

# 2009 | Liquidity in Interdependent Transfer Systems

Proceedings of the joint  
Banque de France - European Central Bank conference  
Paris, 9-10 June 2008



EUROPEAN CENTRAL BANK

EUROSYSTEM





# Contents

---

<b>Introduction</b>	<b>7</b>
<b>Summary of the main messages</b>	<b>9</b>
<b>Key data</b>	<b>15</b>
<b>Opening remarks by Gertrude Tumpel-Gugerell (ECB, Executive Board member)</b>	<b>17</b>
<b>Session 1: Liquidity risk and liquidity management in global transfer systems</b>	<b>21</b>
<b>Chairperson:</b> Yvon Lucas (Banque de France, Head of the Payment Systems and Market Infrastructures Department)	
Dirk Schrade (Deutsche Bundesbank) “Innovations in wholesale payment systems”	
Frédéric Hervo (Banque de France) “Recent developments in intraday liquidity in payment and settlement systems”	
Esmond Lee (Hong Kong Monetary Authority) “Liquidity and risk management in the RTGS system – the Hong Kong experience”	
<b>Session 2: Collateralisation of central bank operations</b>	<b>27</b>
<b>Chairperson:</b> Daniela Russo (ECB, Deputy Director General, Payments and Market Infrastructure)	
Mark Manning (Reserve Bank of Australia) and Matthew Willison (Bank of England) “Modelling the cross-border use of collateral in payment systems”	
Jens Tapking (ECB) and Christian Ewerhart (IEW, Zurich) “Repo markets, counterparty risk and the 2007/2008 liquidity crisis”	
Morten Bech (Federal Reserve Bank of New York) “Intraday liquidity management: a tale of games banks play”	
Discussant: Anne Wetherilt (Bank of England)	
<b>Panel session: Collateral management: recent trends and developments</b>	
<b>Chairperson:</b> Daniela Russo (ECB, Deputy Director General, Payments and Market Infrastructure)	
Panellists:	
Godfried De Vidts (ICAP, Director of European Affairs, and European Repo Council, Chairman)	
John Burke (LCH.Clearnet, Director, Fixed Income Division)	
John Trundle (Euroclear group, Head of Risk Management)	

### Session 3: Provision of liquidity by central banks in times of liquidity crisis

37

**Chairperson:** Sylvie Matherat (Banque de France, Head of the Financial Stability Department)

Stephan Sauer (ECB)

“Liquidity risk and monetary policy”

Gerhard Illing and Jin Cao (University of Munich)

“Liquidity shortages and monetary policy”

Enisse Kharroubi and Edouard Vidon (Banque de France)

“Increasing returns in the interbank liquidity market”

Discussant: Nuno Cassola (ECB)

### Session 4: Modelling payment systems as a risk assessment tool

41

**Chairperson:** Jeff Stehm (Board of Governors of the Federal Reserve System, Associate Director)

Martina Glaser and Philipp Haene (Swiss National Bank)

“Liquidity effects of a participant-level operational disruption in SIC”

Ouarda Merrouche and Jochen Schanz (Bank of England)

“Banks’ intraday liquidity management during operational outages: theory and evidence from the UK payment system”

Fabien Renault (Banque de France), Walter Beyeler (Sandia National Laboratories), Kimmo Soramäki (Helsinki University of Technology), Morten Bech (Federal Reserve Bank of New York) and Robert Glass (Sandia National Laboratories)

“Performance and resilience to liquidity disruptions in interdependent RTGS payment systems”

David Mills and Samia Husain (Board of Governors of the Federal Reserve System)

“Interlinkages between payment and securities settlement systems”

Discussants: Johannes Lindner (ECB) and Douglas Conover (BIS)

### Session 5: The increasing importance of system interdependencies

47

**Chairperson:** Denis Beau (Bank for International Settlements, Head of the Secretariat of the Committee on Payment and Settlement Systems)

Panellists:

Alain Raes (SWIFT, Head of the Europe, Middle East and Africa Region)

Gerard Hartsink (ABN AMRO, Senior Executive Vice President, and CLS Bank, Chairman)

Marshall Millsap (JPMorgan Chase, Senior Vice President for Global Industry Issues)

Chairperson’s concluding remarks on system interdependencies

**Session 6: Interoperability or integration: interdependencies in the EU and elsewhere** **51**

**Chairperson:** Daniela Russo (ECB, Deputy Director General, Payments and Market Infrastructure)

Panellists:

Alain Pochet (BPSS, Head of the Banking Operations for the Securities Division)  
Diana Chan (EuroCCP, Chief Executive Officer)  
Judith Hardt (FESE, Secretary General)  
Konstantinos Tomaras (European Commission, Financial Market Infrastructure Unit)

**High-level panel session: which strategies should be adopted by central banks and other public authorities to prevent liquidity crises?** **57**

**Chairperson:** Jean-Pierre Landau (Banque de France, Deputy Governor)

Panellists:

Charles Kahn (University of Illinois, Professor)  
Claudio Borio (Bank for International Settlements, Head of Research and Policy Analysis)  
Franco Passacantando (Banca d'Italia, Managing Director)  
James McAndrews (Federal Reserve Bank of New York, Senior Vice President)



# Introduction

---

In the field of payments, financial globalisation has manifested itself in a number of ways, such as: the emergence of cross-border payment systems and offshore systems; increasing demand for multicurrency services; the establishment of cross-system links; multiple system memberships among large international firms; and a trend towards international consolidation of infrastructures.

Financial globalisation has also increased the complexity of the financial sector, creating a growing number of interdependencies between systems. More and more, settlement flows, operational processes and risk management procedures of one system, institution or market are related to those of others. While interdependencies can improve the safety and efficiency of payment and settlement processes, they may also serve as channels for spreading operational or financial disruptions.

In order to improve the understanding of the implications of these evolutions for financial stability, the Banque de France and the European Central Bank jointly organised a conference on **“Liquidity in interdependent transfer systems”**, which was held in Paris on 9-10 June 2008. The conference brought together 115 participants – central bankers, academics, industry participants and public authority representatives – in the Galerie Dorée at the Banque de France premises in Paris. The conference was opened by **Gertrude Tumpel-Gugerell**, member of the Executive Board of the European Central Bank, and closed by **Jean-Pierre Landau**, Deputy Governor of the Banque de France.

These conference proceedings are meant to provide the reader with an insight into the papers presented and the discussions that followed. The issues tackled at the conference seem indeed to have even gained in relevance in today’s context.







# Summary of the main messages

---

## Introduction

Liquidity is usually defined as the ability of a financial institution to fund increases in assets and meet obligations as they come due. Structural developments in the financial industry have led in the past years to a clear trend towards a shortening of the time horizon of liquidity management. This is reflected in the following statement by a practitioner: “my short term is intraday, my medium term is overnight and my long term is one week”, as quoted by **Frédéric Hervo** (session 1). A second observable trend in the financial industry has been the growing importance of interdependencies as a consequence of financial globalisation. The settlement flows, operational processes and risk management policies of a given market infrastructure or participant have become increasingly dependent on those of their counterparties across the globe. As pointed out by **Gertrude Tumpel-Gugerell** (opening remarks), this evolution challenges the existing political and financial structures at the domestic level. Adequate new structures that are in line with an increasingly globalised financial sector have not yet been established at the supranational level. The June 2008 conference on “liquidity in interdependent transfer systems” focuses on these two trends, assessing the central issues from several different perspectives.

As a key lesson, the conference demonstrated that the role of infrastructures has to be analysed as part of the financial sector as a whole and that a narrow focus on individual infrastructures alone will not suffice. To understand and assess trends in liquidity management, it is necessary to take into account the linkages and interdependencies between the actions, policies and strategies of the different actors in the financial sector, namely banks, infrastructures, central banks, regulators and governments. This chapter summarises the main messages of the conference, reviewing first the role of the different actors, then discussing the occurrence and resolution of liquidity crises. Subsequently, some conclusions are drawn based on the recent developments that have taken place since the conference in June 2008.

## The role of banks

Banks are a natural starting point for discussing liquidity risk and liquidity management as they are both providers and consumers of liquidity. A bank’s liquidity management policy depends on many factors. As participants in a payment system, banks seek to manage and predict payment flows in a way that allows them to minimise the costs associated with liquidity in normal circumstances. Using a game theoretical framework, **Morten Bech** (session 2) shows how this can sometimes lead to a socially inefficient situation where each bank sends its payments late while hoping that its counterparties will pay early. Such incentives to delay payments can be significantly stronger in extraordinary situations, for example when a system participant is affected by an operational outage and is unable to submit any new payment. **Ouarda Merrouche** and **Jochen Schanz** (session 4) provide a theoretical investigation of this phenomenon and test their model against empirical data collected in CHAPS, the UK large-value payment system. Various measures can be put in place to improve the coordination between participants. In this regard, **Philip Haene** and **Martina Glaser** (session 4) recall that in the Swiss large-value payment system SIC a progressive fee structure has been introduced to set incentives for participants to submit and settle their payments early.

As banks tend to participate in more than one system, they can also act as a channel of contagion between systems. These “institution-based interdependencies” have been described in the recent report of the Committee on Payment and Settlement System’s working group on system interdependencies, as recalled by **Denis Beau** (session 5) who chaired the working group. He highlights in particular the significant overlap in the participant base of domestic systems, leading to strong interdependencies of liquidity flows across systems. This phenomenon is investigated further by **David Mills** and **Samia Husain** (session 4) who model the interaction between a real-time gross settlement (RTGS) system and a securities settlement system (SSS) sharing the same participants and assessed the consequences of a disruption in one system. Large globally active financial institutions that participate in or provide services to many transfer systems in several countries may also allow potential

disruptions to spread across currency zones. This phenomenon is illustrated by the joint work of **Fabien Renault, Walter Beyeler, Kimmo Soramäki, Morten Bech** and **Robert Glass** (session 4) who model the propagation of a liquidity crisis from one RTGS system to another in a different currency zone through the dual participation of a few global banks. To mitigate these risks, **Denis Beau** (session 5) suggests that the globally active banks should put in place robust intraday liquidity management procedures. **Marshall Milsap** (session 5) welcomes the CPSS efforts on reducing risks in payment and settlement systems. He provides the audience with some insights into how the risks related to interdependencies and global linkages are dealt with at JPMorgan Chase, and identifies difficulties that large players of systemic relevance sometimes face in conciliating both the shareholders' perspective and the long-term interest of the global industry.

### The role of infrastructures

In the last decade, the diffusion of new risk management practices, such as the real-time gross settlement of payments in large-value payment systems or the delivery-versus-payment settlement in securities settlement systems, has drastically reduced the level of credit risk in transfer systems. However, as highlighted by **Frédéric Hervo** (session 1), these new risk management practices have also led to an increased demand for intraday liquidity. In his presentation, **Dirk Schrade** (session 1) mentions two solutions to resolve this issue and save on liquidity usage. A first solution is to implement offsetting mechanisms in transfer systems. Due to its advanced liquidity-saving features, the Hong Kong RTGS system is able to exhibit a ratio of 10 to 1 between its turnover and its consumption of intraday credit, as pointed out by **Esmond Lee** (session 1). A second solution lies in the consolidation of accounts in order to avoid liquidity being divided into multiple liquidity pots. TARGET2, the new pan-European RTGS system, for example, relies on both approaches, offering the participants a high level of liquidity efficiency.

**Daniela Russo** (session 6) regrets the still insufficient level of integration between the different markets of the euro area and emphasizes the need for Europe to be able to rely on efficient platforms that would be able to compete at a global level. Large steps have been taken by the Eurosystem, first with the move to TARGET2 and then with the launch of the TARGET2-Securities project for which market participants have expressed their support. Further integration could be achieved in the field of clearing through two possible options: the

consolidation of infrastructures or their interoperability. According to **Konstantinos Tomaras** (session 6), public authorities, such as the European Commission, remain neutral concerning the option to be chosen, as long as it creates an environment for the development of an integrated market. However, there was a consensus among the speakers, notably **Alain Pochet, Diana Chan** and **Daniela Russo** (session 6), that interoperability has not yielded the results hoped for in Europe, in particular in the form of “competitive links” promoted by the Code of Conduct for Clearing and Settlement in contrast to the already implemented “cooperative links”. According to **Alain Pochet** (session 6), integration through interoperability entails higher levels of costs and risks than what could be achieved through consolidation. In this regard, **Diana Chan** (session 6) expresses some concerns about the complexity of managing the mutual exposures of interoperating central counterparties (CCPs).

Exposures arising from inter-CCP links are one example of what the CPSS report on the interdependencies of payment and settlement systems has identified as the “system-based” interdependencies. Other examples are the impact of delivery-versus-payment (DVP) and payment-versus-payment (PVP) mechanisms, or the sharing of operational facilities between different systems. In this context, **Denis Beau** (session 5) calls on system operators to review the risks that their systems bear from and pose to other entities as a result of interdependencies. For **Gerard Hartsink** (session 5) the responsibility for managing these interdependencies lies both with the public and the private sector and good cooperation between industry participants and public authorities should be promoted. In addition to market infrastructures, some service providers such as SWIFT can also play a significant role as a channel of interdependencies since many payment and securities systems across the globe rely on SWIFT for their operation. For **Denis Beau** (session 5), it is therefore important that these critical service providers have risk management tools in place that are proportionate to the risks involved. **Alain Raes** (session 5) explains how SWIFT addresses these risks, whilst being very aware of its importance for the global financial system.

### The role of central banks

As payment and settlement systems are essential for financial markets and the economy as a whole, central banks have a strong interest in their safe and efficient functioning. Depending on the respective legal framework, central banks may pursue this interest by taking up different roles in transfer systems: they may

be involved as operator, overseer, liquidity provider, catalyst or participant.

The central bank's framework for monetary policy implementation, and especially its policy regarding the establishment and the remuneration of obligatory reserves, has a significant impact on the amount of liquidity available to banks for making transactions in transfer systems. The way central banks provide intraday credit to commercial banks – either at no cost and fully collateralised or for a fee without requiring collateral – also has a strong influence on payment and settlement systems, as discussed by **Morten Bech** (session 2).

When intraday liquidity is provided against collateral, the collateral acceptance framework of the central bank is particularly important since the wider the spectrum of collateral accepted, the more banks can obtain intraday credit. As a response to the 2007-08 market turmoil, several central banks have enlarged the range of accepted assets to assets issued in foreign currencies. Taking a game theoretical approach, **Mark Manning** and **Matthew Willison** (session 2) explore the consequences of central banks' policy in this matter and point out that any reduction in liquidity risk achieved through a broadening of the accepted collateral will generally be higher when central banks coordinate their policies allowing for a symmetric cross-border use of collateral.

The collateral acceptance policy of the central bank might also have an impact on the collateralised interbank lending (repo) market. As shown by **Jens Taping** and **Christian Ewerhart** (session 2), it seems that commercial banks lend to each other against their highest quality assets, typically sovereign bonds, while they borrow from the central bank against lower quality assets. When central banks broaden the range of accepted assets, they therefore allow for the higher quality assets to be used on the interbank market. There is a tendency towards an increased demand for secured lending in the euro area, as noted by **John Burke** (session 2), and the industry is longing for an environment where securities can move more freely across borders. **Daniela Russo** (session 2) stresses the need for cost-efficient and robust solutions to allow for the cross-border mobilisation of collateral, and expresses the determination of the Eurosystem to move forward on this issue, notably through the CCBM2 and TARGET2-Securities projects. In the meantime, steps towards harmonising the operational procedures and opening hours of the different central securities depositories (CSDs) in Europe could be taken

immediately, as mentioned by **John Trundle** (session 2).

Cooperation between central banks is relevant not only with regard to liquidity provision and the convergence of operational frameworks, but also concerning the oversight of infrastructures. Cooperation among overseers provides the basis for assessing the impact of interdependencies and for ensuring that in the design of infrastructures, the externalities involved are sufficiently taken into account. Moreover, cooperation with banking supervisors provides overseers with information on the solvency of the banks that participate in the systems. For the central banks that are entrusted with both the oversight and the banking supervision function, the proximity between these two functions proved very valuable during the recent crisis according to **Franco Passacantando** (high-level panel). Indeed, such proximity allows for a rapid exchange of information between the two functions and might also help in resolving potential policy conflicts, for example when the banking supervisor would recommend an individual institution to be as prudent as possible while an overseer would be concerned that this would result in decreased market liquidity.

### The role of regulators and governments

Governments and regulators are responsible for providing the financial sector with a sound legal and regulatory framework. The various laws and regulations governing financial activities are interlinked and policy initiatives targeted at one aspect of the financial sector may have consequences also for other parts. Regulation of banks or exchanges has an impact on payment and settlement systems. For example, the move from Basel I to Basel II resulted for banks in higher capital requirements for unsecured lending, as recalled by **Godfried de Vidts** (session 2), leading to an increased usage of collateralised lending in the interbank market and thus to new market needs in terms of collateral management.

In the European context, **Alain Pochet** (session 6) stresses the importance of the Markets in Financial Instruments Directive (MiFID) which has triggered the beginning of European consolidation on the trading side. On the post-trading side, Europe has relied on self-regulation based on the Code of Conduct by the industry. However, as noted by **Judith Hardt** (session 6), several remaining legal and regulatory obstacles are still slowing down the process of European financial integration in this field. For example, the absence of an agreement among regulators in Europe on whether or not a CCP would need to have a banking status

illustrates the limits that a self-regulation approach faces.

Similarly, at a global level fiscal and regulatory barriers often prevent global banking institutions from managing their collateral and liquidity on a worldwide scale. Some of these challenges will have to be addressed to allow for the development of efficient cross-border infrastructures.

## Liquidity crises

**Claudio Borio** (high-level panel) defines a liquidity crisis as a sudden and possibly prolonged evaporation of both market and funding liquidity with potentially serious consequences for the stability of the financial system and of the real economy. He identifies two idiosyncratic elements that all liquidity crises share. First, at the core of the dynamics of a liquidity crisis is a mutually reinforcing feedback between market liquidity, funding liquidity and credit risk. Second, liquidity crises are best seen as the endogenous result of the build-up in aggressive risk taking over a prolonged period characterised by an “artificial liquidity”.

Having well-designed market infrastructures in place is an important contributing factor in withstanding a liquidity crisis. Central banks have a large responsibility in this regard. As concerns the solvency of several institutions, central bank money becomes the key asset that allows for the safe settlement of all transactions. **Claudio Borio** (high-level panel) notes that badly designed payment and settlement systems exacerbate liquidity crises once they have materialised, by amplifying concerns about counterparty risk and by creating uncertainty about cash flows, for example when the settlement of an unprotected net payment system has to be unwound. In line with this assessment, **Godfried de Vidts** (session 2) believes that the recent market turmoil has brought arguments in favour of central bank initiatives in the area of transfer systems and that market players are now willing to pay more in order to be able to settle their transactions in central bank money. Efficient optimisation mechanisms can also help systems to operate when liquidity is scarce, as pointed out by **Dirk Schrade** and **Esmond Lee** (session 1). Despite the fact that transfer systems have withstood the test of the current crisis, further improvements could still be made in some regards. **James McAndrews** (high-level panel) suggests, for example, working on the reduction of the delay between the trading time and the settlement time of Eurodollar trades in New York as a way to decrease the uncertainty in troubled times.

Once a crisis has materialised, central banks can react in a variety of ways. For example, **James McAndrews** (high-level panel) stresses the importance of the foreign exchange swaps that were conducted between the Federal Reserve System, the European Central Bank and the Swiss National Bank. These swaps proved useful in addressing the lack of integration between the Eurodollar market in London and the Eurodollar market and the Fed funds market in New York. Another reaction from the central banks has been to start accepting assets issued in foreign currencies as collateral. Only accepting domestic collateral in normal times and accepting assets issued in foreign currencies in times of crisis can actually make sense from the central bank’s point of view. Indeed, as shown by **Mark Manning** and **Matthew Willison** (session 2), when central banks accept cross-border collateral only in times of crisis, there is a reduced incentive for the commercial banks to economise on collateral in normal times, even if the central bank’s policy is communicated ex ante. Whether different facilities should be put in place for routine and emergency situations respectively is a question raised by **Daniela Russo** (session 2) when discussing the acceptance of cross-border collateral. **John Trundle** (session 2) would favour a single facility for routine and emergency situations since in times of crisis it is preferable to rely on facilities that the industry is very well acquainted with.

From a more macroeconomic perspective, liquidity crises do not only threaten the smooth functioning of transfer systems, but they also put the real economy under pressure by forcing some agents to proceed with a socially costly liquidation of their productive assets. Such liquidation can in part be avoided if the central bank accepts to lend against the illiquid assets, in accordance with the Bagehot rule according to which central banks should “lend freely at a high rate against good collateral”. According to **Gerhard Illing** and **Jin Cao** (session 3), however, the Bagehot rule could fail to address the moral hazard issue and lead some “naughty” banks to over-invest in highly profitable but potentially illiquid assets with the expectation that the central bank will intervene in their favour in case of a liquidity shortage. This would tend to suggest that central banks should commit themselves to targeting liquidity provision only to prudent banks. For **Claudio Borio** (high-level panel), the moral hazard issue turns the central bank framework for liquidity provision into a “double-edged sword”. Indeed, the liquidity provided during the crisis acts as a buffer. At the same time, it also acts as an accelerator because the ex ante knowledge of the central bank intervention may induce

greater risk taking among industry participants – a problem that **Enisse Kharroubi** and **Edouard Vidon** (session 3) also discuss within their model on the interbank liquidity market. In this context, **Charles Kahn** (high-level panel) stresses that central banks, and public authorities more generally, will inevitably need to maintain a certain degree of flexibility given the exceptional nature of crises.

Besides the problem of moral hazard, **Stephan Sauer** (session 3) points out the inflationary risk of the central bank intervention – even though the central bank might be able to sterilise its intervention in some circumstances. For **Jean-Pierre Landau** (high-level panel), it is of particular importance that the provision of liquidity in times of crisis should not be mistaken for a change of monetary policy in the eyes of the public. In the short term, monetary policy can be clearly separated from the provision of emergency liquidity.

## Conclusions

The conference succeeded in bringing together research papers and policy discussions. It showed that research can provide useful insights for policy-making and raised expectations of seeing further progress in the research field. The conference presentations and discussions identified key policy issues. These findings will be useful to stakeholders and policy-makers in their efforts to further improve the resilience of the market infrastructures at a global level.

While it is too early to draw definitive lessons from the ongoing financial crisis, it seems that the developments that have occurred since June 2008 have confirmed the relevance of many of the issues discussed at the conference. In particular, the failure of Lehman Brothers in September 2008 illustrates that the default of a large global bank has become a relevant scenario which industry participants, market infrastructures, central banks and other public authorities need to be prepared for. Given the web of interdependencies that characterise the world market infrastructures today, managing the departure of a globally active bank requires (i) well-functioning information-sharing mechanisms among overseers and with supervisors, (ii) transparency and consistency in the application of default rules and notification procedures and (iii) knowledge of the precise interdependencies caused by multiple system membership of critical participants.

All in all, however, market infrastructures have so far successfully withstood the test of the crisis. Although well-functioning infrastructures alone cannot prevent the occurrence of a liquidity crisis, they can act as a

stability anchor in times of crisis. Badly designed payment and settlement systems, on the other hand, will exacerbate crises once they have materialised. Central banks and public authorities have shown their will to further strengthen the infrastructures: they have encouraged the use of payment and settlement systems and supported the establishment of new systems when there is no adequate infrastructure solution yet in place. In Europe, for example, the Governing Council of the ECB expressed in December 2008 the need for at least one European CCP for credit derivatives that, given its potential systemic importance and in order for the Eurosystem to be able to ensure the smooth functioning of that CCP, should be located within the euro area.



# Key data

## Payments processed by selected interbank funds transfer systems in 2007

(annual totals)

Systemically important payment systems in CPSS countries		Value of transactions (USD billions)	Number of transactions (millions)
Canada	LVTS	42,928	5.30
European Union	EURO1	79,714	54.35
European Union	TARGET	913,935	98.91
Belgium	ELLIPS	36,453	2.04
France	TBF	198,527	4.88
Germany	RTGS <sup>plus</sup>	317,934	47.50
Italy	BI-REL	57,635	11.50
Netherlands	TOP	53,434	7.26
France	PNS	22,258	6.43
Hong Kong SAR	HKD CHATS	27,785	5.50
Hong Kong SAR	USD CHATS	2,127	2.12
Hong Kong SAR	EUR CHATS	413	0.040
Japan	BOJ-NET FTS	250,381	6.76
Japan	Zengin System	22,313	1,353.3
Japan	FXYCS	47,826	7.75
Singapore	MEPS	10,135	3.42
Sweden	K-RIX	18	1.95
Switzerland	SIC	43,574	356.8
United Kingdom	CHAPS Sterling	135,836	35.58
United States	CHIPS	485,624	87.30
United States	Fedwire	670,665	134.7

Source: BIS (statistics on payment and settlement systems in selected countries).

