globally since the credit crunch began. It also explains why the road to recovery in credit, and thus in the real economy, may be long and winding. In essence, events of the past two years can be retold as a story of the progressive breakdown in trust. […] Trust is an altogether different animal. It is based on beliefs, not observable proofs. It is grounded in perceptions rather than evidence. It is as much a psychological state as a financial one. […] A clean balance sheet might instil confidence, but it need not repair trust. Because it is a moral judgement, repairing trust can be a slow and painstaking business. Moral compasses take rather longer to self-correct than magnetic ones. This has implications for the path of recovery in the period ahead"[158].

Unfortunately, collateral is not such a good surrogate for trust. But it is all that lenders value at the moment, so that borrowers have no choice. This makes the question of collateral dramatically important.

[158] Haldane (2009), pp. 3 and 5.

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Appendix 1: Changes in the structure of the repo market after the crisis onset

Two examples of the close link between the development of the repo market, on one side, and the ECB's monetary decisions and collateral policy, on the other, are reported below. These two examples consider the changes that affected the repo market in the aftermath of the subprime crisis' outburst, with regard to a) the repo term structure, and b) the ratings of repoed securities.

a) Changes in the repo term structure

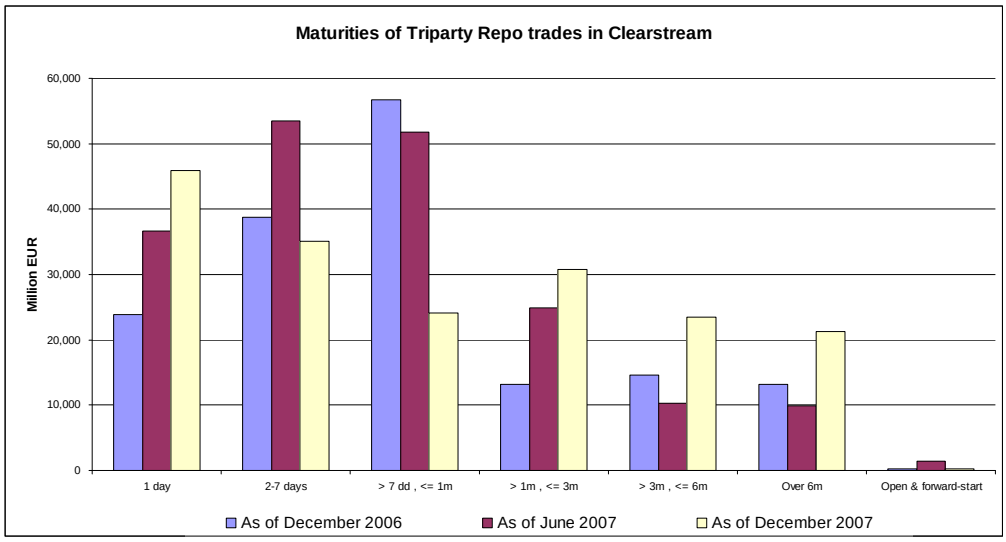
In Section 4.2 we mentioned that, following the onset of the turmoil in August 2007, the ECB began to conduct supplementary LTROs with maturities of three months, and later six months. In fact, such operations amounted up to 55% of the total ECB liquidity made available at end of March 2008, from 35% at the end of March 2007[159]. As a matter of fact, *the longer-term prospective assumed by the ECB for its refinancing operations after the outburst of the crisis, brought about a significant volume increase of outstanding repo trades with longer maturities (over one month)*, as evidenced by data from both Clearstream and ICMA.

Thus, when we consider the maturities of repo trades *ante* and *post* the onset of the subprime crisis, Clearstream's data on triparty repo business volumes[160] show a 'flattening' of the curve, that is, a re-positioning of the market around the very short and very long maturities (see below).

[159] FitchRatings (2008), pp. 1 and 3.

