Tiering in CHAPS

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- In the United Kingdom, many banks access payment systems via relationships with other banks. This introduces risks to financial stability which can be reduced by increasing direct participation.
- The Bank has worked with the payments industry to increase direct participation in CHAPS, as part of its broader work to reduce systemic risk in the United Kingdom.
- As a consequence, by 2015 a number of banks that are systemically important to the CHAPS system will become direct participants. This is a structural change which will significantly reduce interbank exposures, and hence will enhance UK financial stability.

Overview

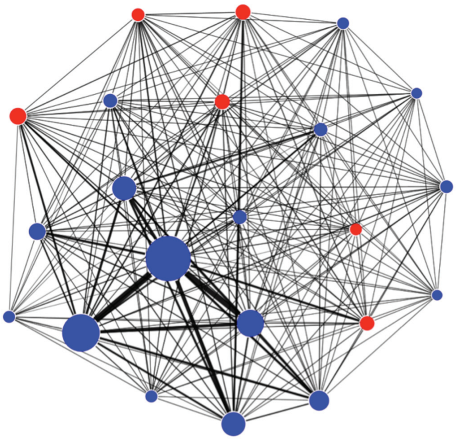
Central banks attach importance to ensuring that payment systems are designed to mitigate the risks to financial stability that can arise in the course of settling transactions between participants. CHAPS, the United Kingdom's high-value sterling payment system, has historically had a small number of settlement banks (banks that participate directly in the system), with a much larger number of indirect participants which access the system through a settlement bank. This arrangement, called 'tiering', introduces credit, liquidity and operational risk between the indirect participant and the settlement bank.

Over a number of years, the Bank has highlighted the merits of decreasing the tiering risks in CHAPS. However, several factors combined to create the basis for a renewed focus on this issue. The financial crisis increased awareness of the risks attached to interbank exposures; the Bank's payment systems oversight regime was put on a statutory basis, bringing the possibility of exercising formal regulatory powers; and improved, richer data on CHAPS payments enabled the Bank to build an evidence base to support the case for increasing direct participation.

The Bank's analysis highlighted that six indirect participants were systemically important to the CHAPS system in terms of the total value of the payments they send and receive, such that financial stability would be enhanced by their direct participation. This would increase the proportion of payments cleared directly between settlement banks from around 50% to approaching 70% of total payments cleared through CHAPS. Network analysis by the Bank shows that these six indirect participants (shown in red in the **summary figure** below) are as systemic to the CHAPS network in terms of connectedness as a number of those banks that were already direct participants.

As a result of this analysis and engagement with the Bank and others, those six indirect participants have agreed to become direct participants in CHAPS. This will materially reduce risks to financial stability.

Summary figure The CHAPS settlement network if the six largest indirect participants joined, January 2011(a)



(a) The size of the circles is proportional to the value of payments sent by each bank on a typical day. The six largest indirect participants, according to values sent in 2011, are included in red. The thickness of the connections is proportional to the value of payments sent between banks.

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Payment systems should be designed to facilitate the safe transfer of money. These transfers can take many forms: they may involve a person withdrawing cash from their bank account via an ATM; a company making salary payments to its employees; or a bank making a multi-million pound interbank loan.

Payment systems often have low public profiles, but the safe, reliable and efficient settlement of payments is vital to the economy. As Alan Greenspan, former Chairman of the Federal Reserve Board remarked: 'We'd always thought that if you wanted to cripple the US economy, you'd take out the payment systems. Banks would be forced to fall back on inefficient physical transfers of money…the level of economic activity across the country would drop like a rock'.(1)

This article explains the concept of 'tiering' in payment systems. It goes on to discuss some of the risks associated with 'tiered' participation in CHAPS, the United Kingdom's high-value sterling payment system, and steps the Bank has taken with a number of banks to address these risks. Finally, it describes progress that these banks have made towards becoming direct participants in CHAPS, thereby reducing the risks to the stability of the financial system that highly tiered participation creates.

Characteristics of a payment system and 'tiering'

Three of the fundamental components of payment systems are:

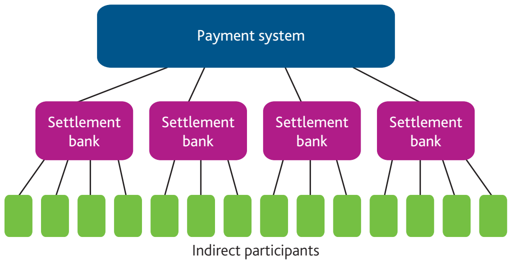
(i) **Rules and infrastructure** of the payment system. These include common standards for participation, a messaging system for sending and receiving payment instructions and a processing system for calculating the obligations of the participants in the system.