## Transactions processed by selected central securities depositories in 2007

(annual totals)

Systems		Value of transactions (USD billions)	Number of transactions (millions)
Canada	CDS	57,298	138.6
Belgium	NBB SSS	9,021	0.302
Belgium	Euroclear Belgium	1,245	1.352
Belgium	Euroclear Bank	390,645	40.7
France	Euroclear France	178,708	32.5
Germany	Clearstream Banking Frankfurt	79,402	67.2
Italy	Monte Titoli	95,002	30.3
Netherlands	Euroclear Netherlands	na	4.65
Hong Kong SAR	CCASS	6,515	16.74
Hong Kong SAR	CMU	2	39.1
Japan	BOJ	188,615	4.28
Japan	JASDEC	11,892	65.4
Singapore	CDP	189*	270.9*
Sweden	VPC	19.12	28.1
Switzerland	SECOM	11,384	47.4
United Kingdom	CREST	223,567	66.3
United States	NBES	435,578	24.2
United States	DTC	210,000	324.9

Source: BIS (statistics on payment and settlement systems in selected countries).

\*2006 figures

## Critical participants and interdependencies in the CPSS payment systems

The table below, extracted from the CPSS report on system interdependencies, presents the concentration ratio (i.e. the cumulated turnover share in value terms of the five biggest participants in the system), the foreign participation ratio (i.e. the cumulated turnover share in value terms of all foreign-based institutions), as well as the cumulated turnover share of a selection of global market participants.

Systemically important payment systems in CPSS countries		Concentration (Top 5)	Foreign participation <sup>1</sup>	Selected large banks <sup>2</sup>
		%	%	%
		2006	December 2007	December 2007
Canada	LVTS	77	9	87
European Union	EURO1	45	na	na
European Union	TARGET <sup>3</sup>	22	16	na
Belgium	ELLIPS <sup>3</sup>	91	na	na
France	TBF <sup>3</sup>	61	8	67
Germany	RTGS <sup>plus3</sup> T2-Bbk	51	38	56
Italy	BI-REL <sup>3</sup>	51	27	46
Netherlands	TOP <sup>3</sup>	72	6	69
France	PNS	78	7	72
Hong Kong SAR	HKD CHATS	51	54	61
Hong Kong SAR	USD CHATS	56	49	50
Hong Kong SAR	EUR CHATS	97	27	52
Japan	BOJ-NET FTS	37	18	47
Japan	Zengin System	64	2	na
Japan	FXYCS	75	35	na
Singapore	MEPS+	52	55	54
Sweden	RIX	86	12	57
Switzerland	SIC	70	20	60
United Kingdom	CHAPS Sterling	76	17	64
United States	CHIPS	63	37	64
United States	Fedwire Funds	54	26	54

Notes: All TARGET and EURO1 figures are for December 2006. BOJ-NET FTS, Zengin System and FXYCS concentration figures are for December 2007. HKD CHATS, USD CHATS and EUR CHATS concentration figures are for December 2007. MEPS+ replaced MEPS in December 2006. RIX was previously named K-RIX.

Source: BIS, "The interdependencies of payment and settlement systems", CPSS, June 2008.

1 Foreign participants include all branches, subsidiaries and affiliates of an organisation whose highest-level entity is foreign-based. In general, figures for foreign participants in TARGET and its components exclude other euro area organisations.

2 Those banks contacted in the preparation of this report.

3 TARGET2 was launched on 19 November 2007 and has successively replaced the decentralised technical platforms operating under the name TARGET. According to the Eurosystem's "country window" approach, the respective central banks and national banking communities changed over to TARGET2 over a range of dates. TARGET2 is a single technical platform; however, from a legal point of view, each national central bank (NCB) participating in it remains the operator of its own RTGS system.



# Opening remarks by Gertrude Tumpel-Gugerell (ECB, Executive Board member)

---

## 1. Introduction

Ladies and gentlemen,

I am very pleased to welcome you to this conference and I am grateful that I can do so also in the name of the Banque de France.

Last week we celebrated the 10th anniversary of the ECB and the Eurosystem. Building on the expertise and reputation of the national central banks of the euro area, the ECB has developed well and we are very proud that the Eurosystem as a team has delivered what we were supposed to: we have achieved our main objective of price stability in the euro area and – more closely linked to this conference – the smooth operation of payment systems.

Given the fast pace of financial markets today, I often feel that the ECB has been around for ages. When I look around this beautiful Galerie Dorée, however, I feel that the ECB is still a very young institution. What I find reassuring is the fact that the euro represents a tangible, perhaps the most tangible, realisation of something that is even older than our conference venue: the idea of Europe. Please allow me to quote Jean Monnet: “Lorsqu’une idée correspond à la nécessité de l’époque, elle cesse d’appartenir aux hommes qui l’ont inventée et elle est plus forte que ceux qui en ont la charge.” [When an idea meets the needs of the time, it ceases to belong to its creators and becomes more powerful than those responsible for it.]

The well-being of Europe is closely linked to its economic prosperity. Economic well-being, in turn, depends crucially on a functioning financial system. I would like to take the opportunity of opening this conference to reflect on the more long-term trends in the financial sector with a special focus on liquidity in the context of market infrastructures. I will derive challenges from these trends that I think are particularly relevant for transfer systems. Finally, I will point out where I see the necessary and adequate responses of the private and public sector to these challenges, in particular the Eurosystem’s contribution to an efficient and safe infrastructure.

## 2. Different perspectives of liquidity

Let me begin with a short reflection on liquidity. If we lived in a world with perfect and complete markets as envisaged by Arrow and Debreu, liquidity problems would not exist. Everybody would be able to make

fully contingent arrangements to insure against unanticipated short-term needs for funds. Well, the recent financial turmoil has painfully reminded us that financial markets do not match the theoretical ideal world of the “Arrow-Debreu” model.

What do we then mean when we speak of liquidity? In general, we can distinguish between at least three types of liquidity<sup>4</sup>:

- First, monetary or macroeconomic liquidity refers to a generally accepted medium of exchange. Such liquidity comprises central bank money and more broadly defined monetary aggregates.
- Second, market liquidity means the ability to trade an asset quickly and at low costs with little impact on its price<sup>5</sup>.
- A third concept is funding liquidity, which means the ease with which firms, households or banks can meet their respective payment obligations with internal or external funds as they fall due.

All these concepts are – of course – closely interrelated. Deviations from expected developments in any of these areas can cause severe disruptions. This is the essence of liquidity risk. In the context of transfer systems, which are the focus of my speech today, liquidity risk is defined as the risk that a counterparty or a participant in a payment or settlement system will not settle an obligation at its full value when due.<sup>6</sup> For example, the operational failure of a major institution in a real-time gross settlement (RTGS) system can turn it into a “liquidity sink”. This would have a negative external effect on the liquidity positions of other banks.

---

<sup>4</sup> See also Roger Ferguson, Philipp Hartmann, Fabio Panetta and Richard Portes (2007), “International Financial Stability”, Ninth Geneva Report on the World Economy, pp. 9-10.

<sup>5</sup> For a more detailed discussion of market liquidity and its relationship with monetary liquidity, see the box “Understanding financial market liquidity” in the ECB Financial Stability Review, June 2007.

<sup>6</sup> See the glossary on the ECB’s website (<http://www.ecb.europa.eu>).

Liquidity risks could thus turn into a systemic risk when disruptions spread across the financial system.<sup>7</sup>

Overall, liquidity risk is a crucial feature of the financial sector in general and market infrastructure in particular. This is ably illustrated by an interesting special issue of the Banque de France's Financial Stability Report that focuses on liquidity.<sup>8</sup>

### 3. Trends in the financial sector

Let me take a step back now and look at some long-term trends in the financial sector that have had an impact on liquidity management and market infrastructures.<sup>9</sup>

First, the financial sector has experienced a tremendous amount of technological and financial innovations. For example, real-time gross settlement systems with electronic book-entries have become state-of-the-art. Such RTGS systems reduce credit risk exposure in settlement, whilst increasing the demand for intraday liquidity and collateral. Financial innovation has also triggered a significant rise in the number of derivatives and the associated trading volume, not least on over-the-counter derivatives markets.

Second, financial globalisation has become evident in the amount of cross-border financial flows and cross-border banking, but it goes much further. The increased global integration has strengthened the natural tendency towards concentrated provision of infrastructural services, a tendency that is further accentuated in the context of the European single market.

This third trend of increased concentration has not been limited to market infrastructures themselves. The emergence of key global players in banking has also led to increased internalisation of payment flows in correspondent banks. Correspondent banks perform payment and custody services for other banks and have in some cases reached a similar size to some national payment systems. Thus, correspondent banking begins to blur the distinction between intermediaries and infrastructure providers. Speaking of concentration, I would also like to mention networks of interoperable systems. They can be seen as intermediate steps towards concentration or as alternatives.

---

<sup>7</sup> For example, Mark Flannery suggests in "Financial Crises, Payment System Problems and Discount Window Lending", *Journal of Money, Credit and Banking*, 28(4), 2006, pp. 804-824, that payment systems can serve as a contagion mechanism from funding liquidity to the interbank (market) liquidity.

<sup>8</sup> The report is available at [http://www.banque-france.fr/gb/publications/rsf/rsf\\_022008.htm](http://www.banque-france.fr/gb/publications/rsf/rsf_022008.htm).

<sup>9</sup> These trends are discussed at more length in e.g. Ferguson et al. (op. cit.).

All these developments have contributed to lower financing costs, new investment and business opportunities, and general welfare gains for all citizens. At the same time, these trends have increased the relevance of market infrastructures and pose considerable challenges for liquidity managers and central bankers, at all their time horizons.

I want to stress here that market infrastructures have shown a considerable degree of resilience and functioned well during the recent months. This is a great achievement that should not be taken for granted. However, some of the trends that I have mentioned have also played a prominent role during the recent financial turmoil. Thus, there is no reason to be complacent.

### 4. Challenges resulting from these trends

I see three challenges, especially from the perspective of market infrastructures, resulting from these trends. These are: growing interdependencies; the potential emergence of a global monopoly; and the need for well-functioning financial and political structures at the supranational level.

Let me first focus on increased interdependencies created by financial globalisation in conjunction with the other trends that I have just mentioned. The significant benefits of financial globalisation come at the cost of a more complex global financial system. Previously, settlement flows, operational processes and risk management procedures could be considered largely from a national or even more a system-, institution- or market-specific perspective. Today, the various transfer systems, financial institutions and markets have become highly interdependent. This can be positive when the associated network effects improve the safety and efficiency of payment and settlement processes. However, it can also be negative when it allows an easier and quicker transmission of shocks and financial disruptions, sometimes in indirect, complex ways. The financial turmoil has once again highlighted how negative developments in one market segment can abruptly spill over to other, seemingly unrelated, segments of the financial sector and across borders. One cause of the severity of the turbulence is that financial institutions had not sufficiently foreseen that liquidity can dry up in certain markets very quickly. Negative effects can be exacerbated if banks do not have access to sufficient collateral. The interdependencies of payment and settlement systems are very well described by a recently released Committee on Payment and Settlement Systems (CPSS) report that I will refer to again when discussing the appropriate responses.<sup>10</sup>

---

<sup>10</sup> CPSS report on "The interdependencies of payment and settlement systems", Bank for International Settlements, Basel, June 2008.

A second challenge arises from the potential emergence of a global monopoly. Economies of scale and network effects are prominent in fixed-cost-dominated infrastructure services. This has given rise to the rather utopian idea of a single integrated market infrastructure covering the whole world as the end-game of the process of financial globalisation and concentration. At the same time, a global monopoly might lead to a single point of failure and other economic costs associated with monopolies (such as the abuse of market power and a lack of innovation). However, it is not obvious that the alternative to a monopoly – that is, networks of interoperable systems – is superior. For example, are a small number of interoperable systems really less risky than a single system?

A third challenge that I would like to highlight today concerns the difficulties in establishing a well-functioning financial and political structure at the supranational level. This challenge reflects the general change in perspective on the financial sector. Over long periods, mature and often efficient financial structures had emerged on a national level, protected by – to a large extent appropriate – regulation, supervision and oversight. National financial communities had developed a certain degree of trust, transparency and cooperation. Today, the perspective has changed from the national to the international level. However, we frequently face a geographical and legal separation between the entities in charge of the oversight of the system, relevant banking supervisors and the entity providing liquidity to the system. An important thing that the financial turmoil has demonstrated is that national degrees of trust, transparency and cooperation have not yet been replicated on an international, global level. This includes the existence of appropriate supervisory structures.

Overall, we face the challenge to create the same seamlessly functioning financial system and market infrastructures on a supranational level that we have already today at national levels.

## 5. Adequate responses to these challenges

It is very important to find adequate responses to these challenges. This duty – for the sake of economic prosperity – falls to all of us, the private sector as well as public authorities.

Let me begin with some responsibilities of the private sector because, I believe, we should rely on market solutions as much as possible. Financial market participants need to take into account the increased interdependencies. As clearly described in the CPSS report, they need to adopt a holistic approach to risk management, in particular as banks have increasingly relied on wholesale and secured funding. And they need to focus on liquidity and operational risk. I have the impression that the private sector is aware of this challenge and is preparing the necessary response, as

evident from the initiatives of the Institute of International Finance, for example. Various committees, both at the international and the EU level, are assisting the private sector in its work. Now, it is necessary to not lose momentum and to implement the proposed holistic approach to risk management. This means that systems and institutions need to look beyond their own operations and direct exposures to understand the broad range of disruptions that might affect them. This is most important for infrastructure and service providers as well as for financial institutions that have a critical role in the global infrastructure.

The trend towards concentration represents the second, more long-term challenge that I have mentioned. I think that it makes a lot of sense to complement the European Monetary Union with harmonised and efficient market infrastructures in certain areas. However, I do not expect the utopian idea of a single, globally integrated infrastructure to become reality. Technological and financial innovation provides limits to concentration. New ideas, the exploitation of market niches and regulatory changes that promote competition will allow platforms to continue to have competitive advantages in some specialised areas. It is crucial that these platforms will be transparent, provide open access to potential users and enable interoperability with other platforms in order to reap the full benefits of financial globalisation. But as interoperability requires competitors to cooperate, I am aware that achieving sustainable and efficient solutions is not always easy.

Finally, let me mention one particular point. As recently recommended by the Financial Stability Forum<sup>11</sup>, market participants should make further efforts to ensure that the settlement, legal and operational infrastructure underlying over-the-counter derivatives markets is sound. I know that also the CPSS closely monitors developments in this area.

Let me now turn to the responsibilities of public authorities. Just like the market, they need to take into account the increased interdependencies, concentration and required international perspective. Being a central banker, I think it is my task to focus on the various roles of a central bank as a liquidity provider, service provider, catalyst and overseer.

The relevance of collateral for liquidity issues has been clearly recognised by central banks. During the past ten years, central banks have – especially in the context of the CPSS and other Basel committees – focused jointly their attention on the use of collateral in financial transactions, including the cross-border use of collateral.<sup>12</sup> Cooperation in this respect is very useful

<sup>11</sup> “Report of the Financial Stability Forum on Enhancing Market and Institutional Resilience”, April 2008.

<sup>12</sup> CPSS report on “Cross-border collateral arrangements”, Bank for International Settlements, Basel, January 2006.

and, especially for emergency situations, I would think that central banks – by enabling the cross-border use of collateral – could make a positive contribution to financial stability.

As a service provider, the Eurosystem has demonstrated with the successful launch of the large-value payment system TARGET2 that it can deliver state-of-the-art infrastructure. TARGET2 is the biggest RTGS (real-time gross settlement) system and settles more than 350,000 transactions worth around €2.5 trillion every day. We in the Eurosystem have also worked a lot together with market participants on two other building blocks of a single European market infrastructure: TARGET2-Securities (T2S), a single settlement platform for securities, and CCBM2, a harmonised solution for collateral management within the Eurosystem. In today's world, the availability of collateral has become the binding constraint for intraday liquidity management. Hence, it is extremely important to be able to move collateral quickly and safely across financial systems, borders and currencies. TARGET2, T2S and CCBM2 are three complementary and mutually beneficial services of the Eurosystem for this purpose. In a recent ECB survey, banks have reported minimum annual savings of €53 million in liquidity and collateral management from T2S alone. Based on the figures from market participants, the very conservatively estimated benefits of T2S for direct users of T2S are at least €145 million per year in the baseline scenario. For the European economy as a whole, we can anticipate dynamic benefits from T2S exceeding one billion euro per year.<sup>13</sup> In addition, TARGET2 and T2S make use of counterparty risk-free central bank money for settlement, a feature that has become even more beneficial in light of the financial turmoil.

The Eurosystem has acted as a catalyst for another building block for an integrated European market infrastructure, the Single Euro Payments Area (SEPA). The same holds true for the interoperability of existing systems. As specialised infrastructures are likely to remain, the relevance of interoperability between different systems stays at the top of the agenda.

Oversight is the third role of central banks in payment and settlement systems. In general, market infrastructures have performed well during the financial turmoil, owing largely to effective capacity planning by service providers enabling them to handle recent peaks in volatility and trading. Overseers have to continue to monitor the safety and efficiency of individual payment and settlement “critical” infrastructure, as well as the safety of the financial system as a whole.

To achieve this, the increased interdependence requires an international perspective to oversight. Overseers need to cooperate and to show a certain degree of convergence in order to avoid regulatory arbitrage and a “race to the bottom” of regulatory standards. I think that we have some scope for improvement on this dimension.

Increased interdependence also calls for a second dimension of cooperation, namely between oversight of market infrastructures and banking supervision. For example, correspondent banks appear to provide substantial non-collateralised intraday credits to their clients. Traditional capital requirements, however, do not focus on the intraday liquidity aspects and on possible exposures during the day. Hence, it is crucial to ensure an adequate surveillance of these intraday risk exposures and the evolution of liquidity and collateral management at both system level and bank level. Recent work at the Bank for International Settlements and within the Eurosystem demonstrates that public authorities have recognised this necessity and started to address it.

The ECB is strongly supportive of the various initiatives at the EU and global level and will contribute to the pertinent work. I firmly believe that the international cooperation among public authorities will continue to foster financial integration, development and stability.

## 6. Conclusion

Let me now briefly conclude. The financial turmoil has once again demonstrated that liquidity should not be taken for granted. I have highlighted a number of more long-term financial sector trends that have had an impact on liquidity management and market infrastructures. Altogether, they result in new challenges from increased interdependencies, consolidation and the required international perspective on seamlessly functioning financial markets. The private sector and public authorities, both in their own responsibilities and in joint efforts, need to continue to address these challenges.

We have made considerable progress in our understanding of the relevant issues and the necessary policy conclusions, as evident from the various initiatives that I mentioned. Financial market infrastructure is in evolution; its improvement remains an ongoing challenge. This conference hosts a number of papers and panel sessions that serve as further examples of how we are improving our understanding of liquidity and interdependent transfer systems. I am looking forward to interesting insights and stimulating discussions that will no doubt be inspired by the outstanding surroundings here in the Galerie Dorée.

---

<sup>13</sup> The ECB's “T2S Economic Impact Assessment” is available at:[http://www.ecb.europa.eu/paym/t2s/pdf/eco\\_impact\\_080523.pdf](http://www.ecb.europa.eu/paym/t2s/pdf/eco_impact_080523.pdf).

# Session 1:

## Liquidity risk and liquidity management in global transfer systems

---

### Introduction by Yvon Lucas, Banque de France

The first session of the conference was chaired by **Yvon Lucas**, Head of the Banque de France's Payment Systems and Market Infrastructures Department, and Chairman of the CPSS Working Group on Standards.

He introduced the presentations that were to be given by three oversight policy-makers from the Banque de France (**Frédéric Hervo**), the Deutsche Bundesbank (**Dirk Schrade**), and the Hong Kong Monetary Authority (**Esmond Lee**).

These presentations developed and illustrated the issue of intraday liquidity management, i.e. the obligation to settle payments and securities transactions during the day in global transfer systems. The intraday flows processed within systems largely exceed the end-of-day balances recorded by the systems' participants on their accounts held with central banks. Against that background, **Yvon Lucas** recalled that payment and settlement systems have significantly evolved during the last decade: large-value systems have frequently evolved from a net deferred settlement model towards a real-time gross settlement (RTGS) model.

That evolution followed the Lamfalussy report on cross-border netting arrangements, published in 1990, and was triggered by the need to reduce settlement risk in both payment and settlement systems and to ensure intraday finality, which is a key asset in a world where links between financial intermediaries and systems have expanded considerably. This evolution has had an effect on demand for intraday liquidity and on the capacity of infrastructures to supply and save intraday liquidity. The equilibrium between demand for and supply of intraday liquidity has to be permanently ensured, including in times of stress. **Yvon Lucas** concluded that central banks, as systems overseers, and banking supervisors attach the greatest importance to the ability of financial intermediaries to manage prudently their intraday liquidity and fulfil their intraday financial obligations.

The presentations helped to better understand the recent evolutions in that respect.

### *Innovations in wholesale payment systems* by Dirk Schrade, Deutsche Bundesbank

**Dirk Schrade's** presentation was divided into three sections: a short reminder of the current business developments in large-value payment systems (LVPSs); a more analytical insight into the developing trends in LVPSs; and a concluding section on the resulting challenges for central banks and the achievements of central banks' policies regarding LVPSs.

The current evolution of LVPS activity shows a continuous growth, especially between 2001 and 2007. Among the remarkable events during that period, one should note the start-up of CLS in 2002. This FX settlement system has shown a large increase in volumes and values processed. When considering the seven largest LVPSs, the daily average value of transactions ranged from a few hundreds of millions of euro to €1,200 billion in 2001, depending on the systems. In 2007, these amounts ranged from less than €300 million up to about €3,700 billion.

In addition, new RTGS systems were built during that period, e.g. in the South African region, twelve countries out of fourteen developed an RTGS system. The last remarkable trend is the consolidation process among existing LVPSs/RTGS systems: in the EU, the twenty-two RTGS systems as at 2002 had become three by 2008. This is not only relevant as an outcome of EU integration, but is a global trend towards more efficiency, as shown by the example of Japan.

The developing trends in LVPSs concern five categories of risks, which have evolved as follows:

- Regarding **credit risk**, the issue of safe RTGS processing and settlement in central bank money has become more common. A more recent phenomenon is the pre-funding of settlement of payment systems in other ones in order to limit or exclude credit risk.
- The management of **liquidity risk** began with the introduction of intraday credit lines. At present, RTGS systems are evolving towards more liquidity-efficient features.
- The protection against **legal risk**, in particular with regard to cross-border participation.

- With regard to **operational risks**, the approach has been enhanced from pure technical issues to a global approach, following the 9/11 events.
- Lastly, the issue of **interdependencies** emerged at a global level as a systemic one.

Regarding credit risk, different settlement procedures give different responses for mitigating credit risk, especially credit risk stemming from interaction between LVPSs and ancillary systems (ASs; e.g. retail payment clearing houses, securities settlement systems). In Europe, two different models for the settlement of securities transactions are currently used, the *interfaced model* (settlements in ASs are mirrored in the participants' RTGS accounts held with the central bank which operates as settlement agent and LVPS operator) and the *integrated model* (settlements in the ASs are mirrored on technical liquidity accounts held with the central securities depository (CSD) and then recorded in the RTGS accounts through liquidity transfers between the AS and the RTGS accounts).

More generally, ASs working on an interfaced basis may use pre-funding for their net settlement position to ensure that the final settlement cycle takes place by the end of the business day, using dedicated liquidity reserved in the RTGS accounts, thus reducing the credit risk. However, reserving liquidity may contribute to "freezing" AS participants' liquidity during the day for the unique purpose of the AS settlement. This might only be efficient if the values are fairly low (since the mutuality of flows between participants in the AS is high) and efficient real-time liquidity bridges are available (which however introduces a new element of operational risk). In addition, pre-funding might lead to intraday finality in the AS, but this is in general not settlement in central bank money.