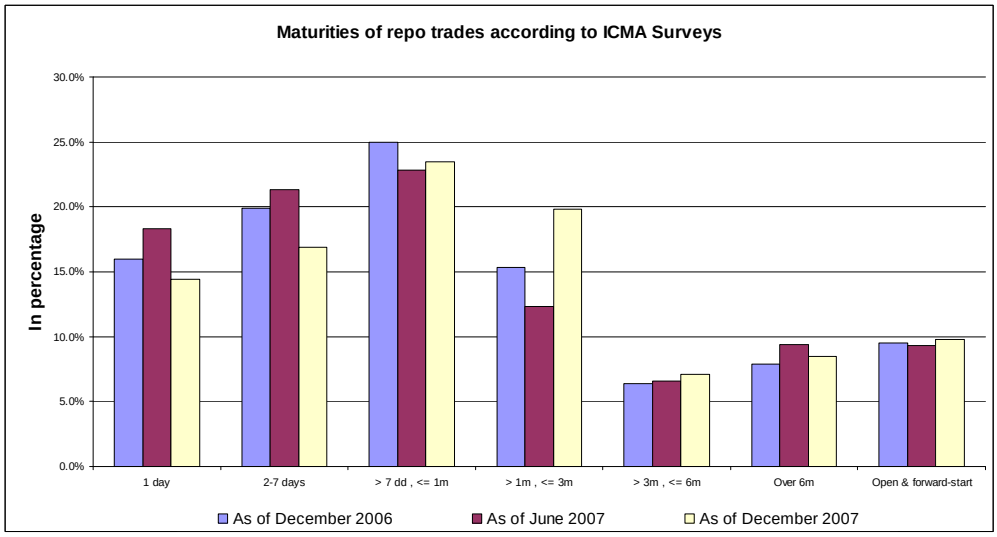
[160] Clearstream data refer to outstanding volumes on three days (13/12/2006, 19/12/2006, and 12/12/2007) characterized by 'normal' customer activity during the reference periods of December 2006, June 2007, and December 2007.

Chart A1.



A comparison with the data offered by ICMA, however, evidences a net shift of the activity in favour of longer maturities: especially the overnight repo segment – which seems to suffer somewhat from the impact of the crisis – is here significantly different from what appears in Clearstream data (see Chart A2 for ICMA).

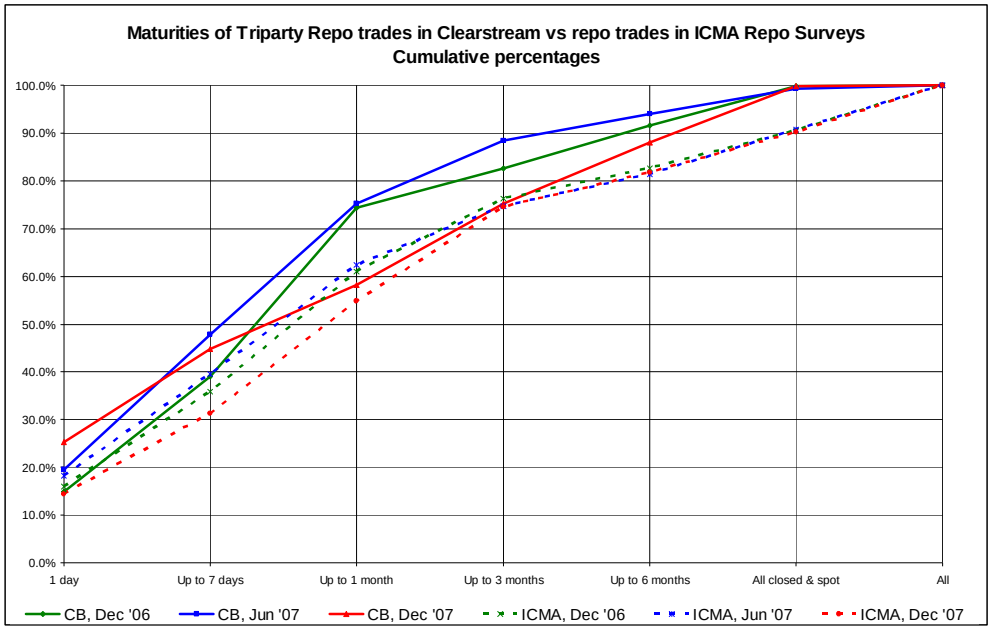
Chart A2.



Finally, Chart A3 compares the evolution of the two term structures over the course of 2007. We can notice – *inter alia* – the drastic contraction in the outstanding volumes of

repo trades with maturities between 1 week and 1 month, in the curve of Clearstream's triparty repos for December 2007.

Chart A3.



One possible explanation for the different directions taken by the overnight repo activity in Clearstream, compared to the rest of the market, points to German banks as a key factor to understand this discrepancy. Indeed, such banks are the most important component of Clearstream's customer base for the GSF[161] product area, especially after the further extension of Euro GC Pooling in September 2007. "The large usage of the liquidity funds provided by the ECB to German banks since the creation of the ECB reflects Germany's larger wholesale banks, including the Landesbanks, which traditionally do not benefit from such strong retail deposit bases as their European peers. *We would expect that those institutions with sizeable, less-liquid structured securities on their balance sheet such as some Landesbanks might have increasingly delivered those securities to the ECB for shorter-term refinance*"[162]. It is clear that the implicit and explicit costs associated with the use of more risky/less liquid securities as collateral increase with the increase of maturity.