(ii) **Settlement banks**, the direct participants in the system. These are typically banks (but could also be other financial institutions) that send and receive payments on behalf of their customers.

(iii) **A settlement agent**, which facilitates the transfer of funds between settlement banks. The settlement agent is often a central bank, and so settlement occurs in central bank money.(2)

In some systems there may be multiple layers of access, sometimes referred to as 'tiered' participation. Tiered participation occurs when the direct participants, or settlement banks, in a system provide services that allow other financial institutions to access the system indirectly. For example, if a consumer pays a bill from an account at a small building society that does not directly access the payment system, a payment will be made from the consumer's account, via their building society's settlement bank (that does participate directly in the system), before being credited to the bank where the bill charger holds its account, possibly via that bank's account at its own settlement bank. Typically, the indirect participant relies on the settlement bank to provide the technical infrastructure to make their payments. This tiered set-up is illustrated in **Figure 1**.

Figure 1 A tiered payment system



Risks associated with tiering

Tiered participation in payment systems can create risks to the stability of the financial system. These risks are greatest for the high-value payment systems given the magnitude of payment flows and interbank exposures.

Such risks have long been recognised nationally and internationally, for example by the International Monetary Fund (IMF) and the Bank for International Settlements (BIS).(3) The internationally agreed 'Principles for financial market infrastructures', published in April 2012, introduced a principle relating to tiered participation.(4) Meanwhile, the Bank of England has highlighted the risk from tiering in UK payment systems in the *Payment Systems Oversight Report* and the *Financial Stability Review*.(5)

The greatest risks to financial stability arise through three main channels:

- **Credit risk**. With tiered participation, credit exposures arise when a settlement bank offers an indirect participant an unsecured overdraft to fund outgoing payments on an intraday basis, or in some cases even on an overnight basis; or when an indirect participant places a deposit with a settlement bank in order to fund its payments. In the first case, the settlement bank has a credit exposure to the

(1) See Greenspan (2007).
(2) See Dent and Dison (2012) for further details on the Bank's role as a settlement agent. For the Bank of England's policy for providing settlement accounts, see www.bankofengland.co.uk/markets/Documents/paymentsystems/boesettlementaccounts.pdf.
(3) See, for example, International Monetary Fund (2003, 2011).
(4) See www.bis.org/publ/cpss101a.pdf.
(5) See Bank of England *Financial Stability Review*, June 2004, *Payment Systems Oversight Report* 2004 and 2005, Jackson and Manning (2007), Lasaosa and Tudela (2008) and Becher, Millard and Soramäki (2008).

indirect participant; in the second case, the indirect participant has a credit exposure to the settlement bank. Credit risk crystallises if one of the parties fails while owing money to the other. If the credit exposure is large, it can threaten the solvency of the bank and in this way payment systems can act as a source of contagion in the financial system.

- **Liquidity risk**. A settlement bank could be exposed to liquidity risk if it uses its liquid resources to make payments on behalf of indirect participants, where there are few offsetting incoming payments to the indirect participants. Additionally, the indirect participant may also be exposed to liquidity risk if the settlement bank decides to cut its credit limits at short notice and is reliant on the settlement bank providing an overdraft to fund its payments.

- **Operational risk**. Indirect participants rely on their settlement bank to make payments on their behalf. An operational incident such as a computer or hardware failure at the settlement bank would impact the other banks that use its services, preventing their payments from being processed. If large enough, these spillover effects could lead to wider disruption to the financial system.

A tiered structure can also offer some benefits. There are a number of costs related to direct participation, including: employing staff to manage the flow of payments and to manage liquidity; procuring and maintaining computer systems and hardware to handle the flow of payments; and the cost of holding sufficient liquidity at the settlement agent to facilitate settlement. These costs mean that it may be uneconomical for some banks to become direct participants, especially those banks that make relatively few payments. Economies of scale may enable settlement banks to offer payments to an indirect participant at a lower unit cost than direct participation. For systems which settle in central bank money, the costs of holding the collateral necessary to access central bank intraday liquidity may outweigh the benefits of direct participation, although settlement banks may well charge for the provision of liquidity as part of the costs of providing payment services to their customers.