The main issues related to liquidity risk regard liquidity saving and liquidity optimisation. Given the values involved, intraday liquidity is critical. Sources of intraday liquidity are threefold: central bank credit, incoming payments and FX nostro inflows. Concerning the euro area: in TARGET2, central bank intraday credit is provided against collateral which is abundant in the euro area (€1,350.5 billion in January 2008); TARGET2 payments represent about €2,420 billion (daily average for 2007); and money market funding is estimated at €774 billion (daily average for the second quarter of 2007). The key role of TARGET2 for the financial infrastructure, the growing importance of central bank liquidity and the huge interdependencies with other systems justify the liquidity-saving features of TARGET2: liquidity of TARGET2's participants is centralised through a unique access point to the system; when banks maintain multiple access points, they may use different tools for consolidating information on their accounts or for liquidity pooling. Participants in TARGET2 may use sending limits which enable them

to control liquidity outflows, contribute to early settlements and mitigate operational problems that may arise when settlements are processed late during the business day.

In such a context, the need for a unique platform for settling securities transactions has emerged. The Eurosystem responded to it by starting the TARGET2-Securities (T2S) project. Alongside the benefits in terms of harmonisation in the EU, costs and resilience, the expected outcomes for liquidity management in T2S are the following: reduced funding costs through a single settlement schedule; and the use of auto-collateralisation of transactions and of common optimisation mechanisms with multiple CSDs.

Central banks have recently focused their attention on reducing operational risk in the LVPS that they operate. The TARGET2 infrastructure is designed to avoid any single point of failure through multi-redundancy of operating centres and backup sites located in distant areas.

Reducing operational risks to the lowest possible level is crucial in a global context of increasing interdependencies between LVPSs, between LVPSs and other systems, and between institutions which participate in multiple systems, often on a cross-border basis. In practice, interdependencies are visible through, e.g. the impact of US holidays on the payment activity in the German TARGET component (about -20% compared with an ordinary business day; see [Table 1](#)).

During the past decade, central banks have significantly contributed to building safer and more efficient systems. Hence, delivery-versus-payment (DVP) securities settlement has become common; systemic risk is overseen through central banks' oversight function; and systems are increasingly resilient in times of crisis.

	on US-holiday	on business day after US-holiday
Birthday of M.L.King	- 9,28 %	+ 10,95 %
Washington's Birthday	- 34,38 %	+ 4,26 %
Memorial Day	- 64,62 %	+ 16,98 %
Independence Day	- 19,16 %	+ 8,59 %
Labor Day	- 24,79 %	+ 3,26 %
Columbus Day	- 28,52 %	+ 6,00 %
Veterans Day	- 19,75 %	+ 13,35 %

**Table 1 Impact of US holidays on settled values in RTGS<sup>plus</sup> (compared with monthly average, 2007 figures) (Dirk Schrade, Bundesbank)**

Despite these important achievements, central banks have to respond to multiple challenges, such as growing interdependencies, emerging global payment and settlement systems (e.g. CLS), and the need for a more flexible use of collateral, especially on a cross-border basis and in times of crisis. In general, central banks have to implement adequate policies for ensuring

monetary control and financial stability in their currency area.

When asked by a member of the audience for the reasons behind the stability of payment and securities systems during the turmoil, **Dirk Schrade** indicated that two factors can be highlighted. First, at least in the euro area, liquidity was abundant and accessible at that time. Second, RTGS systems like TARGET2 include effective liquidity controls, e.g. debit or credit limits, that could have contributed to ensuring confidence among participants regarding their exposures to their counterparties.

### **Recent developments in intraday liquidity in payment and settlement systems by Frédéric Hervo, Banque de France**

**Frédéric Hervo** started his presentation by recalling that recent structural developments in payment and settlement systems have brought about a shortening of the time horizon in liquidity risk and liquidity management. As an illustration of this phenomenon, he quoted a practitioner who recently declared: *“my short-term is intraday, my medium-term is overnight and my long-term is one week”*.

The evolution of intraday liquidity needs affects both the demand and the supply side through quantitative and qualitative factors.

The diffusion of new risk management practices, such as the real-time gross settlement of payments in large-value payment systems and the delivery-versus-payment model 1 (i.e. gross settlement of both the securities and the cash legs) in securities settlement systems (SSSs), have led to an increase in the demand for intraday liquidity. As an opposite evolution, LVPSs have introduced liquidity-saving features which reduce the intraday liquidity pressure through offsetting and optimisation algorithms. In the most advanced SSSs, participants can use automated self-collateralisation procedures whereby the securities to be delivered are used as collateral against intraday credit in central bank money in order to fund the securities purchase itself. The overall effect of these quantitative evolutions is relatively balanced between achieving early finality and saving liquidity.

With regard to the qualitative factors, one of the most remarkable trends is the expanding use of collateralisation. Hence, deferred net settlement (DNS) systems are protected against settlement risk by mutual guarantee funds, whilst intraday margining by central counterparties (CCPs) has become a standard practice. Payments tend to become more time-critical, e.g. the settlement of the positions in CLS, which constrains intraday liquidity and collateral management. In addition, systems tend to extend their operating hours and to synchronise their settlement cycles, with a rather

neutral effect on intraday liquidity. Globally, the overall effect of qualitative factors contributes to increasing the pressure on liquidity.

Intraday liquidity represents the overall funds available during the day for ensuring settlement of payment obligations. The recent trend shows a growing gap between the intraday flows and the overnight balances held by system participants as intraday flows largely outweigh the end-of-day balances. This results from the decline in importance of reserve requirements in many economies. In this context, settlement models become more complex, especially with the development of commercial bank money settlement backed by funding in central bank money. Thus, in CLS, commercial bank money is backed by net funding in central bank money, e.g. in CHIPS in the US. In SSSs, pre-funding in central bank money is a new trend for optimising the use of central bank money. Regarding multi-currency settlements, operators such as (I)CSDs use commercial bank money since central banks provide only the currency they issue as a settlement asset.

In parallel, central banks support converging collateral policies which contribute to broadening the range of eligible collateral. The Eurosystem's single list of collateral implemented between mid-2005 and January 2007 is a good example of such a policy, as the single list includes marketable securities as well as credit claims. A large panel of eligible assets enables banks to better optimise the opportunity cost of mobilising assets as collateral.

Finally, it should be noted that an interbank intraday liquidity market has emerged in relation to the increasing concentration of the correspondent banking business and the growing funding costs of time-critical settlements (e.g. in CLS).

In order to appraise more concretely the settlement systems' activity, it has to be recalled that in the first three quarters of 2007, the daily turnover in the French systems TBF, PNS and RGV2 represented 56% of the French annual GDP. In other words, these three systems processed the equivalent of the French annual GDP in less than two days of operation. The French systems appear to be particularly liquidity-efficient since the provided intraday credit represents only 16% of the total daily turnover. It can also be noted that the Banque de France provided ten times more intraday credit than overnight and longer-term credit in the first three quarters of 2007.

The changes in intraday liquidity risk management have to also be considered from a financial stability perspective. Payment and settlement activities have been strongly concentrated among a limited group of banks which are active in correspondent banking and custodian services. Concentration and internalisation of flows lead some financial institutions to become “quasi-systems” in commercial bank money. In addition, the time criticality of settlement flows and the level of

interdependencies among systems themselves and between systems and participants are increasing (e.g. TARGET2 is connected to about 50 ancillary systems). In the context of a growing gap between settlement flows and available cash in participants' RTGS accounts, interdependencies lead to a higher risk of contagion in the event of disruption of a major entity.

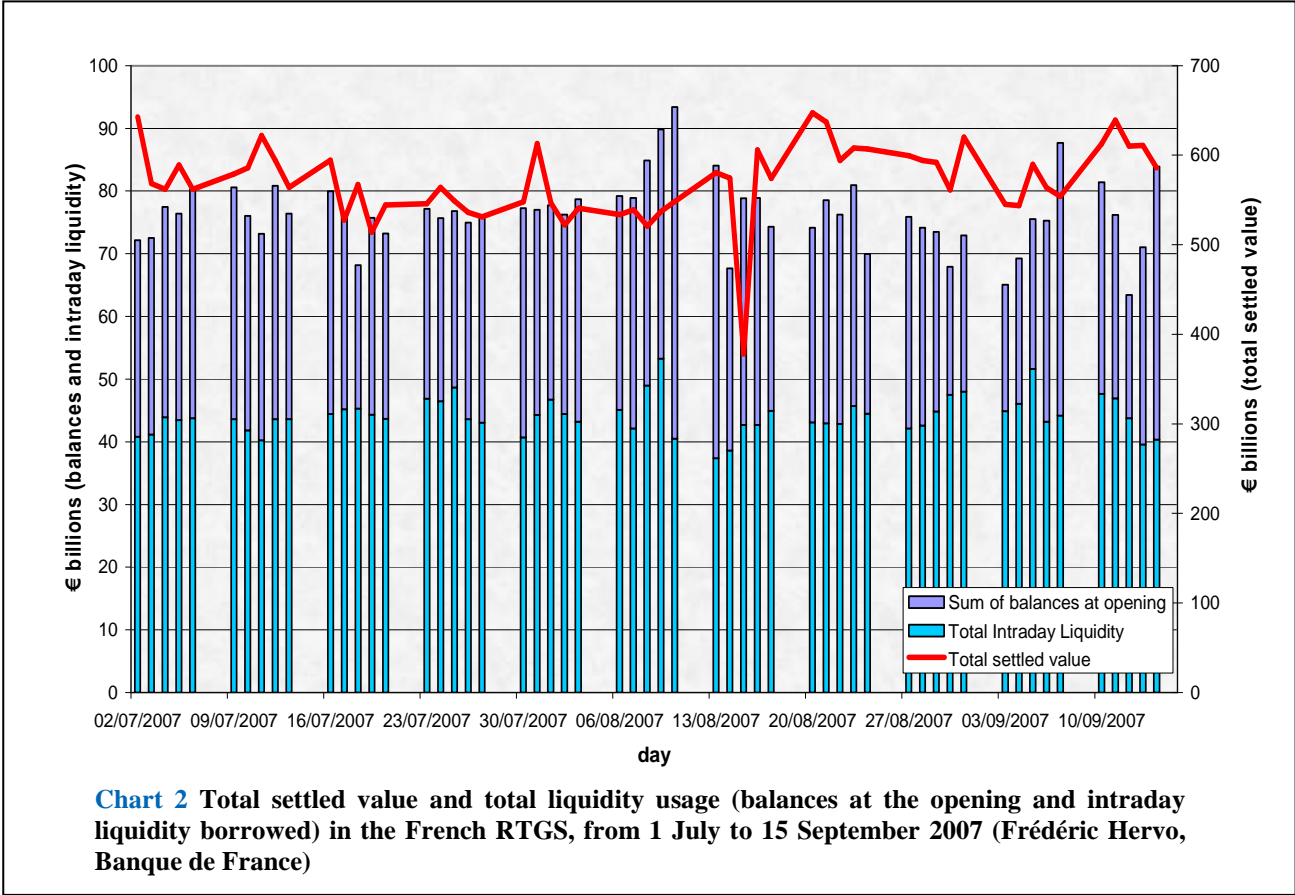
The recent market turmoil has not prevented the smooth functioning of payment and securities systems. When looking at the case of the Paris financial centre between the summer of 2007 and early 2008, it should be pointed out that intraday credit did not spill over into overnight lending, whilst intraday gridlocks remained scarce and settlement delays were stable. Difficulties of banking counterparties on the money market did not prevent system participants from settling in a timely manner their obligations. Moreover, during that stress period, the operational disruptions in the systems did not turn into liquidity stress, i.e. a technical disruption which would have turned a participant into a "liquidity sink". In general, systems had to support soaring volumes during the turmoil, due to higher precautionary liquidity demand (see **Chart 2**). The systems' design showed a strong resilience that enabled them to absorb such an increase.

The turmoil demonstrated the key importance of a broad and diversified collateral panel, as implemented by the Eurosystem. Other central banks decided to provide flexibility by expanding temporarily their collateral list.

The central banks and banking supervisors, as well as the private sector, play a key role in implementing solutions and policies for a better intraday liquidity risk management. For instance, the European Banking Federation issued guidelines for liquidity management, alongside the implementation of TARGET in 1999. Central banks, as payment system operators, implement liquidity-saving features in new systems such as TARGET2. In terms of collateral eligibility and mobilisation, the Eurosystem has constantly adapted its policies, including through the development of arrangements facilitating the cross-border use of collateral, e.g. the CCBM and the future CCBM2. With regard to banking supervision, intraday liquidity risk has become a major issue, which has led supervisors to release guidance in this field (e.g. principle 8 of the new report of the Basel Committee on Banking Supervision on the sound practices for managing liquidity in banking organisations).

From an oversight perspective, it seems crucial that central banks adequately address the changing nature of liquidity risk in payment and settlement systems. Several tools are used to analyse and forecast developments, including simulation models.

Most of the above is drawn from an article published in a special issue of the Banque de France's Financial Stability Review on liquidity risk.





**Liquidity and risk management in the RTGS system – the Hong Kong experience by Esmond Lee, Hong Kong Monetary Authority**

Esmond Lee started his presentation by providing the audience with some insight into the structure of the financial system in Hong Kong. Hong Kong’s payment and settlement infrastructure is a complex one, since it is a multicurrency and multidimensional infrastructure (see Chart 3). It is composed of a central money market component which is linked to six securities settlement channels from multiple countries (Mainland China, Australia, New Zealand, Europe). The infrastructure ensures DVP for securities settlement in multiple currencies (HKD, USD, EUR, etc.).

Contrary to the payment and settlement infrastructure, the organisation of the Hong Kong RTGS system, called HKD CHATS, is simple: 140 banks (all the Hong Kong banks) are direct participants in a single-tier participation structure.

HKD CHATS has proved highly efficient since the ratio of turnover to intraday credit ranges from 8 to 12. This has been enhanced by the implementation of various optimising features.

In HKD CHATS, banks have to use (if needed) interest-free collateralised intraday credit to maintain positive balances as no overdraft is allowed. On average, 35% of the payments are processed before noon and 70% before

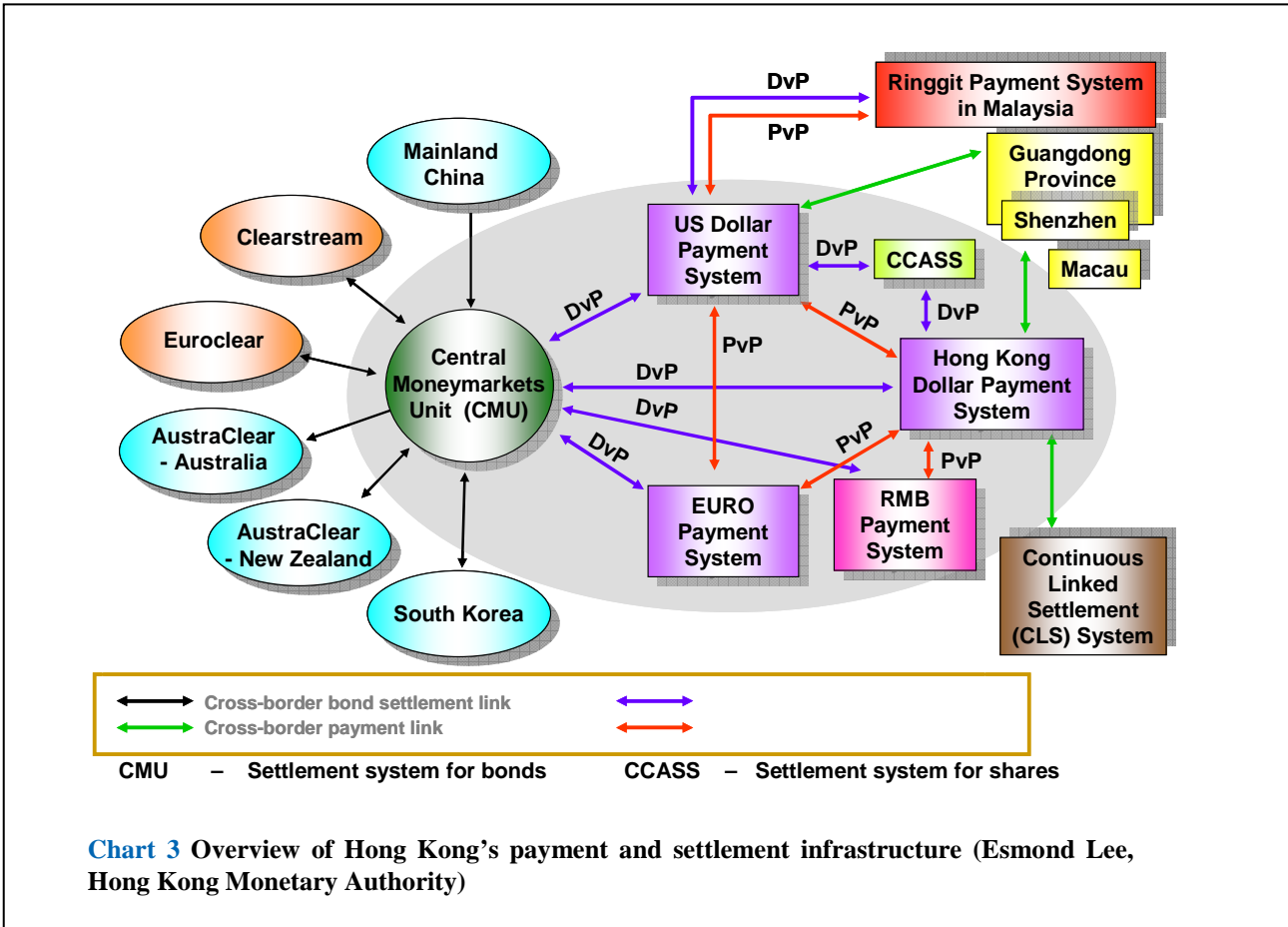
3 p.m.

Various optimisers have been implemented since June 2004. The CHATS (Clearing House Automated Transfer System) Optimiser was introduced in June 2004 to settle paper cheques and large-value CHATS payments simultaneously and in an offsetting manner. This device improves the overall liquidity management by facilitating funds recycling through the matching of cheque settlement with other payment flows.

The RTGS Liquidity Optimiser (RLO) was introduced in January 2006: 12 scheduled RLOs run daily with 30-minute cycles. This enables banks to offset queued payment instructions on a multilateral basis. If needed, on-demand RLOs can be run by the HKMA in the event of liquidity pressures.

The Cross-Currency CHATS Optimiser (CCPO) started operating in October 2006. It helps to optimise the HKD leg of HKD/USD payment-versus-payment (PVP) flows. It is a combination of the CHATS Optimiser and a PVP mechanism. This mechanism contributes to “de-freeze” funds so they can be processed in other settlement processes like cheque clearing. In practice, a bank can replace straight borrowing in the event of insufficient liquidity by a USD/HKD swap through the CCPO with another bank.

In January 2008, the CCASS Optimiser was introduced to allow banks to create payment instructions to be



settled together with the CCASS (Central Clearing and Settlement System) in a daily bulk settlement run. As an example, he considered the case of a bank with some extra liquidity on a given day. The bank would be willing to lend its extra liquidity overnight on the interbank market, but is reluctant to do so because it expects a short position in the CCASS on the next day (the CCASS settles early at 9.30 a.m.) and it fears it might not be repaid in time for the CCASS settlement. This problem can be resolved with the help of the CCASS Optimiser: the bank will make a loan to another bank and the loan repayment will be automatically synchronised with the CCASS settlement.

A person in the audience asked how the loan repayment could be enforced, through an earmarking of the given amount of money or through another mechanism. **Esmond Lee** explained that no cash was actually set aside in the process. The borrower and the lender simply have to agree for the repayment to take place through the CCASS Optimiser, and the Optimiser will ensure that the repayment takes place during the CCASS settlement. An advantage of this is that the borrower can rely on a long position upon the CCASS settlement to contribute to the repayment of the loan. Similarly, the lender can rely on the repayment of the loan to fund a short position in the CCASS settlement.

Hence, the CCASS Optimiser facilitates the liquidity management and the recycling of funds without an undue impact on money market borrowing and lending activities when stock market activity is intense.

The HKMA envisages some additional measures to further improve liquidity management, such as increasing the pool of eligible collateral, extending the RTGS operating hours (to be extended until 6.30 p.m. beginning in November 2008) or developing an intraday money market.

**Esmond Lee** therefore concluded that after 11 years of RTGS operation, there is still room for further innovations in the Hong Kong payment and settlement infrastructure.

When asked by a member of the audience for the reasons behind the stability of payment and securities systems during the turmoil, he highlighted the role of the recently implemented optimising mechanisms. According to him, these mechanisms have contributed to the smooth functioning of the systems during the turmoil, despite a huge growth in processed volumes.

# Session 2:

## Collateralisation of central bank operations

---

### Introduction by Daniela Russo, European Central Bank

The second session of the conference, chaired by **Daniela Russo**, Deputy Director General of the Directorate General Payments and Market Infrastructure of the European Central Bank, was dedicated to issues related to the functioning of the secured lending market segment and to the lessons central banks could draw from this functioning in terms of policy, e.g. for the design of their collateral framework, for the provision of central bank liquidity and for the inducement of changes in the secured lending market.

The session started with the presentation of three papers which addressed some theoretical aspects of these issues and also highlighted, from an empirical point of view, how the recent 2007/2008 market turmoil had highlighted the importance of collateral to address liquidity risk issues.

### *Modelling the cross-border use of collateral in payment systems* by **Mark Manning** (Reserve Bank of Australia) and **Matthew Willison** (Bank of England)

The first paper of the session was presented by **Mark Manning** (Reserve Bank of Australia) and had been prepared together with **Matthew Willison** (Bank of England). It explored the extent to which liquidity risk in real-time gross settlement systems may be mitigated by central banks by allowing cross-border use of collateral.<sup>14</sup>

The topicality of the subject was highlighted as, during the 2007/2008 market turmoil, a number of central banks enlarged the range of assets they accepted as collateral to include assets issued in foreign currencies. In the same vein, the usefulness of the ongoing work by the Committee on Payment and Settlement Systems (CPSS) on the use of cross-border collateral, to complement its January 2006 report on cross-border collateral arrangements, was highlighted.

In terms of policy implications, Mark Manning identified three groups of issues for central banks:

- the relaxation of constraints by means of broader lists of eligible collateral;
- the interaction between emergency and routine operational frameworks; and
- the coordination of policies across central banks.

Then he presented the terms of their theoretical work centred on the access by banks to collateralised intraday liquidity provided by the central bank in order to be able to effect payments in an RTGS system. If a bank is holding insufficient eligible collateral in a particular country, and therefore cannot obtain credit from the local central bank, it may have to delay payments. This constitutes a liquidity risk to the system. Furthermore, if a bank is operating in multiple systems, it may face a mismatch between the location of its collateral holdings and its liquidity needs, hence liquidity risks.

To illustrate to which extent such liquidity risk may be mitigated by allowing cross-border use of collateral, the authors developed a two-country, two-bank model in which banks try to minimise expected costs with respect to their collateral choices in each country. The assumption is that banks must make ex ante collateral choices before knowing their liquidity needs of the day and try to find a balance between the opportunity cost of holding in advance collateral for intraday purposes and the costs of experiencing a collateral shortfall (i.e. the costs of acquiring new collateral to face liquidity needs, plus the costs associated with delaying payments while additional collateral is sought in the market).

First, the authors compare analytical outcomes for liquidity risk in cases with: (i) no cross-border use of collateral; and (ii) cross-border use of collateral in both countries.

They show that, when both countries are connected and permit symmetric cross-border use of collateral, banks will concentrate their holdings in the country with the lowest collateral costs and may reduce collateral holdings in each country. Importantly, the authors find that, even with a decline in total collateral holdings, liquidity risk, as measured by expected collateral shortfalls, will fall in both countries. This reflects the fact that it will always be optimal for a bank to hold a larger amount of collateral across two connected countries than in a single unconnected country. Hence there will always be a larger pool from which to draw to meet a liquidity need in a single country. A further implication of symmetric cross-border use of collateral

---

<sup>14</sup> Mark J. Manning and Matthew Willison, "Modelling the cross-border use of collateral in payment systems", Bank of England Working Paper No. 286, January 2006.

is that banks' total expected costs also decline. Hence, payment system efficiency will also be improved.

As an extension to this basic model, the authors explore the case where there is no coordinated policy across central banks, i.e. only one central bank permits cross-border use of collateral. They show that, under this assumption, banks' collateral choices will be driven by two potentially offsetting factors. On the one hand, banks will shift collateral holdings towards the collateral that is eligible in both countries. On the other hand, banks will still be inclined to accumulate larger holdings of the cheaper collateral. When the cheaper collateral can be used across borders, these two factors are mutually reinforcing and the outcome will be the same as in case 1 (i.e. symmetric cross-border use of collateral). When the collateral eligible in both countries is only slightly more expensive, banks will still hold only this collateral, but slightly less will be held overall than in the symmetric case. Again, liquidity risk will decline in both countries. Finally, when the collateral eligible in both countries is significantly more expensive, collateral will be held in both countries and the expected shortfall of collateral in the country accepting foreign collateral will be the same as in the case with no cross-border use.