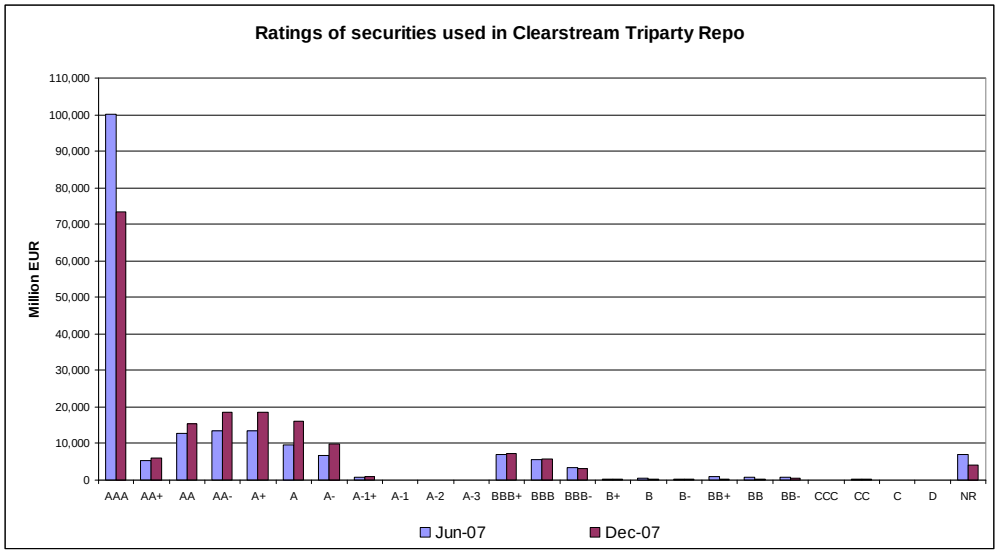
[161] GSF: Global Securities Financing. It includes the Triparty Repo, Collateral Management and Securities Lending products.
[162] FitchRatings (2008), p. 7; italic of the author.

b) Changes in the ratings of repoed securities

Unfortunately, the ICMA Repo Survey does not take into consideration the analysis of collateral ratings. So, from this point of view, Clearstream's Triparty Repo trade data provide a unique prospective to analyze this aspect of the repo markets' evolution.

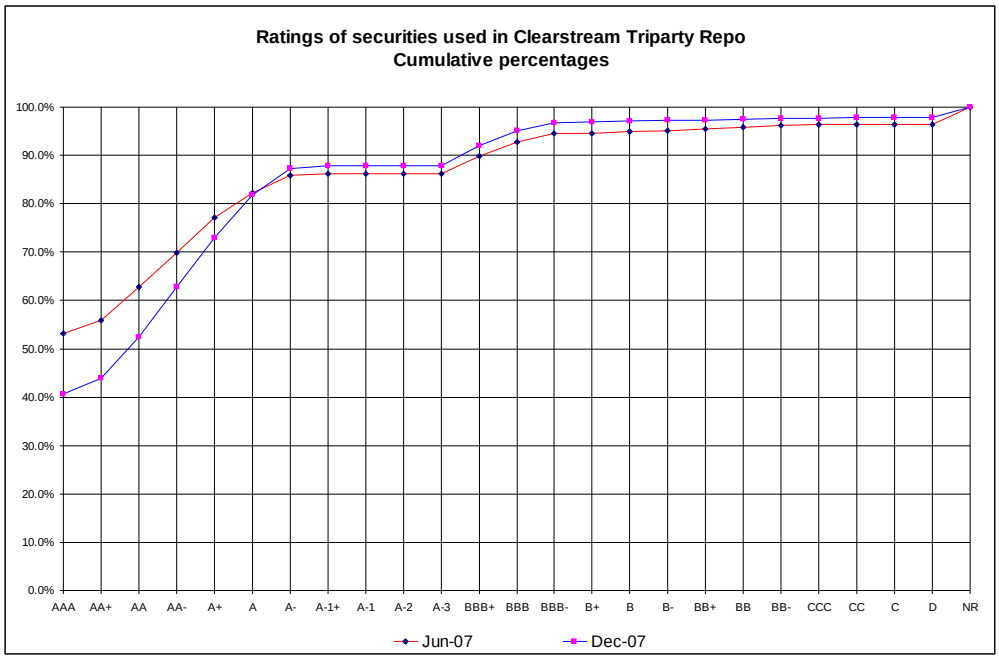
Charts A4 and A5 below illustrate how the rating composition[163] of securities used in Clearstream for Triparty Repos changed in the second half of 2007, and how the risk profile in terms of rating threshold referring to the use of the same securities evolved, respectively.

Chart A4.



[163] Clearstream's Credit Department utilises a composite rating, derived from the rating (when existing) assigned by the three agencies Moody's, Standard & Poor, and Fitch.

Chart A5.