It is not possible to eliminate all of the risks that indirect participation brings to a payment system, so financial authorities need to take a view on whether or not the systemic importance of an indirect participant in a payment system warrants a change to direct participation in order to reduce risks to the system. Any additional costs relating to joining the system would be borne by the indirect participant when it begins to participate directly, but the benefits to financial stability would be shared among all participants, as the likelihood of losses crystallising and potential contagion would be reduced.

The CHAPS payment system

CHAPS and the Bank of England's role

CHAPS is the payment system designed for making real-time, high-value sterling payments. The system is used for the settlement of wholesale market transactions by financial institutions. It can also be used by individuals to make lower value but time-critical payments such as house purchases. In 2012, it settled payments with a total value of £285 billion on an average day, equivalent to around 50 times the nominal value of UK GDP over the year.

The CHAPS system is operated by CHAPS Clearing Company Limited (CHAPS Co), whose responsibilities include setting system rules, monitoring compliance and admitting new members. CHAPS Co is owned by its direct participants, with each settlement bank having a representative on the CHAPS Board, alongside three independent directors. The criteria for becoming a CHAPS direct participant are publicly available.(1)

The Bank of England is the settlement agent for CHAPS, and payments are settled over the Bank's Real-Time Gross Settlement (RTGS) infrastructure. All the CHAPS settlement banks hold settlement accounts with the Bank in RTGS in order to facilitate the transfer of funds arising from their payment obligations. When one of the settlement banks wants to make a CHAPS payment, it sends a payment message to the RTGS infrastructure via the SWIFT network. Assuming the settlement bank has sufficient liquidity available, the RTGS infrastructure transfers the money from the paying bank's settlement account to the settlement account of the recipient bank. The benefit of using an RTGS system is that no credit risk arises as a result of the payment mechanism. The transfer is made individually, irrevocably and in real time, meaning the beneficiary's settlement bank has certainty as soon as the payment message is received that the funds have been received in its account.

In addition to its role as settlement agent, the Bank has two other distinct roles relating to CHAPS: first, the Bank is a CHAPS settlement bank making high-value sterling payments for its own customers, such as HM Government; and second, the Bank has statutory responsibilities with regard to financial stability, as set out in Part 5 of the Banking Act 2009, to conduct oversight of systemically important payment systems, including CHAPS.(2)

Tiering in CHAPS

CHAPS is a highly tiered system. The major UK settlement banks' direct participation in CHAPS and its predecessor payment systems can be traced back over 100 years. CHAPS currently has 20 settlement banks, including both domestic

(1) See www.chapsco.co.uk/membership/joining_chaps/.
(2) See www.legislation.gov.uk/ukpga/2009/1/pdfs/ukpga_20090001_en.pdf.

and international banks, and approximately 4,500 indirect participants (including non-banks and corporates) which access the payment system via a banking relationship with one or more of the settlement banks.(1) The large number of indirect participants reflects, in part, the status of London as an international financial centre. International banks have typically been comfortable with correspondent banking relationships and, historically, only a few judged there to be material benefits in direct access.

For a number of years, the Bank has highlighted the merits of reducing the risks that arise from tiering in CHAPS through increasing direct participation. However, several factors combined to create the basis for a renewed focus on this issue over the past five years. The financial crisis highlighted the need to address low-probability events and eliminate arrangements whereby some banks were 'too big to fail'; the Bank's payment systems oversight regime was put on a statutory basis at the end of 2009; and improved, richer CHAPS payment data became available in 2010, enabling the Bank to analyse the risks of the participation structure more deeply, and providing a stronger evidence base for making the case for wider direct participation. The box on pages 375–77 describes the analysis undertaken by the Bank in further detail.

The financial crisis made indirect participants more receptive to becoming settlement banks. Following consultation with the Bank of England, four banks became direct participants between 2007 and 2010: Bank of America, Danske Bank, JPMorgan Chase Bank and UBS. These banks evaluated the risks and costs of indirect participation and took the decision to become settlement banks in order to mitigate them.

Costs of indirect participation

It can be hard to compare the costs of direct and indirect participation. An indirect participant often pays its settlement bank for a bundle of payment services, so the specific costs relating to CHAPS participation are less identifiable. In contrast, the costs of direct participation such as technical or liquidity costs are relatively easy to estimate. These costs may discourage a bank from considering direct participation.