Third, when exploring the probability that a bank experiences a liquidity need in both countries simultaneously, the following results emerge. Banks adjust collateral holdings to take into account this possibility. But, as there remains a chance that banks could experience a liquidity need in just one country, it may, under some conditions, still be optimal to reduce total collateral holdings relative to the case with no cross-border use of collateral. The authors conclude that such a reduction will imply higher expected shortfalls in at least one country when a bank faces simultaneous liquidity needs, compared with the case with no cross-border use of collateral. The size of the respective shortfalls experienced in each country will depend on how the available collateral is ultimately allocated between countries.

Finally, they consider the extension in which central banks have the option of accepting collateral in stressed situations only (recognising that central banks may perceive certain costs arising from the routine acceptance of foreign collateral). Under such a regime, and with a sufficiently low probability that the emergency facility will be triggered, banks' reductions in collateral holdings may be lower than if cross-border use of collateral were allowed routinely. As a result, should a stressed situation arise in one country, banks may have a larger pool of collateral to draw upon than they would have in the case of routine cross-border use of collateral. Expected shortfalls would, in such a case, be lower. If central banks place a higher weight on liquidity risk mitigation in times of stress, and recognise that it may be more difficult to access additional collateral during a crisis, a policy allowing cross-border use in emergency situations may be attractive.

In terms of the three broad policy issues introduced at the outset, the theoretical work pointed towards the following implications:

- broadening eligible lists via the acceptance of cross-border collateral can lower liquidity risks;
- there is a reduced incentive to economise on collateral if cross-border collateral is accepted in emergencies only, even if this policy is communicated ex ante; and
- any liquidity risk benefits enjoyed will generally be higher when central banks coordinate their policies via symmetric cross-border use of collateral.

**Mark Manning** was asked by a member of the audience which principal elements would need to be added to his model, if he wanted to move from a partial equilibrium model currently centred on the cost of intraday credit to a general equilibrium model. He answered that a number of extensions could be made with a view to this, beginning with enriching the model with what is going on outside the two banks. Currently, the effects of the broader financial environment on the two banks and, in particular, the pricing in the non-modelled market for eligible collateral securities, were not taken into account. He indicated that, although the paper carried out only a partial analysis, it captured some critical elements in terms of the nature of the optimisation decisions that banks are faced with and the way in which their collateral holdings' decisions are actually going to affect the likelihood of shortfalls and hence delays in payment systems.

### ***Repo markets, counterparty risk and the 2007/2008 liquidity crisis by Jens Taping (ECB) and Christian Ewerhart (IEW Zurich)***

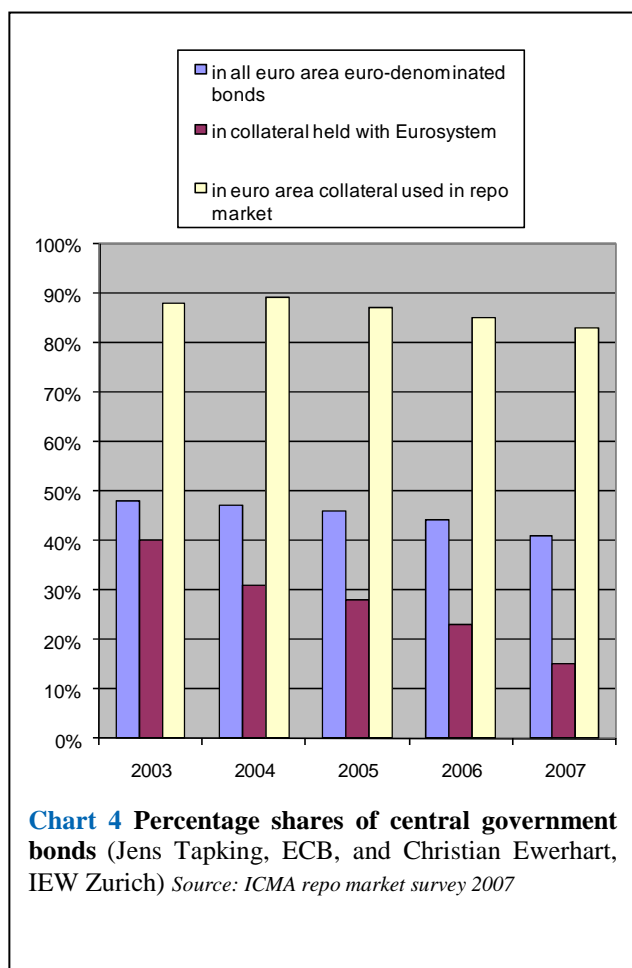
The second presentation by **Jens Taping** (European Central Bank), which was based on joint work with **Christian Ewerhart** (Institute for Empirical Research in Economics, Zurich), considered the functioning of the repo markets, in view of counterparty risks, during the 2007/2008 liquidity crisis, taking the example of the euro area.

Their study was motivated by two empirical observations. One was that only collateral with the highest quality/liquidity is accepted in the interbank repo market. In the euro area, central government bonds represent 40% of euro area euro-denominated bonds, while their share in the total euro area collateral used in the repo market reaches about 80%. This situation stands in sharp contrast with the composition of collateral held with the Eurosystem, which accepts a wide range of asset types. The share of central government bonds in the total collateral posted to the Eurosystem is low and declining, representing about 15% in 2007 (see **Chart 4**). A second observation was

that, during the 2007/2008 market turmoil, requirements on collateral assets imposed by cash lenders in the interbank market became even stricter than they usually are and the two market features described above became more marked.

The paper tries to explain the reasons for these empirical features and addresses the issue of the (short-term) welfare effect if a central bank broadens its range of eligible collateral assets.

The authors analyse a scenario in which two commercial banks, a cash borrower and a cash lender, negotiate simultaneously the following terms of a repo transaction: (a) the collateral assets; (b) the haircut to be applied to the assets; and (c) the repo rate. In their model, the authors allow for a two-sided credit risk, i.e. the possibility that the borrower as well as the lender may default, which is an innovation in comparison with the traditional theoretical literature, which usually puts the default of the cash lender at the centre of considerations.



They show that with two-sided credit risk, the bilateral negotiation between the borrower and the lender achieves a subtle balance of interests. On the one hand, the cash lender may be willing to accept a somewhat lower haircut on assets in exchange for a somewhat higher repo rate, as a higher haircut implies better protection for the lender. Conversely, the borrower may

be willing to provide somewhat more collateral for a somewhat lower repo rate. This balance is not costless because there is a risk that the collateral deposited by the cash borrower may get lost in the lender's insolvency mass. Optimal risk-sharing is achieved, therefore, by making the marginal rate of substitution between the haircut and the repo rate congruent between the two counterparties. It turns out that, as a consequence, if collateral is not perfect, i.e. if price fluctuation or illiquidity is possible, then it is typically optimal to expose both parties to non-trivial counterparty risk.

The efficiency of risk-sharing is what ultimately drives the first main result of the paper. If two counterparties agree to transact, they will always agree to use the most liquid and the least risky assets of the borrower as collateral first. Thus, in a bilateral transaction between two counterparties that may each default with positive probability, "good" collateral drives "bad" collateral out of circulation.

The second conclusion was that, if the most liquid and least risky assets of the borrower are still relatively illiquid and risky, then the two banks may, under certain conditions, not be able to agree on a transaction at all. This outcome occurs in particular if default probabilities are non-negligible and if collateral assets have the potential to become illiquid. The breakdown of the market under two-sided credit risk is a potential result. This can explain why there is hardly any interbank repo market in which risky or illiquid asset types are used as collateral.

Finally, the authors study the welfare implications of the central bank's collateral policy. They show that an expansion of the set of collateral eligible for central bank operations may lead to a (short-term) welfare improvement for market participants. However, the expansion of the set of eligible collateral will typically be accompanied by a replacement of liquid collateral by illiquid collateral, i.e. bad collateral drives out good collateral in lending relationships with the central bank. Moreover, such replacement is not likely to be stopped by an adjustment of the haircuts applied to the collateral.

They conclude that their findings offer a potential rationale for the willingness of major central banks to broaden the range of assets accepted as collateral during the market turmoil. In the specific case of the Eurosystem, with its already very broad range of eligible collateral, the analysis comes to the conclusion that a widening of the set of eligible collateral would not necessarily be, or have been, supportive of a resolution of the credit crunch in the interbank market. Indeed, there is no evidence that too much high-quality collateral is posted in operations conducted by the Eurosystem. The authors also argue that the situation might have been different in the US and in the UK, where policy measures included the expansion of the set

of assets accepted by the Federal Reserve and the Bank of England.

A member of the audience asked whether, for the paper's conclusions, the assumption made regarding the insolvency arrangements was an important one. The question was motivated by the fact that, in some market segments like the retail/mortgage segments, unlike in the repo market, the borrower is not exposed to the failure of the lender. **Jens Tapking** indicated that they had retained in the model the most realistic assumption, according to which, in case of a failure, the non-failing counterparty of the transaction would always have to pass to the insolvency mass of the failing counterparty the profits it would not have otherwise made (for the cash lender for instance, the excess value derived from the sale of the collateral), but that – in his opinion – this assumption did not play any role in terms of results.

As regards these market features, further explanation factors were put forward and discussed by the attendees: (i) the fact that central banks determine their haircuts in a rather bureaucratic/specific manner and that commercial banks might take advantage of this; (ii) the fact that repo traders take into consideration the quality of the counterparty (the safer the counterparty, the riskier the collateral that can be accepted from that counterparty). **Jens Tapking** was asked if some further testing could be envisaged to determine whether this counterparty element was a crucial factor. He acknowledged that an important difference between commercial banks and a central bank was that the central bank could not fail and therefore that the banks do not mind delivering large amounts of collateral, with high haircuts, to central banks, while in a private transaction the failure of the cash lender was an issue for the cash borrower. With regard to the testing of this counterparty factor, he mentioned the limit that the repo market is mostly an over-the-counter (OTC) market and that the only data available are those from the triparty repo segment, which is also the only segment where asset-backed securities (ABSs) were traded, at least before the 2007/2008 market turmoil, and where market players are big banks with lower default probabilities.

Some attendees pointed out that the use of ABSs with central banks could be explained by the fact that ABS holders neither want to show their holdings nor the pricing of these holdings and that no secondary market was therefore possible for such paper. The conclusion of the paper that the cash borrower would try to deliver the best collateral on the interbank market was also challenged as intuition would suggest that he would rather get rid of the worst. **Jens Tapking** acknowledged this point, but confirmed his conclusions (supported by empirical evidence) that both the lender and the borrower would in the end favour the good collateral, because the lender would go for the best collateral and the borrower would try to avoid too high haircuts. Lastly, it was mentioned that another reason why the cash borrower would not have an appetite for non-government bonds in the interbank repo market could be

the traditional importance of unsecured interbank lending in Europe which gave no incentive to finance non-government bonds, while unsecured lending was possible at a low price.

### **Intraday liquidity management: a tale of games banks play by Morten Bech (Federal Reserve Bank of New York)**

In third place, **Morten Bech**, senior economist at the Federal Reserve Bank of New York, presented the conclusions of a paper where he developed a game-theoretical model to analyse banks' intraday liquidity management behaviour in an RTGS system environment and the reasons why this behaviour is a policy concern for central banks.

Intraday credit is costly, whether explicitly in the form of a fee or implicitly as the opportunity cost of the pledged collateral. Consequently, banks try to economise on their use of liquidity throughout the day by carefully scheduling the settlement of payment requests received from customers and the bank's own operations. In his paper, he analyses the strategic incentives for banks' liquidity management, under different intraday credit policy regimes employed by central banks. The study uses the framework of game theory and in particular two classic paradigms in game theory, the "*prisoner's dilemma*" and the "*stag hunt*", to conduct a comparative analysis of the relative desirability of different intraday credit regimes from the perspective of a central bank. In broad terms, the game is played by two banks (Bank A and Bank B), which can decide to settle their payments early, i.e. in the morning (hereafter referred to as the "morning strategy"), or to delay the settlement of their payments until the afternoon ("afternoon strategy").

For example, **in the case of free intraday credit**, the outcome of the game shows that there is no incentive to postpone payments. Early settlement (morning strategy for Bank A, morning strategy for Bank B) is a unique equilibrium and is an efficient outcome as it ensures the lowest possible aggregate cost of all the strategies.

		Bank B	
		morning	afternoon
Bank A	morning	0, 0	0, D
	afternoon	D, 0	D, D

**Under a collateralised intraday credit regime**, where the central bank provides commercial banks with intraday credit against collateral, the equilibrium of the game depends on the relative size of the opportunity cost of the collateral (C) and the cost of postponing a payment request (D). If the cost of delaying is greater than the cost of obtaining liquidity ( $D > C$ ), then banks have no incentive to delay payments and the early payment strategy (morning strategy for Bank A, morning strategy for Bank B) is the

equilibrium/dominant strategy. If the cost of liquidity is higher ( $C > D$ ), the late payment strategy (afternoon strategy for Bank A, afternoon strategy for Bank B) becomes the only equilibrium, although it is inefficient. This inefficiency reflects the fact that the game is, in that case, a prisoner's dilemma. Neither bank wishes to switch to early/morning payments if the other bank keeps making delayed/afternoon payments because the switch would increase its settlement costs. However, both banks would be better off if they chose the morning strategy. Unfortunately, early payment (morning strategy for Bank A, morning strategy for Bank B) is not the equilibrium because starting from a morning, morning situation, each bank would wish to postpone payment in order to lower total settlement costs.

		Bank B	
		morning	afternoon
Bank A	morning	C, C	2C, D
	afternoon	D, 2C	C+D, C+D

In his demonstration, this prisoner's dilemma/inefficient equilibrium illustrates how gridlocks may occur in payment systems and also explains why different solutions to discourage banks from delaying payments have been employed around the world. Among these solutions, central banks, first, seek to keep the opportunity cost of collateral low by accepting a wide range of assets and offering flexible arrangements for posting and using the collateral. Second, some central banks and industry groups have put forward guidelines under which banks are to process certain percentages or types of payments' traffic by predetermined times over the course of the business day. Third, central banks can use pricing. For example, the Swiss National Bank charges higher prices for payments sent later in the day, giving banks a direct incentive to process early. Finally, many systems, for instance the US Fedwire system, place an upper limit on the value of payments. Larger payments are split into smaller payments, allowing the bank balances to be used more efficiently. In recent years, in order to eliminate such gridlocks, a number of RTGS systems with collateral requirements have also introduced mechanisms that allow queued payments to be offset bilaterally or multilaterally. These enhancements aim to reduce the amount of liquidity or collateral required for smooth settlement.

**Under the priced intraday credit regime**, banks are charged a fee ( $F$ ) if their settlement account is overdrawn at the end of a period, for instance a day. No overdraft fee is incurred if the banks manage to synchronise their payments, i.e. pay in the morning. As in the collateralised credit regime, the outcome depends on the relative size of the costs of liquidity and the cost of postponing the processing of a payment request. Early settlement (morning, morning) is a unique equilibrium if the overdraft fee is less than the cost of delaying ( $F < D$ ) and the outcome is efficient. However, if the price of liquidity is higher than the cost of delaying ( $F > D$ ), both the early payment strategy

(morning, morning) and the late payment strategy (afternoon, afternoon) are equilibria. Here the author showed that the priced credit game has the structure of a classic coordination game called the "stag hunt". The key feature of this game is that while the morning/morning equilibrium is preferred by both players in terms of cost, the afternoon/afternoon strategy is preferred in terms of strategic risk because one bank's deviation from the morning strategy, for whatever reason, will impose increased settlement costs on the other bank.

The author concluded that the model could provide insight into the desirability of different payment systems policies and highlighted some of the difficulties faced by policy-makers, who aim to reduce various risks (liquidity risk, credit risk and operational risk), while maintaining or improving payment systems efficiency.

A member of the audience asked about the practicability of the application of different intraday pricing schedules to encourage settlement in the morning. Taking into account the fact that banks do not always have the power to schedule their payments because these payments are instructed by their clients, it would not be fair to apply fees to them. **Morten Bech** and **Philipp Haene**, from the Swiss National Bank, which has put in place such a differentiated pricing scheme, confirmed that the solution was that banks apply a similar pricing scheme to their clients to encourage them to submit their instructions early.

### Discussion of the papers by Ann Wetherilt (Bank of England)

The three papers were commented upon by **Ann Wetherilt** from the Bank of England, who highlighted their interest in terms of addressing the issue of how central bank intraday credit policy and collateral frameworks affect liquidity management of commercial banks, and hence the flows in payment systems.

She shared the conclusions of **Morten Bech's** paper that the actual impact of the choice of an intraday credit policy depends on a number of factors, some related to the design of the RTGS system (e.g. whether the system allows for queues or not), and some others related to the characteristics of participants in the systems which are likely to face different opportunity costs for obtaining intraday credit. She mentioned two additional factors: (i) the role played by the monetary policy framework, for instance whether reserve requirements are remunerated or not; (ii) the impact of liquidity regulations on the opportunity cost of intraday credit.

Coming to the paper by **Christian Ewerhart** and **Jens Taping**, she took note of the overall welfare effect of a central bank collateral policy allowing for the use of less liquid assets against the provision of central bank

money, while liquid and best-quality assets may be used in the interbank repo market. But because this was a short-term effect, she recalled that the wider implications of such policies should also be considered, including moral hazard issues. Moreover, one should not forget the limits of the central bank collateral policy and notably the fact that when the central bank is generous in terms of liquidity, the effect of widening the range of collateral eligible for central bank operations may be more limited.

She also came back to the conclusions of **Mark Manning** and **Matthew Willison**'s paper, i.e. that liquidity efficiency in payment systems generally improves when cross-border use of collateral is allowed, even though banks may hold a smaller total pool of collateral, but that banks could face collateral shortages when faced with global liquidity shocks. She pointed out two risk elements: (i) the cross-border use of collateral implies higher interdependencies between systems; and (ii) commercial banks trying to economise on their total collateral holdings could experience an increase of liquidity risk, although this could be mitigated via the acceptance of cross-border use of collateral in emergencies only. Finally, she recalled that the model only worked when the pool of eligible securities differed across countries.

She concluded by stressing the complexity of financial interactions in the field of liquidity management. Central bank collateral policy is part of a complex operational puzzle of policy choices. Banks' liquidity management, central bank intraday credit policy and liquidity regulation are closely related and therefore central bank collateral policy cannot be thought about in isolation. Central bank policy decisions can enhance the resilience of RTGS systems, but these decisions also change banks' behaviour and may result in an increase of liquidity risk. Hence, central banks may face some trade-off between different objectives. As changes in the conjunctural environment can lead to changes in behaviour in both markets and payment systems, she also mentioned the importance of having crisis tools in place to flexibly respond to these changes. Looking forward, she called for more theoretical work to understand: how collateral policy affects intraday liquidity flows; the nature of the various interactions mentioned, in particular the reaction of participants to common shocks, market frictions and asymmetric information; as well as time-zone differences. She also called for more technical work to understand and address these issues.

## ***Collateral management: recent trends and developments***

**Panel session with Daniela Russo (ECB), Godfried De Vidts (ICAP), John Burke (LCH.Clearnet) and John Trundle (Euroclear)**

To discuss the theme of collateral management, as well as recent trends and developments in this area, the panel session brought together **Daniela Russo** (Deputy Director General for Payments and Market Infrastructure at the ECB), **Godfried de Vidts** (Director of European Affairs at ICAP and Chairman of the European Repo Council), **John Burke** (Director of the Fixed Income Division at LCH.Clearnet) and **John Trundle** (Head of Risk Management at Euroclear group).

The discussion addressed three questions:

- (i) What are the market needs?
- (ii) What are the current constraints upon a global management of collateral?
- (iii) What are the possible actions to address these constraints?

### ***1. What are the market needs?***

**Godfried de Vidts** opened the discussion with messages on a number of important elements for the management of collateral. First, there is a close correlation between liquidity management and collateral management and it is crucial that, within a firm, the various departments involved in these functions, for whatever reason, work together so that the firm has a clear global picture of its liquidity situation, collateral holdings and risk exposure. Second, the monitoring of the eligibility of collateral is important in collateral management, not only the eligibility for central banks but also for other commercial banks or private market players, which may define their own criteria. Third, capital cost is another factor to consider, as illustrated by the effects of the move from the Basel I supervisory regulation to the Basel II regulation, in particular the resulting higher capital requirements for unsecured lending. Finally, legal documentation is a matter of concern as the current legal environment is fragmented into several documentations (ISDA, EMA, GMRA, etc.), which are difficult to bridge and require more standardisation.

**Daniela Russo** recalled the need for the existence of global market (and/or central bank) facilities for cross-border mobilisation of collateral that meet the following requirements: they should be cost-efficient, available on a continuous basis for intraday and overnight liquidity, resilient, legally safe, easy to use and integrated with other similar facilities.



**John Burke**, from LCH.Clearnet, presented ten main drivers of market needs:

1. An increased demand for secured lending in the euro area, for different purposes, e.g. short-term covering, special trading or secured lending based on General Collateral (GC) baskets.
2. Recognition of the role of market infrastructures with, in Europe, a significant shift towards central counterparties and market players looking for infrastructure services that correspond to their interests and cover the four dimensions of collateral management: custody, settlement, borrowing/lending, triparty.
3. A demand expressed for infrastructures for increased netting to minimise any unnecessary settlement.
4. An environment where bonds/securities can move freely and without friction.
5. A demand for cash-led standardised euro-denominated GC baskets.
6. A renewed focus on counterparty credit risk management.
7. A demand for process automation and process innovation in collateral management, which is beneficial to the market, as the more straight-through processing (STP) there is, the more transactions can be made.
8. A demand for increased opportunities for balance-sheet netting.
9. A demand for infrastructures that support, along the value chain, fluid upstream and downstream collateral transfers (central bank to central bank, central bank to bank, bank to bank, or bank to customer).
10. A trading environment where cash investment is not driven or influenced by settlement considerations.

**Godfried de Vidts** supported these views, in particular the view that the market will go electronic, with volumes reaching very high volumes (over €700 trillion for the repo market in Europe according to a European Repo Council survey). Such a move has already been achieved for bank-to-bank trades, but solutions are yet to be developed for bank-to-customer and bank-to-hedge fund trades. From a risk management point of view, electronic repo trading needs to be closely linked to legal departments to ensure adequate protection, e.g. for margin calls to be processed. Also, there is a need for central counterparties to take some risk away from the market, although the risk cannot be completely removed because Europe still lacks a single collateral market.

## 2. What are the current constraints for the market?

**Daniela Russo** (also Chairperson of the CPSS Working Group on Cross-border Collateral Arrangements) gave a

documented insight into the major constraints that lead to the fragmentation of collateral/liquidity pools and make it very difficult to move the right assets to the right place at the right time. She mentioned in this respect:

- Differences in infrastructures' operating hours, i.e. time-zone differences and cut-off time differences, a constraint which is difficult to remove, despite infrastructure willingness, as it stems from different market practices at national level.
- Legal and fiscal barriers, including proliferation of different legal documentation and different fiscal reporting requirements.
- The lack of a complete set of information, in order to assess accurately the availability of liquidity and collateral in various pools.
- The lack of harmonisation of relevant market practices, rendering ineffective initiatives taken by infrastructures. This is a matter of discussion for the Eurosystem's TARGET2-Securities project, centred on the sole harmonisation of the settlement process.

## 3. What are the possible actions to address these constraints?

As regards the central bank viewpoint, **Daniela Russo** presented the initiatives taken by the Eurosystem, in the form of three major projects, to promote global management of collateral and of liquidity in a harmonised way, namely:

- TARGET2, which offers a single platform for cash payments in Europe;
- TARGET2-Securities (T2S), which aims to offer a single European platform for securities settlement; and
- CCBM2, which will offer a common platform for the management of the collateral held by banks in the central banks' books.

She mentioned that a key concept behind the design of CCBM2 was the concept of an integrated pool of collateral, meaning the promotion of an integration of the pool of collateral deposited with the Eurosystem with the pools of collateral used elsewhere in the private sector, for instance for the triparty services provided by international central securities depositories (ICSDs). Satisfying the need for a pool of collateral that is as large as possible, CCBM2 will also provide an infrastructure for credit claims. A third objective of the project is to integrate the collateral services of the Eurosystem with the collateral services provided by central banks in non-euro area countries and therefore to allow for reciprocal use of foreign collateral in case of emergency.