Overall, these two charts tell us that Clearstream customers involved in triparty repos at the end of 2007 used a more homogenous (in terms of risk) set of securities as collateral, compared to the period before the onset of the crisis. Because of the elevate number of rating downgrades during the period June-December 2007, the average quality of customer portfolios deteriorated significantly: in June 2007 over 53% of the securities used for triparty repos had the top-notch rating AAA, whereas in December of the same year this percentage had reduced to slightly more than 40%. In fact, when we consider the percentage of securities with *at least* a minimum rating – starting from the top-class AAA – we can observe that for the first six rating classes, namely, down to the class A, the percentage of securities used for triparty in June 2007 was higher than in December 2007.

Starting from the next class A-, however, this relation reverses: thus, for instance, in December 2007 the percentage of repoed securities rated A- or higher was 87.4% *versus* 85.8% in June. The same occurs for ratings below A-. The reason relates to the more severe collateral eligibility criteria adopted by customers: as an example, the percentage of non-rated securities used in triparty repos during the period in question decreased by nearly 42% (from 6.9 billion Eur to 4 billion Eur).

Notice that the threshold level of rating A- corresponds to the minimum rating for marketable and non-marketable securities accepted as collateral by the ECB until October 2008, besides being linked to the new collateral eligibility criteria adopted by

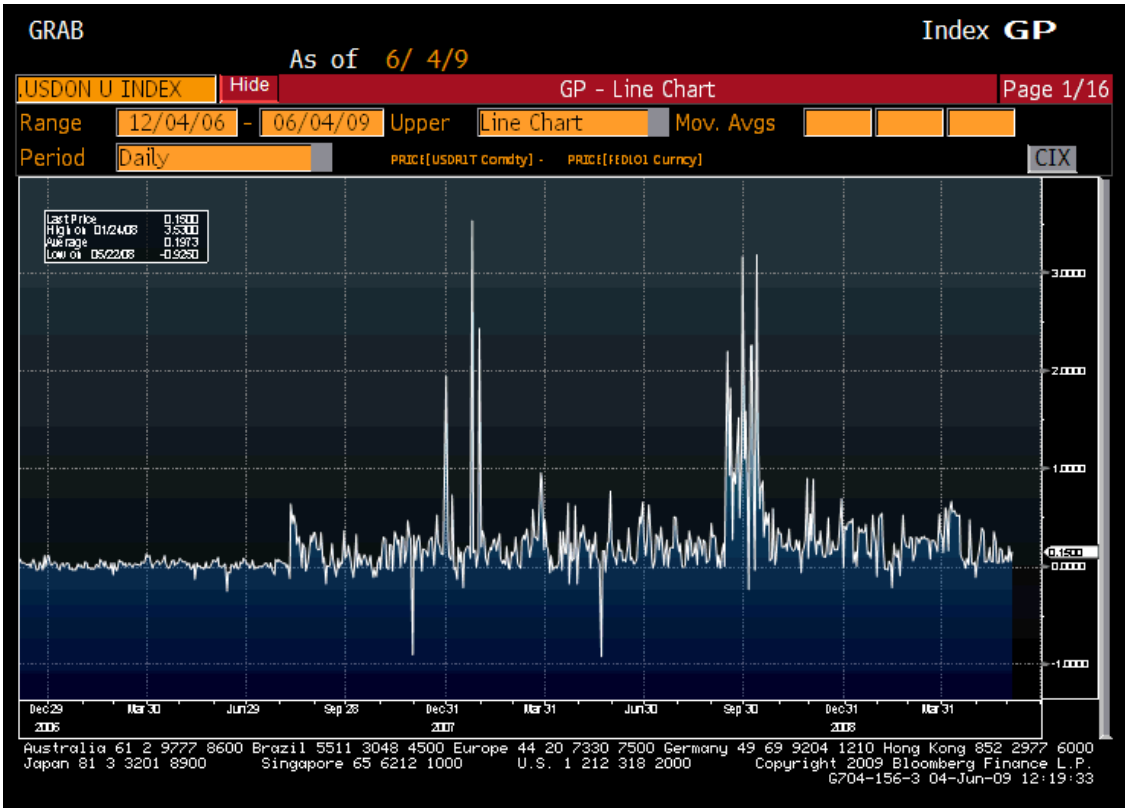
Clearstream GSF after the start of the turmoil[164]. Thus, this seems just another proof of the leading role of central bank collateral requirements vis-à-vis the standards accepted in the money market, especially in periods of crisis.

[164] For example, according to the new ASL+ collateral eligibility criteria, long-term fixed-income securities needed to have a rating above or equal to A+, while short-term fixed-income securities needed to have a rating above or equal to A1+. In fact, A- sits in between the two.

Appendix 2: Unsecured vs. secured interest rate spreads for EUR and USD

a) EUR one-month (source: Bloomberg).

b) USD overnight (source: Bloomberg).



c) USD one-month (source: Bloomberg).

d) USD 3-months (source: Bloomberg).