The cost of indirect participation in CHAPS has probably increased since the onset of the financial crisis. This follows the general shift in securing exposures with collateral in order to reduce risks — which has been reflected in correspondent banks' reduced appetite for unsecured intraday lending to their indirect participant customers.(2) Although some banks with low values of payments may still be able to rely on intraday credit lines from their settlement bank, there has been a notable shift towards settlement banks requiring larger indirect participants to 'pre-fund' their CHAPS payments. Pre-funding entails the indirect participant holding funds at the settlement bank so that an intraday credit line is unnecessary. This creates an exposure for the indirect participant and means that one of the largest, previously hidden costs of indirect participation has become quantifiable.

Reducing the extent of CHAPS tiering

Working with CHAPS Co and others, the Bank implemented a strategy to mitigate the risks arising from tiering in CHAPS. The Bank's analysis determined which indirect participants could be considered systemically important to the CHAPS system, concluding that six banks should be targeted for direct participation. Beginning in 2011, the Bank engaged with these six indirect participants, their settlement banks, prudential banking supervisors and CHAPS Co to discuss the risks and encourage these banks to become direct participants in CHAPS. The Bank highlighted the importance that it placed on them becoming direct participants in CHAPS and reducing financial stability risks in the system.

In parallel, CHAPS Co developed system rules that seek to limit the potential for significant risks to build up as a result of tiered participation in the system.(3) In summary, the CHAPS rules, adopted in April 2012, create a presumption that banks with a significant value of sterling payments should participate in the CHAPS system directly, and give the CHAPS Board the power to preclude indirect relationships that present unacceptable systemic risks. An indirect relationship may be prohibited if an indirect participant's average daily payment activities exceed either: (i) 2% of the average total payment activity, by value, processed each day; or (ii) 40% of the average daily value of its settlement bank's own payments.(4) The CHAPS system rules also require the company to consider the credit and liquidity risks that arise between members.

Against this background, the six target banks concluded that the benefits outweighed the costs and decided to become direct participants. Of the many smaller institutions that are eligible to become direct participants, analysis suggests that, for the vast majority, their payment values are too small for direct participation to generate systemic risk reduction relative to its costs. It is therefore unlikely that many further candidates for direct participation will be identified as systemically important in the near future. However, the Bank and CHAPS Co will continue to monitor payment flows and engage banks whose payment values rise sufficiently to warrant direct participation.

(1) See CHAPS Clearing Company Limited (2013). For details of the current CHAPS membership see www.chapsco.co.uk/membership/current_members/.
(2) See Jackson and Sim (2013).
(3) See www.chapsco.co.uk/-/page/2509/.
(4) Includes payments sent through the CHAPS system, and payments that are internalised across the books of a direct participant, rather than entering the CHAPS system (for example where two indirect participants are customers of the same direct participant). See sections D & E of the CHAPS Tiering Criteria for further details: www.chapsco.co.uk/files/chaps/governance_documents/tiering_criteria_2013.pdf.

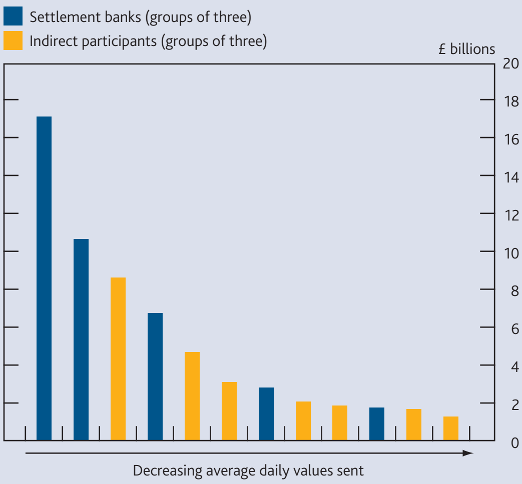
Choosing a target level of tiering in the CHAPS network

This box describes the analysis undertaken by the Bank to support the detiering initiative and understand the impact on the CHAPS network of a larger number of settlement banks. The analysis showed that if the largest indirect participants became settlement banks, the system would be significantly less concentrated; and that these additional banks are as connected to the rest of the network as the existing direct participants, further supporting the case for their direct participation.

The Bank conducted analysis to identify which indirect participants are systemically important to the CHAPS system — that is, matter for the stability of the system as a whole. The results of this analysis suggested that only a modest number of additional new direct participants was required to secure significant benefits to financial stability.(1) The banks approached to consider direct participation in CHAPS were selected on the basis of the results of that analysis.