**John Burke** illustrated initiatives by the private sector with the example of the LCH.Clearnet group and in

particular the launch of its RepoClear product in the UK (in March 2007) and in the euro area (at the end of April 2008). He described the features of the product that aim to meet the needs of a cash-oriented repo market:

- the execution of trades in the form of generic GC baskets and the possibility to create baskets that meet the specific needs of a specific community of users;
- a system allowing for maximum netting, taking place for all trades, all bond types, all maturities of trades, but not for a given security ISIN code or for a given maturity date; and
- a settlement achieved via the auto-allocation mechanisms provided by the ICSDs, illustrating the profits generated by automation as the settlement is processed by a computer, rather than by a trader.

**John Trundle** underlined some further steps towards a more global pool of collateral that could be achieved without waiting for the launch of TARGET2-Securities or CCBM2. One step could be a better use by central banks of the triparty services provided by the ICSDs. Another step would be to allow users to choose the location of the collateral and to scrap the repatriation rule in force in some European countries, according to which the collateral must be returned to its place of issuance before it can be used. He finally called for further progress in the harmonisation of rules, such as operating hours, in the avoidance of pre-deposit needs and in consolidation, quoting the example of the recent agreement between the Euroclear group and the Nordic CSDs.

### **Expectations of the market regarding a potential Eurosystem facility for the cross-border use of collateral**

**Daniela Russo** opened this session by asking the other panellists the following question: *If the Eurosystem were to set up a facility to allow for the cross-border use of collateral:*

- *What would be the first priority of the market with regard to such a facility?*
- *Would the market players favour:*
  - *a single facility to be activated both in routine and in emergency situations, the advantage of this solution being that, in emergency situations, counterparties will use tools they are accustomed with; or*
  - *different facilities for routine and emergency situations respectively?*

**John Trundle** answered that, in this field, a distinction should be made between short-term solutions and long-term solutions. In the short term, solutions for the cross-border use of collateral can be found using existing procedures, for instance by increasing the number of counterparties eligible for the Eurosystem facilities and

enlarging the eligibility criteria for the collateral. In the longer run, solutions for such a cross-border use could be found in further harmonisation and consolidation.

From a practical point of view, he added that it would be very important that the industry knew how the facilities work and use them daily, especially since there is a better return from an investment in a facility if the latter is used regularly. This does not rule out the existence of a “plan B”, according to which it would always be possible for the central banks to use simple tools to manage crisis situations, such as accepting assets they normally do not take as collateral and putting in place very large-value operations. For these non-routine interventions, the main (if not only) requirement is that counterparties know in advance the relevant legal arrangements. He insisted that such emergency procedures should nevertheless remain a last resort option and that central banks and market players should normally try to make maximum use of existing procedures when managing non-routine situations.

Along the same lines, **Godfried de Vidts** argued in favour of the use of existing facilities, for instance triparty repos, and for further progress in removing national barriers to the centralised use of collateral. As a consequence, the Eurosystem should base its actions on an understanding of how bilateral commercial bank transactions work. The central banks should equip themselves with simple tools for any future crisis. They could for instance prepare themselves to use the custody accounts they hold in other central banks’ books to accept, under crisis circumstances, any collateral on these accounts. He finally praised the work on the eligibility of credit claims by the Eurosystem as the use of these claims in central bank operations shows that there is a willingness to use them also on a bilateral basis, which obviously calls for more harmonisation.

**Marshall Millsap** (JPMorgan Chase, Senior Vice President for Global Industry Issues) questioned the reasons why there were such expectations from the infrastructures in Europe, while the commercial banks could already provide solutions.

**Daniela Russo** first pointed out that custodian banks also faced the constraints presented during the session, in particular those leading to the fragmentation of pools of collateral between different jurisdictions and the difficulties in using the collateral management services on a remote basis. Second, she recalled the reasons why the Eurosystem had adopted the policy line that it would only use for its operations the collateral located in infrastructures that meet the Eurosystem user standards. A first reason was to ensure that the Eurosystem’s rights to the collateral were adequately protected. Such protection is better ensured with eligible infrastructures than with a private bank, notably in case of failure. Another issue was that it would have been difficult to provide custodian banks with information on the credit extended by the Eurosystem to banks they are in competition with.

To put the issue into perspective, **Godfried de Vidts** recalled that, five to six years ago, market players would not have let the Eurosystem take initiatives they did not want because central bank money was more expensive than commercial bank money. But the recent turmoil had brought arguments in favour of central bank actions. Without central banks, there would have probably been more failures like the Bear Stearns one.



# Session 3:

## Provision of liquidity by central banks in times of liquidity crisis

---

### Introduction by Sylvie Matherat, Banque de France

Session 3 was chaired by **Sylvie Matherat**, Head of the Financial Stability Department of the Banque de France. In her introductory remarks, she referred to the current context of financial turmoil and liquidity pressure and underlined the timely nature of this session for central banks and economists.

### Liquidity risk and monetary policy by Stephan Sauer (European Central Bank)

**Stephan Sauer** first presented historical evidence of past liquidity crises and the corresponding reaction from the US Federal Reserve System. In the three crises considered (the 1987 stock market crash, the 1998 LTCM crisis and the September 2001 events), he noted that the Federal Reserve drastically lowered its key interest rate in response to the crises. His paper sought to provide a framework to analyse the central bank's reaction to a liquidity crisis.

His paper presented a model that combines both the microeconomic perspective of market liquidity (the ability to sell assets quickly and at low cost) and the macroeconomic perspective of monetary liquidity (a medium of exchange that influences the aggregate price level of goods). This single framework is used to analyse the effects of liquidity shocks on the financial market, and the subsequent emergency liquidity provision by the central bank. Contrary to most of the other models available in the literature, the central bank's intervention is represented in nominal terms and not in real terms. While this choice leads to an increased complexity of the model, the author stressed the importance of taking into account the fact that the central bank does not provide real goods, but only a nominal amount of money, in order to model properly the spillover of the crisis from the financial market to the real economy.

The presented model included a market for assets where investors can either invest in productive but potentially illiquid nominal bonds or simply hold some non-interest-yielding, always liquid, cash. The model also included a goods market, where investors can buy goods with money, under a cash-in-advance constraint. In a first stage, investors decide how to split their

wealth between productive but potentially illiquid bonds and cash. The amount invested in bonds by the investors determines the capital available to the real economy and therefore has an impact on output. With this information, workers engage in nominal wage negotiations.

In a second stage, investors are subject to a liquidity preference shock: some investors may choose to consume more goods than they thought they would when they made their investment decision in the first stage. These investors try to sell their bonds to other investors on the asset market. Should this prove impossible or insufficient to fulfil their consumption needs, they can liquidate their bonds at a price below the fundamental value. When liquidation occurs, it reduces the amount of capital available to the real economy, and therefore the amount of goods which can be produced in the third stage. The second stage ends with the workers engaging in a new nominal wage negotiation.

In the third stage, goods are produced, and the investors that hold bonds are refunded and receive a nominal interest on their investment. Finally, the investors can buy goods on the goods market.

The central bank can choose to intervene in the second stage to prevent the liquidation of bonds by offering repos on the bond market. By doing so, the central bank faces a trade-off between allowing for the maximum number of real goods to be produced (which requires preventing the socially costly liquidation of bonds to provide the real economy with the maximum amount of capital) and keeping the goods price at its expected value to avoid any arbitrary wealth redistribution effect from the workers to the investors.

Using an analytical loss function for the central bank, the author is able to derive the optimal amount of liquidity to be injected by the central bank. He showed that the size of the optimal intervention increases with the size of the liquidity shock, the importance given to goods production relative to inflation, the immediate cost of liquidation, and the future negative supply effects of the crisis. The size of the optimal central bank intervention decreases as the amount of liquidity available to the investors increases.

If investors anticipate the central bank intervention, they will tend to invest more in the productive assets

and less in money. On the one hand, this will lead to an increased amount of capital available to the real economy and thus to a higher output of goods. On the other hand, it will lead to an increase in the frequency of the liquidity crises, as less “buffer money” will be held by the investors. This gives rise to the possibility of an optimal monetary policy under commitment.

In some cases, the central bank can sterilise its intervention, i.e. recover the liquidity injected in order to prevent the inflationary effect of the injection. In particular, such a sterilisation of the central bank’s intervention is possible if the liquidity shock is very short term or if the distribution of the liquidity matters only, rather than its total amount.

### **Liquidity shortages and monetary policy by Gerhard Illing and Jin Cao (University of Munich)**

**Sylvie Matherat** welcomed **Gerhard Illing** as the second speaker of session 3. He presented a paper that he had prepared with **Jin Cao**. As he noted in his opening remarks, their paper is closely related to the previously presented work of **Stephan Sauer**, although the two papers have a slightly different focus. Their paper models, for the case of pure illiquidity risk, the interaction between risk-taking in the financial sector and the central bank policy with regard to its role of lender of last resort. The paper highlights the potential moral hazard effect that may arise as a consequence of the central bank policy.

Common wisdom in this regard is that the central bank should rely on the Bagehot rule, namely that it should “lend freely at a high rate against good collateral” to prevent any moral hazard from arising. The central bank should not target specific institutions, but rather should provide liquidity to the market as a whole and ensure that the illiquid yet solvent institutions can carry on their operations. However, according to him, the adequacy of the Bagehot rule might have to be questioned, based on the lessons learnt from the recent financial turmoil, and based on the teachings from theoretical models such as the one presented here. As an illustration of the banks’ incentives to free-ride on each other’s liquidity, he quoted Citigroup CEO **Charles Prince** who made the following confession in July 2007: “When the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you’ve got to get up and dance. We’re still dancing.”

**Gerhard Illing** presented the assumptions underlying their model. There is a continuum of investors that can either store their unit of endowment at no interest rate or deposit it at a bank under a fixed payment deposit contract. The banks invest the deposits by lending to entrepreneurs, which are of two different types in the model. The first type of entrepreneurs offer safe, low-

yielding projects that are always liquid and pay out early. The second type of entrepreneurs offer risky, high-yielding projects that may be illiquid. Only a certain share of this second type of projects will pay out early, while the rest of them will be delayed and pay out late.

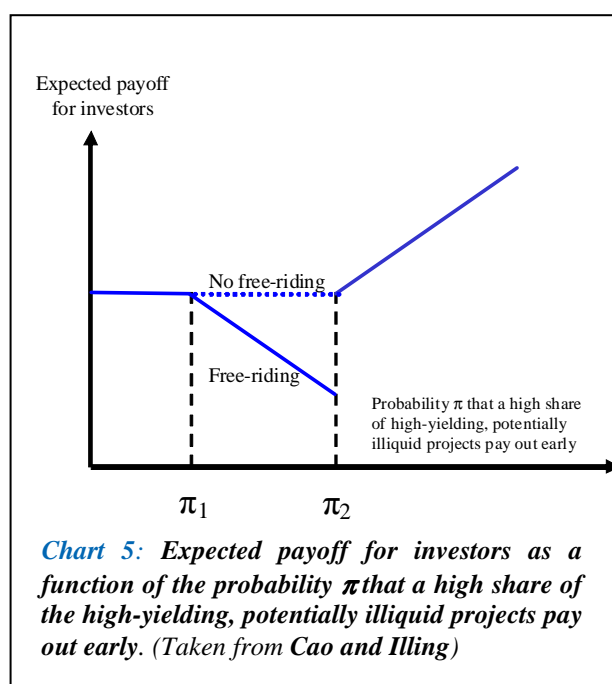
If there is no aggregate risk (i.e. the share of type 2 projects which will be delayed is known in advance), all banks choose the same allocation between the two types of projects. While some banks end up unlucky (with a large number of delayed type 2 projects), they are still able to borrow liquidity from the lucky banks. All in all, all banks remain solvent in the absence of aggregate risk.

The presence of potential aggregate risk is modelled as follows. The share of the risky, high-yielding projects that will pay out early is not known in advance, but can take two states: a low value where many risky projects end up delayed and a high value where most risky projects pay out early. The behaviour of the banks in this situation will depend on the probability of either state occurring. If the probability of a liquidity shock is high, all banks will allocate their assets so as to be able to stay liquid should the liquidity shock occur. If the probability of a liquidity shock is low, all banks will allocate their assets so as to maximise their return under the assumption that the liquidity shock will not occur. They prefer higher profitability to staying safe. The banks will thus have to liquidate their projects if the liquidity shock occurs, but the high payoff in normal times more than compensates for the bad performance in bad times.

When the probability of a liquidity shock is intermediate, the resulting equilibrium is mixed. Some cautious banks choose the safe option and allocate assets so as to stay liquid in case the liquidity shock occurs. As a result, when the shock does not occur, these cautious banks provide an excess supply of liquidity to the market. Some more reckless banks take profit of this situation by allocating all their assets into risky, high-yielding projects. When the liquidity shock does not occur, the free-riders can simply borrow liquidity from the cautious banks to obtain funding if a few of their projects are delayed. If the liquidity shock does occur on the other hand, there is a run on the free-riding banks by investors and they have to liquidate their projects. With their model, it is possible to quantify this free-riding effect and to show that it actually makes the investors worse off. This effect is illustrated in **Chart 5**, which presents the expected payoff for investors as a function of the probability that a high share of the high-yielding, potentially illiquid projects pay out early.

Emergency liquidity provision by the central bank is shown to help in the high  $\pi$  region as it increases the expected payoff for investors. By providing liquidity, the central bank is able to avoid the socially costly liquidation of projects, increasing the social welfare.

However, in the mixed strategy zone (represented by the area between  $\pi_1$  and  $\pi_2$  in **Chart 5**), liquidity provision by the central bank tends to make things worse, even when the liquidity provision is only targeted towards the cautious banks.



In conclusion, a surprising finding of their paper is that, contrary to prevailing intuition, the moral hazard problem is inherent even in an economy with pure illiquidity risk. According to the Bagehot rule, in a pure liquidity crisis, central banks should lend freely against good collateral at a penalty rate. Their model shows that such a policy fails to address the moral hazard problem: even in the case of pure illiquidity risk, unconditional lending encourages banks to behave more recklessly, providing an insufficient level of liquidity. As more reckless banks are always able to offer more good collateral than prudent banks, it seems that central banks should commit to targeting liquidity provision only to prudent banks, contrary to what is suggested in the Bagehot rule.

### **Increasing returns in the interbank liquidity market by Enisse Kharroubi and Edouard Vidon (Banque de France)**

**Enisse Kharroubi** was the third speaker of session 3. He presented a paper prepared with **Edouard Vidon**. In his introductory remarks, he explained his motivation for investigating the behaviour of the interbank liquidity market. **Chart 6** shows the spread between the three-month interbank lending rate and the

average central bank rate expected by the market in this three-month period (taken as the overnight indexed swap rate) for the euro, the dollar and the pound sterling. The sharp increase of the spread clearly indicates that banks are now much less willing to lend to one another than they were in July 2007.

The list of reasons for this increase of the premium required by the banks includes a higher perceived credit risk (banks are more reluctant to lend because they fear their counterparties are more likely to default) and a higher perceived liquidity risk (partly because several banks considered they might face the need to re-intermediate the special investment vehicles and other conduits they had previously funded off their balance sheets). According to him, two additional features of the recent crisis must be taken into account in order to explain the observed liquidity market seizure. First, the originate-to-distribute model may have provided the wrong incentives regarding the monitoring of underlying asset quality, leading to a situation of moral hazard. Second, the liquidity market may suffer from adverse selection due to the perception that the institutions borrowing liquidity on the interbank market may be the ones that are in bad shape.

These two features were included in the framework proposed by the authors to analyse the functioning of the interbank liquidity market and the occurrence of liquidity crises when banks can face liquidity shocks to their assets.

The model presented includes a continuum of risk-neutral, profit-maximizing banks that initially have to divide their investments between a liquid asset and an illiquid project. The illiquid project may face a liquidity shock in the intermediate period, leaving the investing bank with two options, either to reinvest in the project by providing additional cash and making a non-pecuniary effort, or to lose their initial investment in the project. The banks with projects affected by a liquidity shock can try to borrow liquidity from other banks.

With large ex ante liquidity provision, the moral hazard problem is mitigated as banks facing the liquidity shock make a large effort. Since banks finance reinvestment mostly from their own funds, they pay particular attention to improving the probability that the reinvestment will be successful. By contrast, with low ex ante liquidity provision, the argument is reversed: the moral hazard problem is amplified and banks make a smaller effort.

Their model provides two main results. First, credit rationing on the interbank market is more likely to happen when the individual probability of a bank facing a liquidity shock is lower. Second, ex ante competition between banks for illiquid, long-term investments can hamper the functioning of the interbank market.

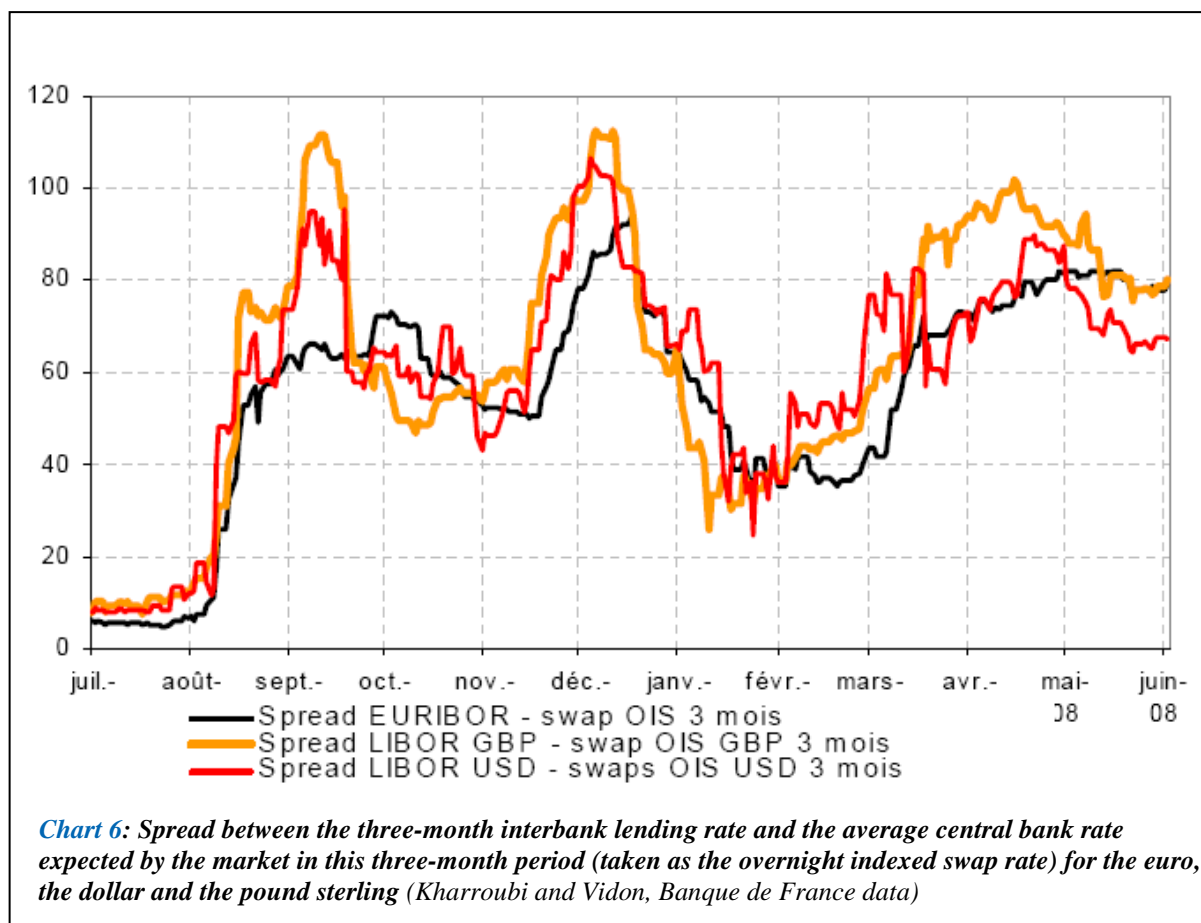
## Discussion led by Nuno Cassola (ECB)

**Nuno Cassola** then made some comments on the three papers to close the session. First, he noted the following paradox: some observers locate the cause of the current financial turmoil in the previous period of abundant liquidity when cash-rich investors began looking for high yields; however, the provision of a sufficient amount of liquidity to the market is seen as an important objective in the three presented papers.

He welcomed the contribution of these three papers, in which the notion of liquidity is central, to the existing central banking literature, which until now has focused essentially on the question of the interest rate and not on the provision of liquidity.

He highlighted the multiple definitions of liquidity used in the different papers. The concept of market liquidity (the possibility of selling an asset without excessively depressing its price) is present only in **Stephan Sauer's** paper. Funding liquidity (the possibility to borrow money either without collateral or with assets as collateral) is present in all three papers, but with some differences. Funding liquidity is expressed in nominal value in Sauer's paper just like cash, while in **Jin Cao** and **Gerhard Illing's** paper liquidity keeps its real value across the periods. Finally, in **Enisse Kharroubi** and **Edouard Vidon's** paper liquidity yields a constant return in each period just like bonds.

Nuno Cassola also suggested giving a greater role to the public authorities (central bank, banking supervisor and deposit insurer) in the presented models. In **Jin Cao** and **Gerhard Illing's** paper for example, deposit insurance might prevent bank runs, so that the central bank does not have to intervene. Neither the central bank nor the banking supervisor is modelled in **Enisse Kharroubi** and **Edouard Vidon's** paper, which makes it difficult to draw definitive policy conclusions from the paper.





## Session 4:

# Modelling payment systems as a risk assessment tool

### Introduction by Jeff Stehm, Board of Governors of the Federal Reserve System

The fourth session of the conference, chaired by **Jeff Stehm** (Board of Governors of the Federal Reserve System, Associate Director), focused on how models of payment system activity can be used as a risk assessment tool. Payment systems are a recent and growing research area for economic modelling. The modelling of payment systems represents a useful tool for central banks, insofar as it helps to understand dynamics and risks that exist in the systems under normal and stress conditions.

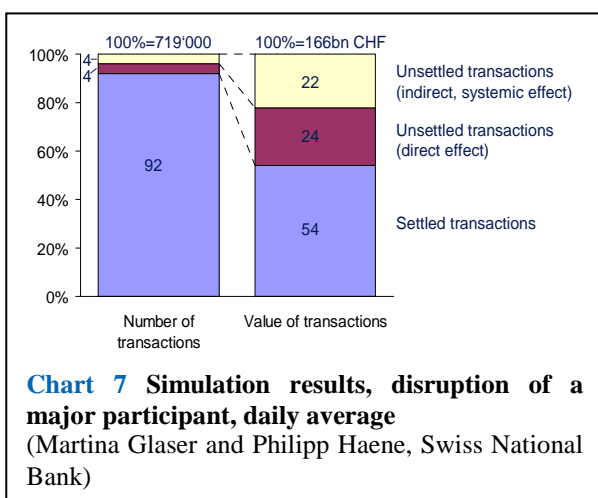
### Liquidity effects of a participant-level operational disruption in SIC by Martina Glaser and Philipp Haene (Swiss National Bank)

The session began with the presentation of two research papers that gave an insight into the effects of an operational disruption on liquidity flows within a payment system.

The first paper presented by **Philipp Haene** and co-written with **Martina Glaser**, both from the Swiss National Bank, explored the liquidity implications of an operational disruption affecting a large participant in the Swiss large-value payment system SIC (Swiss Interbank Clearing).

The authors distinguish between two types of liquidity effects caused by an operational disruption taking place in a payment system. First, as a direct effect, the disrupted participant can no longer submit payment instructions and other participants may cancel their payment orders to the disrupted participant after having received the information that this participant is unable to submit any further payment instructions into SIC. Second, as an indirect effect, since the disrupted participant can no longer recycle the payments received, some liquidity is trapped on its account. This can deprive the system of liquidity and eventually prevent other participants from settling their own payments, potentially creating systemic risk.

Using simulations, the authors evaluate the significance of the two liquidity effects in the specific case of SIC. Their simulation of a disruption that affects a major participant until the end of day is based on two assumptions. First, the disruption occurs at the moment of the day when the potential liquidity sink is largest. Second, the participant's counterparties react only two hours after the disruption occurs. The simulation results showed significant direct and indirect liquidity effects in terms of value after the disruption: on average 46% of the overall payment value was not settled due to the disruption (see **Chart 7**). In comparison with similar studies, the authors found larger systemic effects of a participant's operational disruption in SIC than in other large-value payment systems.



**Chart 7 Simulation results, disruption of a major participant, daily average**  
(Martina Glaser and Philipp Haene, Swiss National Bank)

These larger effects in SIC may be at least partly explained by system-specific factors. The first factor specific to SIC identified by the authors is the concentrated participant structure. As the two largest participants account for more than 50% of the values settled in SIC, the failure of one of these participants can have more severe consequences than in a less concentrated system. Furthermore, the relatively low liquidity levels in SIC (SIC settles all payments with liquidity amounting to 7% of the total value settled) contribute to increasing the potential systemic effects. Finally, the input behaviour of the participating banks plays a significant role. Some participants tend to actively manage their queues, only submitting new payments when their outgoing payment queue is empty. As a consequence, these participants often have only a

few queued payments at a given point in time. When such a participant is affected by an operational disruption, it results in a significant liquidity sink effect. By contrast, a participant submitting a large part of its payments at the opening of the system will typically have very large queues at the beginning of the day. These queues can serve as a liquidity buffer should such a participant be affected by an operational failure. While payment queues are usually considered with suspicion from an operational perspective since they induce settlement delays, they can however have positive effects in terms of liquidity, acting as shock-absorbers in case of participant-level operational disruptions.

In conclusion, the authors emphasised the importance of taking adequate measures to mitigate the systemic impact of a participant's operational disruption. For instance, the Swiss banking industry has issued recommendations for a maximum downtime of critical participants in SIC. Measures such as incentives for early input and settlement, access to intraday liquidity and the possibility for the Swiss National Bank to initiate on-behalf payments were also mentioned.

### ***Banks' intraday liquidity management during operational outages: theory and evidence from the UK payment system by Ouarda Merrouche and Jochen Schanz (Bank of England)***

**Ouarda Merrouche** and **Jochen Schanz** presented their theoretical and empirical study on banks' reaction to operational outages experienced by one participant in the United Kingdom's large-value payment system CHAPS.<sup>15</sup>

The authors started by explaining what kind of liquidity risks a bank's operational outage could produce. When a bank experiences operational problems in a payment system, there is a risk that other banks continue to make payments to this bank. As the stricken bank is unable to send payments, it absorbs liquidity that is not available anymore to settle payments between healthy banks. Payments between healthy banks may have to be postponed, which increases settlement risk. How healthy banks react to the operational failure of one of their counterparties thus matters for risk in the payment system.

They developed in their paper a game-theoretical approach to predict banks' reaction in the event a bank experiences operational problems. In the model, a bank's decision to make payments depends on whether another bank experiences operational problems, and on the time of the day at which the problem arises. Based on the assumption that delaying transactions overnight

would be more costly than delaying transactions intraday, the model concludes that healthy banks have an incentive to delay their payments to stricken banks in the morning, but not in the afternoon.

The theoretical results were then tested against empirical evidence using data from CHAPS: the dataset covered eight outages having occurred in CHAPS in 2007. The results of the empirical estimation supported the model's conclusions. During an outage affecting a major bank, the incoming payment flows to the stricken bank decline. On average it takes 60% longer for a stricken bank to receive GBP 1 billion during an outage than during normal times. The outage has also a much stronger effect on the payment flows to the stricken bank when it happens during the morning than during the afternoon. Regarding the impact of outages on the payments activity between healthy banks, the investigation did not reveal any significant effect, and payment flows between healthy banks appear unaffected by the outage.

### **Discussion led by Douglas Conover (BIS)**

**Douglas Conover** pointed out that the main rationale for central banks' interest in operational risk events is the large external cost of operational outages in payment systems. When an operational problem happens within a payment system, liquidity may not be recycled between banks. This can lead to unexpected funding and delay costs for banks and may even affect funding markets including overnight interest rates.

Both papers looked at the liquidity impact of a bank's operational disruption in a system. **Martina Glaser** and **Philipp Haene** examined the issue by modelling the largest possible effects of an outage – or a worst-case scenario – while **Ouarda Merrouche** and **Jochen Schanz** tried to understand how banks react to a real disruption. In response to the risks implied by an operational outage in a payment system, different types of policy measures may be taken: (i) enhancing business continuity planning, designing the system in such a way that minimises the systemic risk, e.g. implementing liquidity-saving mechanisms; or (ii) encouraging good practices among banks, e.g. early submission of payments and active queue management.

He concluded by suggesting possible extensions to the papers. Additional issues could be addressed, such as the financial costs related to operational outages or the collateral needed by banks to cope with unexpected disruptions.

<sup>15</sup> CHAPS is an RTGS system. In 2006 average daily volumes and values settled in CHAPS amounted to 131,000 payments and GBP 231 billion.

***Performance and resilience to liquidity disruptions in interdependent RTGS payment systems*** by **Fabien Renault (Banque de France), Walter Beyeler (Sandia National Laboratories), Kimmo Soramäki (Helsinki University of Technology), Morten Bech (Federal Reserve Bank of New York) and Robert Glass (Sandia National Laboratories)**

The papers by **Fabien Renault, Walter Beyeler, Kimmo Soramäki, Morten Bech** and **Robert Glass** on the one hand, and by **David Mills** and **Samia Husain** (Board of Governors of the Federal Reserve System) on the other hand used multi-systems models to analyse the consequences of system interdependencies.

The paper by **Renault** et al. modelled the interactions between two RTGS systems through the settlement of FX transactions and tried to understand, based on this modelling approach, how liquidity disruptions in one system can, in some cases, spread to the other system.

In the model, two RTGS systems are linked through two sources of interdependencies. A first source of interdependency is created by the dual participation of a few global banks that are direct participants in both systems and make FX trades with each other on a gross basis. This is a so-called institution-based interdependency in the typology developed by the CPSS Working Group on System Interdependencies. A second, system-based interdependency is created by linking the two RTGS systems through a payment-versus-payment (PVP) mechanism that ensures the simultaneous settlement of both legs of FX transactions.

The model captures how, due to these two interdependencies, the settlement activity of the two payment systems becomes correlated. The settlement activity of the two systems is deemed correlated when a period of high settlement activity (respectively a period of low settlement activity) in one system statistically corresponds to a period of high settlement activity (respectively a period of low settlement activity) in the other system.

Modelling is performed under normal conditions and in the event an operational disruption affects a significant local bank in one RTGS system (i.e. the bank affected neither participates in the other RTGS system nor engages in FX transactions). During normal operation, the two RTGS systems are shown to be interdependent. The level of correlation between the activity of the two systems depends on the level of liquidity and on whether the FX transactions are settled PVP or non-PVP. At high liquidity levels, the correlation, which is driven by FX trading, is pretty low, since banks have in any case enough liquidity available to settle any payment immediately. At low liquidity levels, the degree of correlation between both systems depends on the way FX trades are settled. While no correlation is observed in the non-PVP case, the correlation between the two systems, which is explained by the

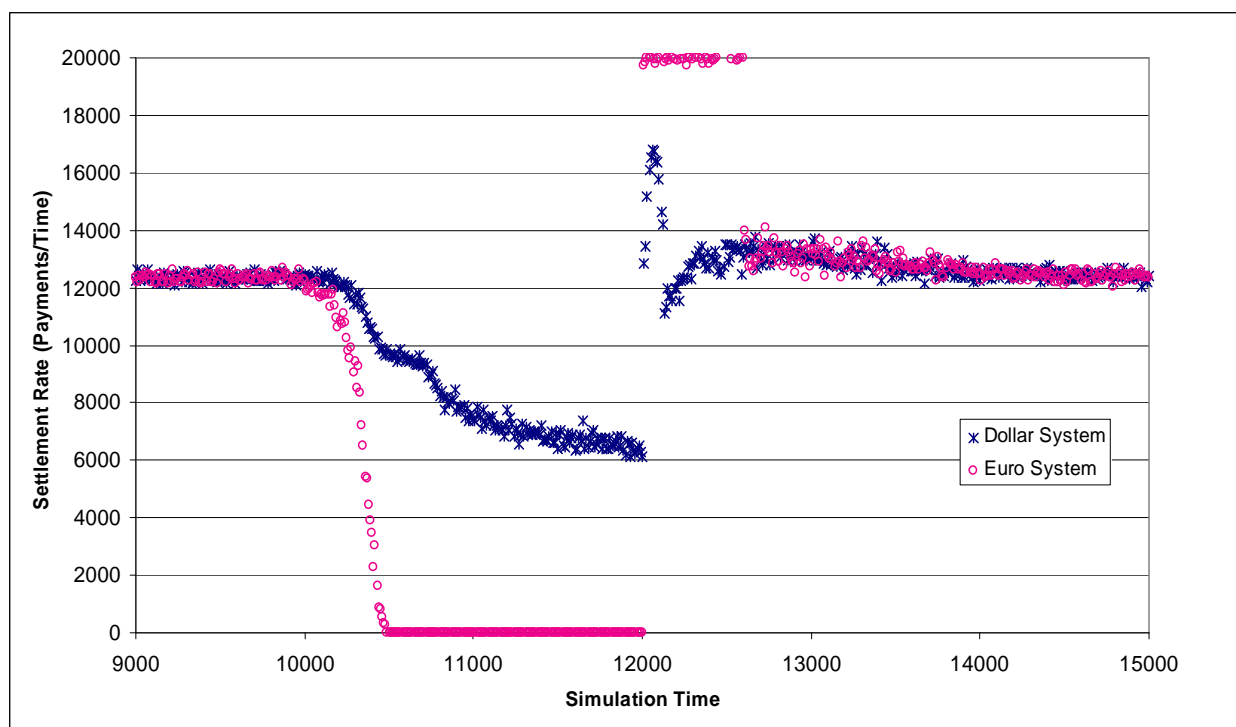
synchronisation of FX transactions, is very high in the PVP case.

When the operational disruption of a significant local bank in one system occurs, it causes a liquidity sink in this system. The paper investigates the effect of such an operational outage on the other system. In all considered cases, a liquidity crisis affecting one RTGS system has an impact on the activity of the second RTGS system (see **Chart 8**). The disruption is shown to propagate from one RTGS system to the other through three different identified channels. The first channel is the queuing of both legs of FX transactions in the PVP case, which mechanically creates queues in the unaffected system. In the non-PVP case, this leads to the build-up of FX exposures instead. The second identified channel is the decrease in the submission rate of new FX transactions. As many transactions are pending, the global banks become less likely to emit new FX transactions according to the model, affecting the activity in both RTGS systems. The last channel is more complex, and is related to the distribution of balances and customer deposits of the different banks. As not all banks are equally affected by the outage – the most important counterparties of the stricken bank are more affected – a liquidity imbalance is created in the first system and propagates to the second system through FX transactions.

***Interlinkages between payment and securities settlement systems*** by **David Mills and Samia Husain (Board of Governors of the Federal Reserve System)**

**David Mills** and **Samia Husain** built a theoretical framework of interconnected systems to understand how disruptions in one system may affect the functioning of other systems. Their work focuses more specifically on linkages between large-value payment systems (LVPSs) and securities settlement systems (SSSs).

The paper studies how disruptions may impact interlinked systems through banks' behaviour. Banks are supposed to minimise their costs of transferring funds and securities, which include the cost of intraday liquidity. Their decisions regarding when to send transactions are influenced by three given factors: the cost of intraday liquidity, the settlement risk and the alternative design of systems. The cost of intraday liquidity is measured as encompassing two types of costs: an overdraft fee and/or an opportunity cost of collateral. The cost's calculation may thus be adapted to the various existing central bank policies on intraday liquidity access. The settlement risk can be defined as the risk that payments are not sent by the expected time. When materialising, the settlement risk is assimilated as a temporary disruption. The third factor is the alternative design of payment systems. The design used in the paper is inspired by the actual configuration of payment systems in the US and UK. The first one



**Chart 8** Evolution of the settlement rate in the dollar and euro system, following an operational disruption affecting a large local euro bank. PVP, high liquidity case. (Renault, Soramäki, Beyeler, Bech and Glass)

consists of a central bank-operated LVPS and a DVP model 1 SSS, which corresponds to the US Fedwire funds and securities systems. In this situation, banks use the same account for both funds and securities transactions and all their transactions are settled in real time on a gross basis. The second design combines a privately operated LVPS and a DVP model 1 SSS – UK CHAPS and CREST – and securities are settled in real time on a gross basis in the SSS with a corresponding funds transfer in the LVPS. The third design is a privately operated LVPS and DVP model 2 SSS – US Fedwire funds and DTC: securities transactions are settled on a gross basis for the securities leg and on a net basis for the cash leg.

The authors evaluate the effects of disruptions on a system by looking at banks' balances. Under normal conditions (no disruption), the model predicts low overnight liquidity needs whichever the system design. As regards crisis conditions, two different situations are examined, i.e. when disruptions happen in both systems (the LVPS and the SSS) and when the shock only concerns one system (the LVPS or the SSS). When there are disruptions in both systems, the model indicates an increase in the need for overnight liquidity that is linked to disruptions: some banks have greater overnight liquidity needs because they failed to receive expected funds. Furthermore, the impact is more pronounced in the third arrangement of systems (with a DVP model 2 SSS) than in the two other ones. Indeed, banks are not able to use any positive balance that comes from the SSS to offset negative balances in the LVPS. When disruptions are limited to one system

(either the LVPS or the SSS), the effects on banks' liquidity depend on the design of systems. For the first design, the effects are equivalent to a shock affecting both systems. For the second and third designs, the effects are less pronounced because the LVPS and the SSS are separate.

### Discussion led by Johannes Lindner (ECB)

The discussant **Johannes Lindner** elaborated possible model extensions and drew policy lessons based on the papers.

As regards the paper by **Renault et al.**, he suggested simulating new scenarios, e.g. looking at the outage of a global bank or several banks in addition to the outage of one significant local bank, considering two RTGS systems of different sizes (one large and one small) or having a coexistence of PVP and non-PVP mechanisms to settle FX transactions. He proposed revisiting some theoretical assumptions on which the model is based: in particular, the paper could investigate the strategic behaviour of banks when deciding to send payments or not and could make the liquidity level endogenous.

He envisaged some possible enhancements to the theoretical approach of **David Mills** and **Samia Husain**. This approach could for instance benefit from additional dimensions of banks' behaviour or a larger sample of banks. It was also suggested to test the model against stylised facts. From a broader perspective, he

questioned the traditional SSS typology to which the paper refers because new developments in SSSs have blurred the boundaries between DVP model 1 and DVP model 2 (e.g. liquidity-saving mechanisms in DVP1 and settling security and cash sides in DVP2).

Finally, he emphasised the central bank policies that could be driven by the conclusions of the two papers. Given the existence of system interdependencies, central banks have a keen interest in cooperating with other central banks and supervisors. They may also, as a catalyst, encourage banks to adopt good practices, as system operators, and enhance RTGS features (e.g. by introducing limits) to facilitate risk management within systems.

In conclusion, it was pointed out by the audience that all current research work in payment systems modelling, including the papers presented during the session, concentrated on the liquidity effects of operational outages. However, it could be interesting to look at shocks other than operational disruptions, e.g. the financial insolvency of a participant.



# Session 5:

## The increasing importance of system interdependencies

---

### Introduction by Denis Beau (Head of the Secretariat of the Committee on Payment and Settlement Systems)

The fifth session of the conference was chaired by **Denis Beau**, Head of the Secretariat of the Committee on Payment and Settlement Systems, and former Chairman of the CPSS Working Group on System Interdependencies, which described and analysed the complex phenomenon of interdependencies among the different market infrastructures in a report<sup>16</sup> published on 4 June 2008. Interdependencies arise when the settlement flows, operational processes or risk management procedures of one system are related to those of other systems. He stressed that in many circumstances, the smooth functioning of one system becomes conditional on the smooth functioning of another system.

The Working Group identified three main forms of system interdependencies. System-based interdependencies result from direct relationships between systems, such as DVP or PVP links. Institution-based interdependencies occur when a global financial institution either participates in or provides services to several systems. Finally, environmental-based interdependencies refer to the common reliance of several systems on the same external element, for example several payment systems relying on the same messaging service provider, or several CCPs relying on the same collateral valuation methodology.

He discussed the results obtained by a survey conducted by the CPSS Working Group on System Interdependencies that shows that the three forms of interdependencies are particularly strong on a domestic basis, as the LVPS, SSS and CCP of the same country are often interconnected and often share the same bulk of participants and sometimes the same service providers. Interdependencies are also present on a cross-border basis, through CLS which interconnects many different LVPSs, SWIFT which provides services to many systems across the world, and a limited number of globally important financial institutions that are

significant participants in many different systems. The recent rise of system interdependencies can thus be attributed to the combined effects of globalisation, financial consolidation, technological innovation, and public and private efforts to strengthen the global infrastructure, for example by establishing PVP or DVP links between systems to eliminate credit risk.

In terms of risk implications, system interdependencies have several conflicting consequences. He thus recalled that the establishment of DVP and PVP links between systems has allowed for a large reduction in the amount of credit risk faced by financial institutions. On the other hand, system interdependencies now allow disruptions originally occurring in a single system to spread quickly and widely to a large number of other systems. A consequence is that the level of resilience of the global financial system has become dependent on the consistency and the quality of the risk management arrangements of a limited set of critical actors including major systems, financial institutions and service providers. There is therefore a need to ensure that the new risks created by system interdependencies are well understood and well managed by all relevant stakeholders.

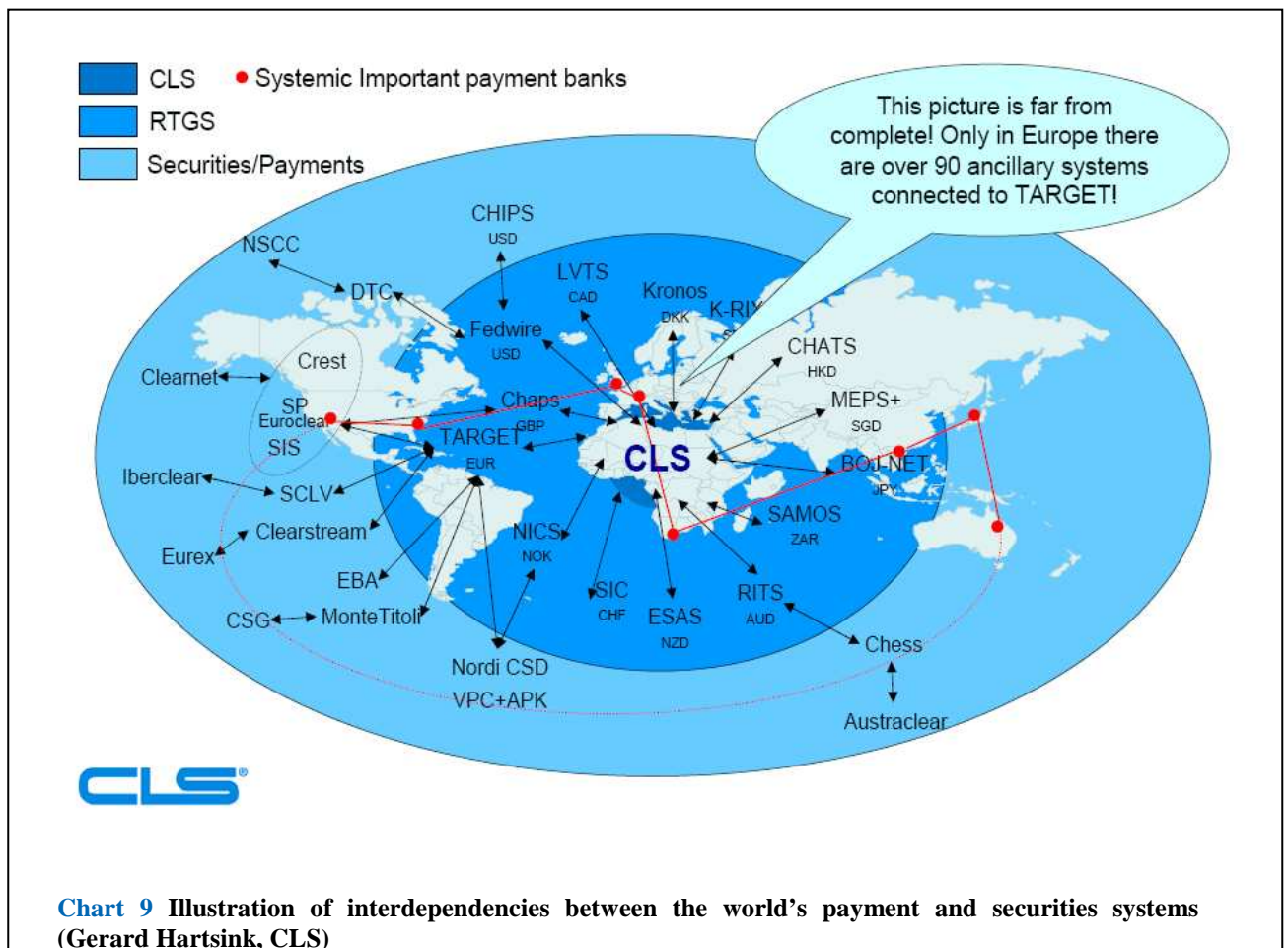
### Panel session with Alain Raes (SWIFT), Gerard Hartsink (ABN AMRO and CLS Bank) and Marshall Millsap (JPMorgan Chase)

The panel's composition well reflected the taxonomy of interdependencies as identified by the Working Group. **Gerard Hartsink**, Chairman of CLS Bank and thus representing globally important systems, was the first panellist to take the floor. **Marshall Millsap**, Senior Vice President for Global Industry Issues at JPMorgan Chase, then shared with the audience the views of a globally important financial institution. Finally, **Alain Raes**, Head of the Europe, Middle East and Africa Region at SWIFT, presented his thoughts on the current situation as a representative of a globally important service provider.

**Gerard Hartsink** first recalled the importance of the CLS system, which settles USD 4 trillion a day in 17

---

<sup>16</sup> The report entitled "The interdependencies of payment and settlement systems" is available on the BIS website ([www.bis.org](http://www.bis.org)).



**Chart 9 Illustration of interdependencies between the world's payment and securities systems (Gerard Hartsink, CLS)**

currencies for its 60 bank members in 22 jurisdictions. **Chart 9** well illustrates the critical role of CLS within the network of the world's payment and securities systems. CLS provides its customers with high-value settlement services for PVP FX transactions, by eliminating the Herstatt risk, by reducing the liquidity needs of the settlement banks thanks to a net funding mechanism, by offering a high level of operational efficiency and by allowing for an increased trading capacity.

Although the settlement of PVP transactions remains its core activity, CLS has started to diversify and is now settling OTC credit derivatives with DTCC. In a fast-moving environment with many new entrants on the FX trading side, CLS is willing to benefit from economies of scale, while remaining committed to offering a high quality service in terms of risk management.

He successively mentioned three possible opportunities for CLS to develop new services.

First, CLS might want to set up a CCP for FX transactions. Indeed, while CLS is able to eliminate the Herstatt risk by exploiting the self-collateralising nature of PVP FX transactions, it does not act as a CCP – for now – and thus does not guarantee settlement. In this regard, he expressed his concerns that some traders might misunderstand the nature of CLS and inadequately monitor their counterparty risks by

believing that CLS guarantees the settlement. Adding a CCP layer to CLS could thus be a possible way forward in this regard.

Second, CLS could offer a cross-currency intraday swap facility. Banks are often long in collateral in one currency, but short in another. Some of these banks could then have difficulties in meeting their intraday obligations in one given currency, although their overall collateral position is comfortable. Referring to the recommendations of the October 2005 report<sup>17</sup> from the Payment Risks Committee, he suggested offering a cross-currency intraday swap product within CLS as a way to provide relief to the banks with an unbalanced distribution of collateral across currency zones.

Third, CLS could become an information provider with regard to FX trading. Besides CLS's main role of suppressing principal risk in FX transactions, he also highlighted the critical importance of the real-time information provided by CLS. Benefiting from a real-time view of their exposures, the participating banks are able to make informed decisions with regard to their risk management policies, which is particularly important in times of crisis and uncertainty. In his opinion, there might be room for a greater role of CLS as an information provider with regard to FX

<sup>17</sup> The October 2005 report from the PRC is available at [www.newyorkfed.org/prc/](http://www.newyorkfed.org/prc/).



transactions. Should the CLS members agree to share information, very valuable information might indeed be extracted from the half million transactions settled in CLS every day.