Chart A shows that the values of payments made in CHAPS by the largest indirect participants in 2011 were similar to those made by mid-sized settlement banks, and substantially larger than the smallest settlement banks (the blue bars represent the existing direct participants, and the orange bars represent indirect participants, grouped into sets of three, to ensure that the confidentiality of payment flow data of individual institutions is preserved).

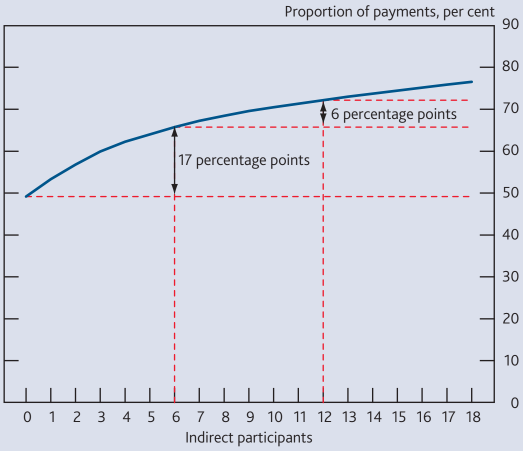
Chart A Average daily values sent by settlement banks and indirect participants, 2011(a)



(a) Banks are grouped in sets of three for anonymity.

If the six largest indirect participants, of which five are global systemically important banks,(2) became direct participants, the value of all CHAPS payments that are settled directly would increase from around 50% to approaching 70% (**Chart B**). **Charts A** and **B** also illustrate that the values of payments made by other indirect participants is lower, so there would be diminishing marginal benefit from requiring further direct participation in the CHAPS system. For example, if a further six indirect participants became direct participants, the value sent by direct participants would only increase by a further 6 percentage points.

Chart B Anticipated effect of increasing membership of CHAPS on the proportion of payments made by direct participants, 2011(a)



(a) There are around 4,500 indirect participants in CHAPS. The chart shows the effect of increasing CHAPS membership to include the largest 18 indirect participants by values sent in 2011.

When considering the systemic importance of a bank, the value of payments sent and received by a participant in CHAPS is a useful guide to the 'size' of a bank. However, it is also important to consider how connected a bank is to other banks within the network. The following section explains the network analysis undertaken by the Bank, and the concept of 'connectedness' in more detail. The Bank's network analysis authenticated the case for the six largest indirect participants becoming settlement banks on grounds of connectedness.

How 'connected' is the CHAPS network?

Banks that make or receive payments to a large number of other banks in the system may be more central to the network than those with a larger value of daily transactions, but fewer connections to the other banks. The more central a bank, the greater its potential to disrupt the rest of the network in the event that it fails. And the greater the risk of contagion, the stronger the policy case is for it to become a direct participant in order to mitigate risks to the stability of the United Kingdom's financial system.

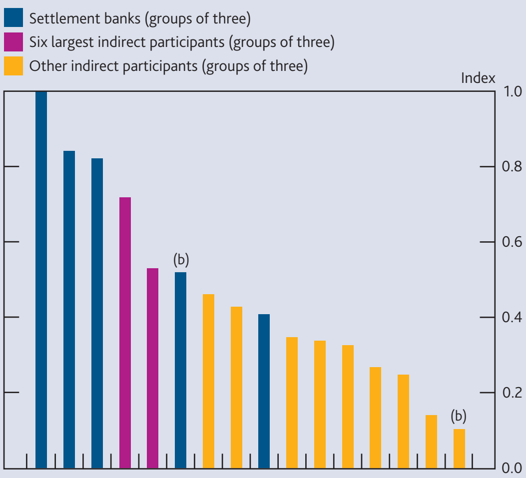
By representing CHAPS as a network, it is possible to measure each bank's connectedness. If a large indirect participant is less connected, and therefore less central, than the settlement banks, the financial stability case for it joining CHAPS as a direct participant is less strong than if it is well connected.

The Bank's analysis used two well-established measures from the literature on network economics to assess connectedness. First, the proportion of payments (weighted by value) between pairs of banks that pass through a particular bank, or 'flow centrality'; and second, the number and value of a bank's links to other banks in the network, and how many connections those banks have in turn, or 'second-round centrality'.(3)

If a bank is the link between other important banks, the impact of it shutting down is large; flow centrality therefore captures how dependent other banks are on this bank. Second-round centrality, in turn, provides an indication of which nodes are more important in the propagation of a shock once knock-on effects are taken into account.