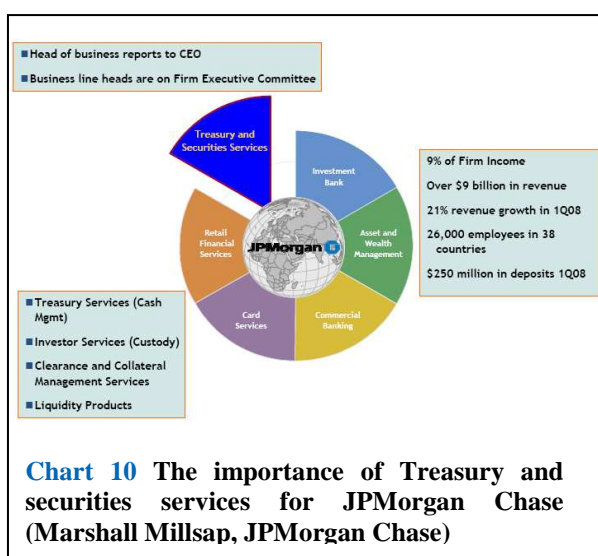
While CLS is open to new opportunities to offer additional services and benefit from economies of scale, he stressed that the Board of CLS remained fully committed to fulfil its primary mission of ensuring a high level of operational reliability on a day-to-day basis. In the rapidly moving environment of an FX world which is likely to undergo significant changes in the next ten years with further consolidation expected, he believes it is important to find the proper balance between the low costs provided by the utility model and the increased operational risk of concentration. In a more and more interconnected financial world, he welcomed the CPSS report on system interdependencies as a way to move forward with the regulatory framework at a global level and to promote cooperation between private and public actors at an international level.

Asked by a member of the audience whether CLS had any plans to widen its settlement window, he mentioned a series of possible future developments. Currently being discussed by the CLS Board is the possibility of having more than one settlement cycle per day within CLS. While this could solve some problems for the Far East countries, some participants believe it might however lead to some large intraday short positions. Other changes might also be needed in order to offer settlement for the BRIC (Brazil, Russia, India and China) currencies, once they meet the strict risk management criteria set by CLS.

Then, **Marshall Millsap** briefly presented the payments and securities settlement business of JPMorgan Chase. As a direct participant in 45 payment systems in 28 countries, the largest clearer of dollar payments and the second largest clearer of euro payments, JPMorgan Chase easily qualifies as one of the few globally important financial institutions described in the CPSS report on system interdependencies. In this regard, JPMorgan Chase is not only an important consumer of payment and settlement services, but also a very large provider of such services, and this activity accounts for a respectable 9% of the firm's total income, as shown by **Chart 10**.

JPMorgan Chase has adopted an interdependent view of the business to set up its risk management function in this domain. The same functional teams (risk, compliance, legal and network management) indeed oversee both payments and securities activities, and large deals are reviewed from a global perspective.

He welcomed the recent central bank initiatives on cross-border arrangements and interdependencies, qualifying the work of the CPSS as crucial and constructive, and called for the efforts to be carried on even after the present turmoil has been resolved. He



hoped the fruitful public-private dialogue would continue to strengthen in the future and was particularly eager for a further central bank involvement on the question of industry standards and interoperability. As a shareholder of SWIFT and CLS, JPMorgan Chase is also calling upon the globally significant financial institutions to have an open dialogue on the role, governance and strategy of the global financial infrastructures.

He concluded his presentation with a series of “existential questions”, pointing to the difficulty for the large global players, whose actions can have systemic consequences, to reconcile the shareholders’ perspective with the long-term interests of the global industry. As the move towards increased consolidation is likely to continue in the next decade, this question is likely to become even more pertinent in the future.

Subsequently, **Alain Raes** started by recalling the multifaceted nature of SWIFT, which is at the same time a highly resilient messaging network, a standard-setting body and a community of financial institutions. In this regard, he emphasised SWIFT’s recent efforts to broaden the community of its users, allowing corporates, insurance companies and government institutions to join. According to SWIFT, the arrival of these new customers will lead to an increased standardisation of the financial messages, eventually allowing for both lower costs and a higher level of resilience of the global financial system.

The importance of SWIFT with regard to the world financial system is highlighted in the CPSS report on system interdependencies, according to which “the common reliance on SWIFT significantly contributes to the interdependence of operational processes of payment systems and, to a lesser extent, securities clearing and settlement systems in CPSS countries”. Indeed, “if SWIFT were unavailable for a sustained period of time, a large number of other systems would be [simultaneously] affected”.

Acknowledging the importance of SWIFT for the global financial system, he presented an overview of SWIFT’s most recent efforts to further increase the resilience of its messaging services. While prior to the September 2001 events, SWIFT focused on preventing single points of failure, it has ever since worked on further improving its operational arrangements so as to cope with the possibility of coordinated attacks, along with more traditional large-scale natural disasters. SWIFT has therefore undertaken a series of actions, in coordination with its customers, the industry and the national authorities. He stressed the importance of SWIFT efforts in the areas of security, people, crisis management and service continuity. With regard to the latter, he was delighted to announce that SWIFT had achieved a 100% level of availability in the first six months of 2008.

Asked by a member of the audience how SWIFT managed its human resources from an operational risk perspective, he replied by insisting on the “failure is not an option” company culture. By ensuring that each staff member is well aware of the risks involved for the users and other stakeholders, SWIFT can expect a high involvement of its employees with regard to meeting the company’s operational objectives.

SWIFT’s current architecture involves two operating centres (OPCs) that back each other up, each OPC being able to handle alone the totality of the traffic. One OPC can thus take over the failed OPC’s traffic within 30 minutes. A cold start disaster recovery infrastructure is also available in case both OPCs are no longer in operation. In an effort to further increase its level of resilience, SWIFT has recently launched the distributed architecture programme, which will include several improvements to the current situation, including a third OPC and a possible extra layer of resilience with a recovery from an “ice cold” site (see [Chart 11](#)).

Current Architecture	Rearchitecture (future)
<b>Layer 1</b> Day to day resiliency. Multiple connections, protected sites, built in backup within OPC	<b>Better than today</b> Strong local resilience with significant OPC and DRI site improvements
<b>Layer 2</b> Intercontinental backup in 30 minutes in the unlikely event layer 1 fails	<b>Better than today</b> <ul style="list-style-type: none"> <li>• 20 minutes site switchover</li> <li>• Zone failures don't impact other zones' internal traffic</li> </ul>
<b>Layer 3</b> Cold Start Infrastructure for the extreme case where layer 2 is not enough	<b>Better than today</b> <ul style="list-style-type: none"> <li>• Not needed for dual-OPC failure</li> <li>• Can be activated for single zone with no impact to other zones</li> </ul>
	<b>Layer 4 (Does not exist today)</b> <b>Extra protection layer possible</b> A site in a zone may "Ice Cold" Start another zone

**Chart 11 SWIFT rearchitecture and operational resilience (Alain Raes, SWIFT)**

Besides working on its own internal arrangements, SWIFT is also looking at new ways to help market infrastructures prepare for disasters. SWIFT is therefore currently investigating the feasibility of a bulk retrieval facility, which would help a market infrastructure reconcile its messages before restarting from its cold backup site. Another option would be for SWIFT to host a generic contingency market infrastructure application, which would keep track of all liquidity movements, allowing the market infrastructure to quickly reconcile after a disaster.

He concluded by emphasising SWIFT’s critical role at the centre of many payment and securities systems, as well as SWIFT’s commitment to further contribute to the mitigation of the risks faced by the global financial system.

Following the panel session, a question from the audience triggered a discussion on how to best organise the necessary public-private dialogue on payment and settlement issues. Based on the experience of the G30, a group of 30 private banks involved in the field of securities settlement, **Marshall Millsap** insisted on the need for the private banks to first select the relevant industry players and then approach the authorities. In this regard, **Gerard Hartsink**, based on his ABN AMRO experience, highlighted the difficulty of setting a fair and transparent criterion to select the relevant players, potentially excluding some willing parties, and the sensitivity of the choice of a proper representative for the group. While no equivalent to the G30 yet exists in the payments world, **Marshall Millsap** expressed his hope that such a group would be formed, as a natural interlocutor of the CPSS. With regard to SWIFT, **Alain Raes** mentioned the existence of the SC3 (SWIFT Crisis Coordination and Communication) group, which brings together representatives from SWIFT, the industry and the public authorities, with the aim of improving current crisis management practices.

**Denis Beau** concluded session 5 by encouraging all relevant stakeholders to continue working together in order to further improve the resilience of the global financial system in the light of today’s new challenges.

## Session 6:

# Interoperability or integration: interdependencies in the EU and elsewhere

---

The aim of this session was to analyse the interdependencies generated by European initiatives seeking to harmonise post-market infrastructures. In this respect, two types of projects are currently being implemented in Europe: (i) the development of the interoperability between trading, clearing and settlement infrastructures within the framework of the Code of Conduct on clearing and settlement; and (ii) the implementation of European platforms, e.g. TARGET2-Securities, which are fostering the integration of the post-market. Thanks to the wide horizon covered by the speakers in this panel chaired by **Daniela Russo** (ECB), a fruitful exchange of views on these issues took place between user representatives (**Alain Pochet**, BNP Paribas), the exchanges (**Judith Hardt**, FESE), the CCPs (**Diana Chan**, EuroCCP) and the public authorities (**Konstantinos Tomaras**, European Commission).

### *Is the EU a model for the world? by Alain Pochet*

**Alain Pochet** started his presentation by noting that the payment systems landscape had changed dramatically in the past ten years. The systems used to be specialised at each level of the settlement chain, i.e. trading, clearing, settlement. But today, the increasing interdependency between each level of the settlement chain requires users to be involved at each of these levels in the management of projects.

Since 2007, the implementation of the Markets in Financial Instruments Directive (MiFID) has introduced a revolution in the post-market, implying a much higher level of complexity. There used to be for one security (ISIN code), one trading platform, one CCP and one CSD. As of September 2008, there will be for one security, numerous trading platforms, a few CCPs and a few (I)CSDs. Against this background, two major initiatives are aimed at introducing rationalisation in the post-market: (i) Euroclear's ESES project, which will cover three markets (Belgium, France and the Netherlands); and (ii) TARGET2-Securities, which will provide rationalisation at a wider level.

Concerning interoperability, he noted that up to now, 82 interoperability demands had been sent across Europe within the framework of the Code of Conduct on clearing and settlement, which raises the matter of the economic efficiency of that trend in terms of investment costs, savings for users and the cost of implementation. The potential higher level of fragmentation entailed by interoperability may generate higher costs for the users in several areas: position management in CCPs, collateral management, risk management and business continuity. Given these costs related to the implementation of interoperability, he wondered whether the time needed to pay back the investments associated with interoperability will be acceptable for users, who cannot afford a "thousand years' payback". According to him, the most efficient way to foster the harmonisation of post-trading is to have one common project with one target platform.

In the area of cash management, he considered that harmonisation has been achieved thanks to TARGET2, and that this harmonisation is also well on track for securities settlement, if the TARGET2-Securities project is confirmed. The sole element lacking in the European landscape is a single CCP, which could help to decrease the costs of clearing, which still account for a substantial proportion of overall post-trading costs, and could allow for sounder risk management.

Between these two solutions aimed at harmonisation (i.e. interoperability and the integration of platforms), he expressed himself clearly in favour of the second option, insofar as the first option would involve a higher level of costs and risks. If a higher degree of competition at trading level is desirable, there is no need to duplicate competition at the lower levels of the settlement chain. According to him, the solution for harmonisation of cash and settlement management has been found thanks to the complementarities between the TARGET2, TARGET2-Securities and CCBM2 projects. Europe should now be focusing on the implementation of a single CCP.

## *The EU Code of Conduct and the concept of interoperability by Judith Hardt*

**Judith Hardt's** presentation focused on the way interoperability is being implemented by European infrastructures today, the limits that can be identified and the possible solutions put forward in Europe.

The fact that some major players at trading level are already integrated and that others are not makes integration difficult to achieve. At the clearing level, a lot of discussions arise on the possibility to develop cooperation for cash equity clearing, as well as for derivatives clearing. Some years ago, every country in Europe had its own exchange and its own CSD. With the implementation of the European Monetary Union, there has been a clash between the starting horizontal integration promoted by the euro and the historical vertical silos at national level. However, only some actors have started thinking "horizontally", so as to face the challenges raised by integration.

The MiFID is one of the instruments applicable since 1 November 2007, which is trying to open up competition mostly at the trading level. But, when deciding on MiFID, European regulators were not smart enough to see that behind trading, there is post-trading, and that the development of competition at the trading level does not foster automatically competition in post-trading. Actually, everything fundamentally "goes back to the same plumbing".

However, after MiFID, there was only a small appetite within the industry for re-regulating post-trading, as the birth of MiFID had already been a painful one. In turn, with the Code of Conduct, the European Commission, which was not very keen on having more regulation but was willing to promote competition, asked the industry to propose its solutions for post-trading.

The Code of Conduct is aimed at providing the users with the freedom to choose their provider at each level from trading to post-trading. Therefore, the Code is structured around three objectives: (i) price transparency; (ii) separation of activities; and (iii) unbundling. The latter objective is especially relevant for vertically integrated infrastructures which may potentially cross-subsidise certain services, as well as for access and interoperability, obviously the most difficult part.

The part on access and interoperability, which was negotiated separately from the Code's other objectives, resulted in the adoption of the Guideline on access and interoperability, i.e. 62 articles which define how interoperability should work at the European level. On the basis of that Guideline, 82 access and interoperability requests have been sent across Europe. But no project has been effectively implemented so far.

After having recalled the principles and the content of the Guideline on access and interoperability, she pointed

out the difficulties faced in practice with the implementation of this theoretical framework. The Code is very ambitious, since it tries to create a contractual European passport, whereas the European legislator did not have the courage to come up with a solution. According to her, what the industry has put on the table is pretty good in theory and probably much less complex than what a directive would have proposed. The problem is to put into practice a contractual instrument in a non-harmonised environment. The industry faces obstacles which are, to some extent, related to the regulatory environment. In particular, there are no commonly agreed standards for CCPs at the European level. There is no agreement on the need for a CCP to have a banking status, although the trend in Europe is for CCPs to have this kind of status, which allows them to benefit from a banking passport. There is also the need for CSDs to operate only in their own country. These public obstacles will be very difficult to overcome, unless there is harmonisation of the environment at the European level.

The industry is also facing obstacles from the private sector, which are linked to the fact that interoperability implies new technical challenges. These obstacles are not the most serious and depend on the political willingness of infrastructures to find solutions. There are also differences in the interpretation of some principles of the Access and Interoperability Guideline, like the obligation for a CCP sending a request for interoperability to clear the whole range of products cleared by the CCP receiving the request. Debates have also surged on the prioritisation by infrastructures in the treatment of requests for interoperability. Another topic for discussion is the definition of risk management principles.

She regretted that before going for self-regulation and interoperability, a sufficient cost-benefit analysis from users' and from supervisors' perspectives has not been carried out. Nevertheless, she considered that it is still too early to assess the results of the Code of Conduct. One of the key questions concerns the benefits of competition at all levels of post-trading, and notably at the level of clearing in the absence of harmonisation of the minimum safety standards. Besides, in a fragmented environment where economies of scale are still quite small, one of the important questions regards the ability of European operators to face up to the competition of bigger non-European competitors, like DTCC which benefits from enormous economies of scale.

Today, the legislators seem uncertain about what should be favoured: competition or investor protection. She noted that in the US, the SEC focuses its whole policy on the latter aspect. A challenge facing the industry is that the views of the global players and of small players are diverging with regard to the need for harmonisation. Global players are in favour of a higher level of harmonisation, whatever its degree of complexity, as their economies of scale allow them to maximise the benefits of harmonisation. Small players, however,

consider that harmonisation does not let them play the same game on a level playing-field and that they are protected by their local rules. This is the political framework within which interoperability is discussed in Europe today.

### **Interoperability 1, 2, 3 by Diana Chan**

**Diana Chan** wished to look at the subject from a different angle, with the viewpoint of an independent CCP. Interoperability has one objective, two ways of being implemented and three barriers.

The single objective of interoperability is to increase competition, in order to lower the price of post-trading services and to have much more efficient capital markets in Europe. “Competition” means the ability of trading firms to choose their CCP.

Two categories of CCP interoperability links can be distinguished: competitive links promoted by the Code of Conduct, on the one hand, and the already implemented links which can be qualified as “cooperative links”, on the other hand. An ECB study published last year demonstrated that several cooperative links already exist in Europe. This second form of links is working because there are benefits for each involved party. Generally, a CCP which requests a cooperative link responds to a demand from its users who want to trade in a new market but do not want to take out a new CCP membership. Their existing CCP provides an intermediary service, on which it can charge fees. The CCP which receives the request considers the link as an opportunity to extend its market coverage to a new user population. When exchanges go global, there will be demand for cooperative links between CCPs because trading firms in different locations typically want to keep their existing clearing solution. The cooperative links are commercially sensible because they bring advantages to every stakeholder.

The approach of competitive links is completely different. The fact that no CCP link has yet been implemented under the Code of Conduct demonstrates the difficulties of implementing competitive links. According to her, “it is like inviting yourself to eat someone else’s lunch”.

The three barriers to competitive links involve competition, legal and risk issues.

First, competitive links raise issues of prioritisation. For the incumbent CCP, there is an incentive to prioritise less competitive offers which will get less market share from the incumbent. In her view, EuroCCP’s requests for interoperability would not be on the top of the list for other CCPs. Indeed, EuroCCP charges €0.06 to clear each side of a trade, while other European CCPs are charging 3 to 8 times more. This example demonstrates one difficulty in using interoperability to lower post-

trading costs in Europe. Moreover, exchanges which own CCPs, and trading venues that have an economic interest in the CCPs they appoint, are likely to use their CCP as an additional source of revenue and will protect themselves from the competition of new CCPs.

Second, the development of interoperability is also slowed by legal barriers. There is neither the mutual recognition principle for CCPs in Europe, nor minimum risk management standards. These obstacles are pretty immovable without a directive.

Last but not least, there are risk barriers, which are arguably the most relevant. The mutual exposure of interoperating CCPs creates additional risks. Default management procedures are notably much more complex in the case of interoperating CCPs. Most CCPs have risk mutualisation schemes which imply a cost, generally not taken into account by trading firms but which they should pay more attention to if their CCP interoperates with another one. A single CCP in one market operates in a much more controlled environment. Risk management issues involving two interoperating CCPs are already difficult. Managing risk issues involving multiple interoperating CCPs is much more complex, and would probably require the implementation of a CCP for CCPs. One option to manage such complex risks would be to ask regulators to guarantee the CCPs in their jurisdictions in case of default, but then there could be strong incentives for CCPs to behave as if they are “too big to fail”.

Clearing and settlement costs in the US have been cited by various studies as very low compared with Europe. In the US, interoperability led eventually to consolidation towards one infrastructure. There used to be seven silos of exchanges and clearing houses and CSDs. All the CCPs merged to form NSCC and all the CSDs merged to form DTC. Then, NSCC and DTC merged to form DTCC, which is the single clearing and settlement infrastructure for the US cash equities markets. The biggest benefit of consolidation is economies of scale, as observed in the US. DTCC is owned by users in proportion to their usage, with a rebalancing of their shareholding every two years. DTCC gives back all the profits to its users, aside from what is needed for investment. Today, the cost of clearing in the US is €0.0033. The weighted average cost of clearing in Europe is between €0.20 and €0.30, while EuroCCP charges a maximum of €0.06. In Europe, the unit cost remains high because the volumes cleared by each infrastructure remain low. In 2001, just when CCPs were being introduced for the cash equities markets, a group of banks advocated one CCP for Europe, but exchanges kept building their own CCPs. It is quite ironic that the same group of banks came in 2007 to create the trading venue “Turquoise” with its own preferred CCP, “EuroCCP”. The proposal of EuroCCP is to provide Europe with US-level low prices for clearing via a user-governed, at-cost business model. Consolidation is the solution to bring costs down, whilst having an appropriate governance structure.

For the future, she considers that European infrastructures should contemplate how to compete globally and the best ways to ensure future European competitiveness.

## Konstantinos Tomaras

**Konstantinos Tomaras** started by wondering whether the title of the session is meant to oppose the concepts of interoperability and integration and whether this opposition is relevant and really reflects the approach of the European Commission on post-market issues.

In his view, it is more relevant to oppose the integration of markets against the segregation of markets, or the interoperability of infrastructures against their consolidation.

The action of the Commission is focusing on the opposition between integrated and segregated markets. The Commission's aim is to foster a move from numerous segregated markets to one integrated EU-wide market. There are several levels of segregation, which are interconnected among themselves. For instance, the legal definition of a securities transfer may influence the design of systems. The focus of the Commission is mainly to try to get away from these differences and to end up with a single harmonised market. Therefore, the Commission's objective is to achieve equivalent sets of rules at technical, fiscal and legal levels, so that participants may equally compete on the market in a harmonised environment.

The Commission is not focused on a particular kind of market organisation (e.g. a vertical or horizontal model, consolidation or interoperability). But it is willing to create an environment for the development of an integrated market not slowed by barriers.

This move towards a more integrated market environment will provide the participants with the possibility to choose their preferred market organisation model. Reciprocally, interoperability and consolidation also foster market integration. As a matter of fact, market integration, as well as the interoperability and the consolidation of infrastructures, form a dynamic process. This dynamic process justifies having simultaneously projects of consolidation, like T2S or Euroclear's single platform, with the promotion of interoperability.

The policy stance of the Commission is to be neutral with regard to particular types of market organisation. The Commission's support for the Code of Conduct should not be read as support for the so-called "spaghetti model". The most important part of the Code is to have an undertaking of the industry on market integration.

The Commission is also trying to solve legal barriers, e.g. the prohibition for issuers to issue securities in a non-domestic CSD. This kind of barrier is a clear hurdle to the development of an environment where both consolidation and interoperability are possible. These are not easy problems to solve because a balance has to be struck between corporate and tax law issues.

With regard to obstacles pointed out by other speakers, such as the lack of regulatory action to facilitate the whole process, he considered that there were two main issues: (i) the passport issue for CCPs and CSDs; and (ii) the issue of cooperation between European regulators. He recognised that these issues are not as easy to solve as anticipated. When the Commission discussed its action plan for the post-market, it felt that it was too early to raise these issues and that it would have proved to be counterproductive, as it would have taken an enormous amount of time to reach a consensus. The Commission preferred to take sufficient time to assess the whole situation.

As a conclusion, he underlined that the question of risks related to interdependencies is crucial. The actions under way for the finalisation of the ESCB-CESR recommendations will really help in addressing that issue. This discussion is greatly facilitated by the already existing cooperation between regulators in Europe. The Commission is constantly assessing how discussions in the industry as well as among regulators are progressing, and will evaluate soon the impact of its policy on the market. He thought that the EU should not be too pessimistic about where it is and where it is going on the post-market. Nevertheless, a lot of issues have yet to be considered and addressed.

## Conclusion of the panel by Daniela Russo

**Daniela Russo** concluded by stressing the fact that there is obviously a problem of integration in Europe. This is an issue for the single currency area, which does not have a single infrastructure, and also for the single market. This is a peculiar situation where the currency area does not coincide with the single market.

She stressed that it could be difficult for global players to understand why the consolidation process should take place in three steps: first in the euro area, then in the single market and finally at the global level. If a big investment is required, she considered that Europe should look forward, i.e. avoid developing solutions which could prove inadequate in the short run.

A second difficulty relates to the fact that it is not so easy to introduce a single infrastructure in 27 countries, which have different legal and fiscal regimes. This is the reason why the Commission chose not to impose a single infrastructure, but tried to create a favourable environment for consolidation, which corresponds to the

objectives of the Code of Conduct as well as removing the Giovannini barriers.

In this respect, interoperability could have been a step which could have led smoothly to integration. But, as noted by all the speakers, this is not happening. According to her, this would be due to the issue raised by **Diana Chan**, i.e. the increase of costs and risks related to interoperability which is further increased by the lack of harmonisation of legal and regulatory frameworks.

To resolve this issue, the solution supported by the Eurosystem has been to push for harmonisation and for the introduction of common platforms that would allow for competition and will be designed in such a way as to favour their extension, possibly to become global in the future. TARGET2-Securities is the most remarkable example of these initiatives.





# High-level panel session: Which strategies should be adopted by the central banks and other public authorities to prevent liquidity crises?

---

The closing high-level panel session of the conference was chaired by **Jean-Pierre Landau**, Deputy Governor of the Banque de France. Four distinguished panellists, **Claudio Borio**, Head of Research and Policy Analysis at the Bank for International Settlements, **Charles Kahn**, Professor at the University of Illinois, **James McAndrews**, Senior Vice President at the Federal Reserve Bank of New York, and **Franco Passacantando**, Managing Director at the Banca d'Italia, were invited to elaborate on the theme of the panel regarding the strategies that should be adopted by central banks and other public authorities to prevent liquidity crises.

## Charles Kahn (Professor at the University of Illinois)

**Charles Kahn** emphasised first the need to better approach the concept of liquidity, by defining critical terms. The first term defined was “flexibility”. Since institutions desire flexibility, they maintain short-maturity assets, transparent and easily marketable positions, and hold options.

The second key term was “interdependence”. Generally, institutions maintain flexibility by handling the situation by themselves, independently. However, they sometimes maintain flexibility by hoping that others in the economy will provide flexibility to them, which results in their putting themselves at the mercy of the other institutions. If an institution maintains flexibility by having readily saleable assets, the expectation is that other agents would be able to buy these assets.

The third key word was “externality”. In the context of payment systems and liquidity provision in general, the operation of one given institution can be facilitated by the actions of other agents. However, numerous papers emphasise that the flexibility provided through these externalities is sometimes inadequate, because it is not contracted upon perfectly. Regulators can encourage or subsidise institutions to provide that flexibility to one another, should the need arise. But in doing so they are going to discourage the institutions’ individual provision of liquidity. Moreover, the flexibility provided may not be used for the purposes intended, i.e. to provide flexibility to the other institutions, but

only to maintain self-protection, which is not what regulators had in mind.

He pointed out that a fourth important term is “exceptionalism”. Not every externality can be corrected by the regulators. In normal times, despite the imperfections of the liquidity market, the institutions can be expected to protect themselves adequately in normal times. But this benign neglect would not induce them to maintain adequate flexibility in a crisis situation. It is not simply a case of regulatory moral hazard, where individual firms are calculating that central banks would step in necessarily. The whole problem arises because it is certainly not worth writing the complete contracts for this exceptional state of the world, which cannot be adequately taken into account by individual firms.

The first question the panel can try to answer is under what circumstances can central banks and public authorities properly identify the channels of liquidity crisis propagation today and tomorrow. He stressed that the question is difficult to answer, because it depends upon which financial institutions implicitly rely on other financial institutions to handle for them this individual question of flexibility, without any contract being written. It entirely depends upon what kind of exceptional systemic risk would arise in the context of interdependencies, which is a difficult question to answer for regulators in new situations.

The second question to be asked is what type of cooperation is needed to prevent liquidity crises in the context of interdependent economies. He underlined that the main concern is to distinguish between normal disciplinary mode and crisis resolution mode. Once the realisation is there that a crisis has arisen, cooperation between the regulators seems to come rather quickly. To further improve the cooperation among regulators a better understanding is crucial of what tripwires are there that move your fellow institutions from one mode of behaviour to the other.

The final question addressed was under what conditions can the monetary policy strategy be effective in preventing liquidity crises. With a looser monetary policy, the central bank wants the provided liquidity to disperse widely through the whole economy, rather than being hoarded by its initial recipients. However, monetary policy is only the

general provision of liquidity with the hope that it will be spread from the initial recipients to subsequent ones, and seems therefore insufficient to prevent liquidity crises.

**Jean-Pierre Landau** subscribed to the view that it is difficult to provide liquidity to one specific institution, rather than to the market as a whole. He stressed that a clear distinction should be made between monetary policy and liquidity provision. The issue of providing liquidity should not be framed as a change of monetary policy. In practice, central banks have to make sure that people understand that the setting of interest rates, on the one hand, and the provision of liquidity, on the other hand, are two separate sets of monetary policy instruments.

**Charles Kahn** agreed that monetary policy can, in the short term, be separated from the problems of provision of emergency liquidity, and welcomed **Jean-Pierre Landau**'s insight on this matter. He regretted however that such a view was not yet considered as obvious in many central banks around the world, pointing to the "shadow of Bagehot" that still hangs over the thinking on this issue.

In his concluding remarks, he pointed out that each time the regulators fix a liquidity-related problem by making it costly for a bank or a financial institution to engage in an inappropriate behaviour, they simply create a new need for this financial institution to find another clever way of enjoying the benefits of that liquidity. This particular problem is therefore insoluble, as the regulators will always be a step behind in terms of financial innovation.

When the crisis comes, it is no longer possible to talk about clever regulations to prevent moral hazard behaviour in the long run. In times of crisis, the regulators have to react in the short run and it is important to humbly acknowledge this fact in the design of the regulatory operators.

### **James McAndrews (Senior Vice President at the Federal Reserve Bank of New York)**

**James McAndrews** addressed the questions regarding which strategies and which type of cooperation are needed to prevent liquidity crises in interdependent economies, how to ensure at the same time convergence and flexibility of monetary policy frameworks and what type of cooperation is useful in crisis resolution.

He pointed out that one striking fact observed in the turmoil has been the level of central bank cooperation regarding liquidity provision. Major central banks made several joint announcements and enhanced their provision of liquidity, including an expansion of the types of collateral accepted, a lengthening of the terms

of liquidity provision and an expansion of access to dollar liquidity in Europe. Referring to the FX swaps conducted by the European Central Bank and the Swiss National Bank to provide dollar liquidity, he suggested that it would be useful for central banks to maintain these FX swap agreements established among themselves in the recent months. These swaps proved useful in addressing a particular friction observed in this financial crisis, i.e. the lack of integration between the Eurodollar market in London and the Eurodollar market and the Federal funds market in New York and in the US more generally.

The comparison between the LIBOR overnight interest rate reported by the British Bankers Association and the effective Fed funds rate that is calculated by the Federal Reserve Bank of New York shows that these two markets are normally fairly well integrated (see [Chart 12](#)). The very low spread was down to zero from 1 January 2007 and then, on 19 August 2007, an enormous range of rates became apparent between these two overnight interest rates on USD interbank lending. There was simply one interest rate for the New York Federal funds market and another interest rate for the London Eurodollar market.

Further research by the speaker on the New York Eurodollar market showed that it is quite well integrated with the Federal funds market in New York. The divergence therefore lies between the London market and the New York market.

One of the differences between the two markets, besides the time-zone difference, is that the European banks active on the Eurodollar market do not have the benefit of the reserve averaging provision that is applied by US banks. The US banks are required to hold reserves and they can average them over a two-week period. They can arbitrage across days and consequently their demand is very elastic. In contrast, a bank in London which needs dollars one day has to find them that day and consequently its demand is very inelastic. In periods such as the last months on the money market, this gives rise to an extraordinary volatility in the overnight LIBOR rate. Providing USD liquidity in Europe can address that sort of volatility and reassure banks that they have access to much needed USD funding in future. In this respect, the periodical auctions that have been held by the SNB and the ECB have been very important. In some other of his research, the announcements of these auctions were found to have led to a significant decrease in the three-month LIBOR rate.

A second issue addressed was whether there is any further progress to be made in adapting the design of infrastructures to cope with times of liquidity crisis. Actually, liquidity provision is not adequately modelled by the idea of complete contingent contracts, a world in which all markets are competitive and complete, so that contingent promises can be made enforceable. However, the money market is an OTC

market. It is not even subject to the same procedures as those available with exchange-traded financial instruments. For example, the money market settlement occurs through the unilateral action of participants in relation to different countries' LVPSs according to certain market conventions.

Some research done recently by **James McAndrews**, **Leo Bartolini** and **Spence Hilton** using a dataset of trading times and settlement times for money market loans showed an extraordinary delay of several hours in the settlement in Fed funds of Eurodollar trades in New York. If the trades were settled hours earlier, the situation would probably improve and it is very possible to imagine that there could be ways to settle money market instruments on a more multilateral basis. In an article published in 2006, **James McAndrews** suggested some ways in which this could be conceived using existing market infrastructures, i.e. the Federal Reserve National Settlement Service. Without going to a full exchange-traded market, there are realistic ways of improving things in terms of the regularity and expectation of settlement of money market trades.

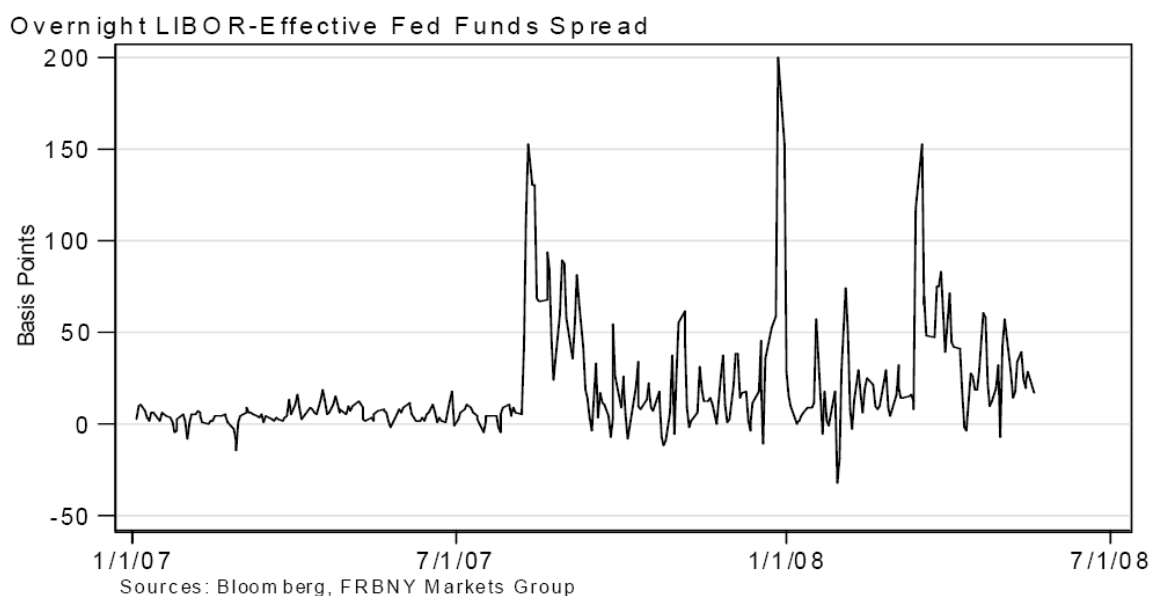
Another type of improvement that might be feasible is to envisage a complete market for contingent liquidity provision, as suggested by **Allen and Gale** (2007) in their work on financial crises. In this framework, all promises made by the banks are eventually enforceable. The forward market for money market trades is a thin market, which is not well supported by margins or other risk control measures. Likewise, the market for lines of credit and letters of credit is a very disaggregated market in which a particular bank is simply making a promise to a customer and no one knows exactly how this promise is to be enforced.

According to **James Mc Andrews**, there may be a socially useful role for a regulatory intervention in this area. In this respect, capital requirements for contingent liquidity provision may be more carefully considered. There may also be some room to require a certain amount of syndication of large lines and letters of credit, which should improve resiliency and information about the overall system's exposures and which might also lead to better pricing. There are marginal steps towards making a multilateral arrangement, if not going straight for an exchange-traded idea for money market instruments. Nonetheless, some of the exchange-traded benefits of margining could be adapted and clear expectations for settlement times could make important improvements in the future.

**Jean-Pierre Landau** then asked whether it was right to say that the potential demand for liquidity in a crisis is infinite and said that, if so, there is no way it can be satisfied. The ideas that were developed by the speakers were extremely interesting because they could reduce the probability of this situation happening, but if it does happen again, the question remains open as to what can be done.

**Franco Passacantando** (Managing Director at the Banca d'Italia)

**Franco Passacantando** agreed with the previous speakers that the most difficult question is, under which conditions can central banks and public



**Chart 12: Spread between the LIBOR rate and the effective Fed funds rate, from July 2007 to June 2008 (James Mc Andrews)**

authorities properly identify the channels of liquidity crisis propagation today and tomorrow. According to him, investing in knowledge and conducting further research on this topic would be valuable.

Actually, the channels for the propagation of crises are difficult to model. First of all, the easiest channel is the sudden and sizeable contraction of liquidity in certain structured products. A second one is the unexpected return to banks' balance sheets of off-balance-sheet commitments. A third one relates to the link between price movements, margin calls and the demand for collateral. A fourth, even the most difficult one, is the effect of intraday liquidity risk with respect to overnight risk. Conducting research in this area is desirable and the Banque de France's Financial Stability Review on liquidity risk, issued in February was thus very timely.

A macro-stress program is something that needs to be further enhanced. Perhaps a good way to approach this issue is to combine a top-down approach and a bottom-up approach, in collaboration with the financial industry, which is something that is being done by the Banca d'Italia. Another area of research for the Banca d'Italia is how the intraday liquidity patterns affect the overall risk. A lot can be learned by analysing the intraday liquidity patterns in RTGS systems.

Regarding the second question about how to enhance cooperation, he emphasised the existence of two types of cooperation. The first one is cooperation between central banks and supervisory authorities and the second one is the cooperation among authorities in charge of payment systems oversight.

On the first issue, the experience of the Banca d'Italia, which has both responsibility for supervision and central bank authority, illustrates that the proximity of these two areas was very valuable during the crisis, for two reasons. Firstly, it has allowed a rapid exchange of information between the two functions of the Bank, i.e. between supervision on the one hand, which has a more detailed understanding of risks and positions of individual banks, and the central banking area on the other hand, which has a much more immediate and real-time interest in what is going on in the market.

Secondly, it is interesting also from a policy perspective. Actually, recommendations to individual institutions tend to be as prudent as possible regarding the liquidity management of their own position. The perspective of the market as a whole instead requires that this excessive prudence is not such that it would limit the liquidity of the market as a whole. This is an inevitable tension that can be better managed if the two components in charge of liquidity management reside in the same institution or have a very strong cooperative framework.

Regarding the cooperation among oversight authorities, it should be recalled that the payment systems worked

smoothly during the crisis. In Europe, although TARGET2 was a major new system coming into operation during the crisis, it ran very smoothly. The smooth functioning of payment systems was the result of the great attention that the industry has paid to operational and systemic risk. This was also the result of the attention that the oversight authorities gave to these types of risk.

The situation may become more challenging in the coming years because of the interdependencies. The creation of a global infrastructure will require a much enhanced form of oversight framework.

Regarding the collateral policy, sufficient flexibility is a virtue, but it can also sometimes be a vice. The Eurosystem's policy is in favour of establishing a clear range of collateral that is available for systems to avoid changing it when things become more difficult because this would create moral hazard. In certain exceptional circumstances, however, a certain flexibility is inevitable.

As to the question whether central banks should promote an organised market for liquidity, his answer was positive. The Banca d'Italia has a long experience of promoting an organised market for both bonds and liquidity. This market performed regularly during the crisis of the 1990s and are also doing so in the current crisis, with the organised market recovering its volume after an initial fall.

Among the issues that have come up, one is related to the optimum level of transparency. Franco Passacantando underlined that transparency is valuable and that this liquidity market helped, through its transparency, to improve overall efficiency. At the same time, in crisis situations, transparency becomes a problem for certain institutions. During crises, some individual institutions were trying to avoid trading in this market, preferring to engage in bilateral trades. This is an issue that deserves attention and the central banking community should make a joint effort to promote the organised market because this could provide further information for the management of this crisis.

### **Claudio Borio (Head of Research and Policy Analysis at the BIS)**

**Claudio Borio** focused first on how one can prevent and manage liquidity crises. After defining the term "liquidity crisis", he listed a series of eight propositions regarding the nature of those crises, how they can be addressed and about the role of payment and settlement systems in this context.

**Claudio Borio** started by defining a liquidity crisis as a sudden and possibly prolonged evaporation of both market and funding liquidity with potential serious

consequences for the stability of the financial system and of the real economy. “Market liquidity” is the ability to trade an asset or an instrument at short notice, with relatively little impact on its price. “Funding liquidity” can be defined as the ability to raise cash or cash equivalents, either through the sale of an asset or through external funding.

The first proposition is that beyond the obvious idiosyncratic elements, all liquidity crises share at least two key characteristics. The first one is that when they materialize, at the core of their dynamics is a mutually reinforcing feedback between market liquidity, funding liquidity and counterparty risk or credit risk more generally. Sometimes what evaporates first is market liquidity, which in turn generates an evaporation of funding liquidity. According to **Claudio Borio**, the recent turmoil could probably be classified that way. An extreme lack of confidence in the valuation of structured products led to the freezing of the market and to a run on Asset Backed Commercial Paper. On other occasions it is funding liquidity that evaporates first, inducing a dry-up of market liquidity through distress selling or threatened distress selling. This was probably the case for LTCM. But in all cases, counterparty risk either triggers or amplifies the original disturbance and induces a withdrawal from transactions, a cut in credit lines and funding and an increase in variation margins and haircuts.

The second key characteristic that all liquidity crises share is that they are not like a meteorite strike from outer space (that is “exogenous”). Rather, they are best seen as the endogenous result of the build-up in aggressive risk taking and associated over-extension in balance sheets over a prolonged period, which might be referred to as “financial imbalances”. The implication is that the build-up phase of a liquidity crisis is characterized by what might be called “artificial liquidity”. This results from the self-reinforcing process between liquidity and risk-taking, which implies that both market liquidity and funding liquidity look highest precisely when they are the most vulnerable. Funding liquidity or easing funding constraints support risk-taking, which raises asset prices, reduces volatility and risk premia and in turn feeds back into funding liquidity. So, this strong positive feed-back process ultimately sets the seeds of its own destruction.

The second proposition is that the role of payment and settlement systems in liquidity crises is important but limited. It is important because badly designed payment and settlement systems exacerbate liquidity crises once they materialize. They do so in two ways. They amplify concerns about counterparty credit risk. This is why so much effort has gone into mechanisms such as delivery versus payment (DvP), payment versus payment (PvP) and central counterparties (CCP). And they amplify uncertainty about cash flows and payments, for example in the case of the unwinding of transactions in net settlement systems.

It is, however, limited for two reasons. First of all, because some of the mechanisms to deal with counterparty risk put, by design, more pressure on liquidity; the resulting pressure needs to be properly managed. This is the case in DvP and PvP. The second and more important reason is that fool-proofing payment and settlement systems can not address the build-up in risk taking and the deterioration in underlying asset quality that almost invariably hides behind liquidity crises. To be provocative, **Claudio Borio** said that, in the limit, it could even be counterproductive to the extent that greater confidence in the strength of the infrastructure induced market participants to take on greater risk, just as the improvement in the state of the roads makes people drive faster. The implication is the need to complement the strengthening of payment and settlement systems with other policies.

Those other policies give rise to several propositions. The third proposition is the need to improve buffers, such as car bumpers, continuing the analogy with the state of the roads. **Claudio Borio** provided two examples. One is higher capital buffers. Up to a point, capital buffers can enhance liquidity because of the critical role that credit risk plays in the process. One should recall that it was concerns with potential losses on thinly capitalized off-balance-sheet vehicles – the infamous conduits and SIVs – that triggered a run on them. The second type of buffer is a liquidity buffer per se. One way of having stronger liquidity buffers is to strengthen liquidity risk management. The most recent report of the Basel Committee finds a lot of room for improvements, both in terms of stress testing and contingency planning. The second way is to use regulation and supervision to ensure that buffers are high enough. In this context, however, **Claudio Borio** cautioned against time-invariant liquidity ratios. Actually, only amounts in excess of those minima can act as buffers. When liquidity crises strike, the binding minima will raise the imbalance between supply and demand for liquidity and can accordingly act in a kind of pro-cyclical way. Indeed, it is likely that the size of the buffers will decline as risks build up. This is because the mispricing of risk lies at the origin of the problem in the first place.

As a result, there are basically two types of potential problems with buffers. The first one, which is very specific, is that time-invariant minima fail to address the endogeneity of risks with respect to the collective behavior of institutions. This can add to the procyclicality of the financial system. The more general one, in the same spirit of improving the state of the roads, is that they may simply lead to faster speeds. As some senior bankers would say, the whole point of a better risk management system is to take on more risk. Therefore, they can basically act as an accelerator rather than a brake.

The fourth proposition of **Claudio Borio** is the need to complement “improvements in the state of the roads” and buffers by putting in place “variable speed limits”. The general principle would be to slow down the build-up of risk taking and associated overextension in balance sheets, by increasing the resistance to them as they develop, as a kind of dragging anchor. And in order to allow the speed to pick up faster following any strains that materialize, the drag would be released. As a result, the variable speed limit can act as a kind of stabilizer both on the way up and the way down of the credit cycle. What is needed is to think of how to induce a degree of countercyclicality in the prudential framework, including its buffers, so as to offset the potential excessive procyclicality of the financial system. It is this procyclicality that can generate liquidity crises and financial instability. One can think of these instruments as including capital and liquidity standards, but the task is not an easy one.

The fifth proposition of **Claudio Borio** is related to the liquidity provision role of the central banks. The central bank framework for liquidity provision is a “double-edge sword”. There is a tradeoff, as on the one hand it acts as a buffer but, on the other hand, it may also act as an accelerator. As the ex ante knowledge of its presence may induce faster speeds or greater risk taking (this is very much the moral hazard issue that was discussed in theme 3), the two aspects need to be balanced.

The sixth proposition of **Claudio Borio** is of a more technical nature. In a liquidity crisis, the key to effectiveness is not the net amount of liquidity provided by the central bank but its distribution in the system. Despite what can often be read in the press or in more academic papers, what central banks put in with one hand they generally take away with the other. The key to the effectiveness of liquidity provision is to ensure that liquidity reaches those that need it most and are unable to obtain it at sufficiently attractive terms in the market. The intermediation role of the central bank is key, hence the increase in the range of eligible counterparties and eligible collateral as well as the lengthening of the maturity of the operations. The implication is that, by necessity, in order to be effective, liquidity provision will need to be at more favorable terms than the market’s. This is possible either because the central bank has better information than the market and counterparties, which could be true if the central bank is in charge of supervision, or because the central bank can solve the coordination failure that gives rise to an externality. The concern, however, is that the central bank may take too much risk ex ante and its liquidity operations may be too large and too prolonged. There is a risk to be locked in. And there is an exit problem that needs to be addressed.

The seventh proposition of **Claudio Borio** is the need to develop principles for liquidity provision to address

such market-wide disturbances. In the context of a solvency crisis of individual banks, there are agreed principles regarding how to restructure them or what kind of role liquidity provision can play. However, there is no equivalent consensus when the problem initially takes the form of market-wide liquidity disruptions, as in the recent case. So far, central banks have largely been de facto shaping those principles through their own day-to-day actions. However, more reflection is needed. The principles would need to address the relationship between operations in normal times and times of stress, how to balance liquidity support with moral hazard risk, and effective exit strategies.

Finally, the eighth proposition of **Claudio Borio** is the need to reconsider the possible role of monetary policy, specifically interest rate setting policy, in the prevention of liquidity crises. The key link is between the level of policy rate, on the one hand, and risk taking, on the other hand. The relevant issues can be summarized through three questions. The first one is the extent to which the unusually low level of policy rates in recent years may have induced greater risk taking. The personal answer of **Claudio Borio** is that this effect should not be underestimated. In a recent paper with Haibin Zhu, **Claudio Borio** has argued that the risk taking channel is an important but neglected aspect of the transmission mechanism of monetary policy. The second question is whether monetary policy should lean against the build-up of risk taking and associated financial imbalances, even if near-term inflation appears to be under control. **Claudio Borio’s** answer would be yes, as monetary policy can be thought of as another kind of speed limit, probably the most important of all. The third question is whether there is a risk of an excessively strong and prolonged easing in response to the unwinding of financial unbalances or the emergence of liquidity crises. The answer of **Claudio Borio** would again be positive, as there is potentially a serious exit problem, such as the one Japan has been facing in recent years.

### Conclusion by Jean-Pierre Landau (Deputy Governor of the Banque de France)

**Jean-Pierre Landau** emphasised the first important conclusion of this conference, which was that payment and settlement systems have not failed. At the Eurosystem level, work is under way to ensure that this continues, e.g. the successful launch of TARGET2 and the progress made with the TARGET2-Securities project, and to maintain confidence in systems in the future.

Another important lesson is that central banks have cooperated very much during this period, leading de facto to a convergence in operational frameworks. There are still differences in the way liquidity is

provided, but the convergence in what central banks are trying to achieve is very high, including the lengthening of maturities, and the extension of the range of collateral and list of counterparties. Central banks' liquidity frameworks are also converging. Therefore, the three main pillars are: convergence, cooperation and resilience of payment and settlement systems.

He mentioned that very important issues have been raised by all the interventions, including whether more of a buffer is needed, whether these should be capital or liquidity buffers, or whether "speed limits" should be implemented. These important issues are still open, including the one on moral hazard. In his concluding remarks, he also pointed to the relationship between transparency and liquidity needs as another area to be further explored.

**Jean-Pierre Landau** closed the conference by thanking the distinguished panel and the audience for their attention.









**Managing Editor**

**Frédéric Peyret**  
Secretary General  
Banque de France

**Editor-in-Chief**

**Yvon Lucas**  
Director  
Payment Systems and Market Infrastructures Directorate  
Banque de France

Imprimerie Banque de France  
Atelier SIMA

Document achevé de rédiger le 26 mars 2009

Dépôt légal 1<sup>er</sup> semestre 2009

**ISBN**

978-2-11-098736-5