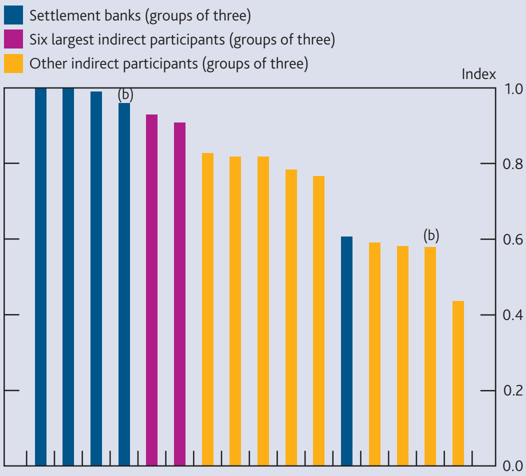
Charts C and **D** show that the largest indirect participants are as central to the CHAPS network as the settlement banks. The blue bars represent the existing direct participants, the magenta bars represent the six indirect participants targeted to become direct participants, and the orange bars represent other indirect participants. For both charts, all banks (direct and indirect participants) are collected into groups and then ranked in terms of their centrality. Each bar represents a group of three (or in some cases four) banks. **Chart C** shows the six largest indirect participants are of similar importance to the network as the direct participant in terms of the flow of payments (flow centrality), but the level of importance falls beyond the six largest indirects. **Chart D** shows that the dependency in terms of propagation of shocks (second-round centrality) declines less markedly after the six largest indirect participants, but that they are more central than some direct participants. It can therefore be concluded that the largest six

Chart C Flow centrality in CHAPS, January 2011(a)



(a) Banks are grouped in sets of three and, in two cases, four, for anonymity. Banks are grouped according to values sent in 2011. A higher score indicates that the banks in that group are more important to the CHAPS network in terms of the flow of payments.
(b) Groups of four.

Chart D Second-round centrality in CHAPS, January 2011(a)



(a) Banks are grouped in sets of three and, in two cases, four, for anonymity. Banks are grouped according to values sent in 2011. A higher score indicates that the banks in that group are more central to the CHAPS network.
(b) Groups of four.

indirect participants are broadly as systemic in CHAPS as settlement banks, not only in terms of values sent, but also in terms of connectedness.

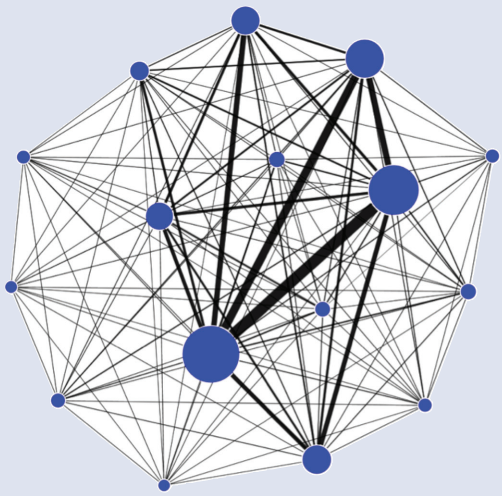
Depicting the CHAPS network

The CHAPS network, as of January 2011, is depicted in **Figure A**. Settlement banks are represented as nodes in the network and payments between banks, in both directions, form the links between these nodes. Each bank is represented by a circle proportional in size to the value of payments sent on a typical day. The lines between banks represent the payments sent, with the thickness proportional to their value. Note that all payments are represented as 'belonging' to the settlement banks sending and receiving them, including those made on behalf of indirect participants using the settlement bank. **Figure A** shows that the CHAPS network as of January 2011 is a very well-connected network, with practically all (96%) of potential links between banks being used.

Figure B shows how the CHAPS settlement bank network would look if the largest six indirect participants as of January 2011 (represented by red circles) became direct participants. To carry out the simulation, the model supposes that the largest six indirect participants become settlement banks, and assigns to these new settlement banks the payments that they previously sent or received through their former settlement bank.

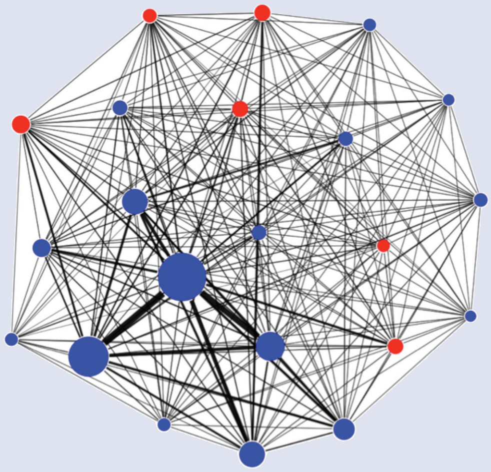
Two observations stand out from this network, in contrast to the one depicted in **Figure A**. First, the reduced size of the largest nodes and reduced width of the largest links illustrates that risk has been mitigated by the reduction in dependency on a small number of key settlement banks. Second, this network is just as well connected as the settlement bank network depicted in **Figure A** — 96% of potential links are active; in other words, adding these six banks as direct participants does not dilute the connectedness of the network. This is further evidence that the largest six indirect participants in CHAPS are as well connected as current settlement banks, supporting the case for them to become direct participants.

Figure A CHAPS settlement network, January 2011[(a)]



(a) The size of the circles is proportional to the value of payments sent by each bank on a typical day. The thickness of the connections is proportional to the value of payments sent between banks.

Figure B The CHAPS settlement network if the six largest indirect participants joined, January 2011[(a)]



(a) The size of the circles is proportional to the value of payments sent by each bank on a typical day. The six largest indirect participants, according to values sent in 2011, are included in red. The thickness of the connections is proportional to the value of payments sent between banks.

(1) See Salmon (2011).
(2) As defined by the Financial Stability Board.
(3) 'Flow centrality' is called 'betweenness centrality' and 'second-round centrality' is called 'eigenvector centrality' in the network literature.

Detiering progress

By 2015, 25 banks are on course to be CHAPS direct participants, an increase of eleven since the 2007–08 financial crisis. The six banks identified by the Bank as systemic in 2011 — BNP Paribas, BNY Mellon, ING, Northern Trust, Société Générale and State Street — have all decided to become settlement banks; State Street completed its transition to direct participation in September 2012. One additional bank, Handelsbanken, recently became a settlement bank independently of the Bank's detiering initiative.

These seven banks, in conjunction with the four banks that became direct participants between 2007 and 2010, collectively account for more than 26% of the value of payment flows in CHAPS. They all previously accessed CHAPS as indirect participants via settlement banks. Once all become direct participants, nine of the largest fourteen global systemically important banks (G-SIBs) will be settlement banks in CHAPS; the remaining five G-SIBs do not process significant values in CHAPS. The proportion, by value, of CHAPS payments settled directly between settlement banks will increase to approaching 70%, compared with around 40% at the time of the 2007–08 financial crisis.[(1)] This will significantly reduce risks to financial stability.

There are parallels to tiering risks in other systems, most notably CREST, the United Kingdom's securities settlement system. The Bank is working alongside CREST's system operator to identify those indirect participants with sufficient business to warrant becoming CREST settlement banks. Analysis of UK retail payment systems indicates that the risks are not currently significant enough to require action on tiering for financial stability reasons. While these systems do exhibit a high degree of tiering, the flows of indirect participants are relatively small and so the consequent risks for financial stability are lower.

The Bank's detiering efforts and the CHAPS system rule will ensure that banks that grow to become systemically important will be identified as candidates for direct participation. However, other banks that meet the requirements for direct participation may also choose to become settlement banks and enjoy the benefits of RTGS settlement, even if the values they process via CHAPS are not of systemic importance.

Conclusion

The Bank assessed the risks to financial stability that arise from tiered participation in CHAPS and has acted to reduce these risks by encouraging the most systemically important banks in sterling wholesale payments to participate directly in CHAPS.

(1) See Salmon (2013).

The direct participation of the six banks identified by the Bank will reduce settlement risks between some of the largest banks operating in the United Kingdom.

The system rules that CHAPS Co has adopted ensure that indirect participants in CHAPS will be monitored and those that grow to become systemically important will be encouraged to become settlement banks. Meanwhile, banks that are not identified as systemic to the CHAPS system can choose to become settlement banks to benefit from the risk reduction that direct participation brings about.

This action has resulted in a material reduction in the risks that settlement of high-value payments creates as part of the Bank's ongoing work to protect and enhance the stability of the UK financial system.

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