

Securities settlement systems: assessing their relative riskiness

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Securities settlement systems are a fundamental piece of the financial infrastructure of an economy. The Bank therefore has an interest in ensuring that adequate risk mitigation techniques are employed by the securities settlement systems most used by UK market participants. In this article, we identify these systems and propose a framework for assessing the quality of their risk controls.

SECURITIES SETTLEMENT SYSTEMS¹ (SSSs) provide a means of transferring the ownership of securities. This occurs through three, normally linked,² steps: (a) the securities are delivered to the buyer, usually through entries on the SSSs' books; (b) the funds are paid to the seller, on the books of either the central bank or a commercial bank; and (c) the legal record of ownership is updated.

Settlement is an essential part of the post-trade process and as such its resilience is fundamental to the efficient functioning of financial markets. But institutions using SSSs face a number of risks, or potential 'settlement shocks'. Broadly speaking, settlement shocks can be mitigated in two ways: either *ex ante* by decreasing the likelihood of the risk crystallising, or *ex post* by reducing the impact of the risk once it has occurred. Table 1 summarises the risk mitigants relevant for each type of shock.

For example, participants in settlement systems could encounter *operational risks*, which might cause delays and affect market liquidity. An *ex ante* approach to mitigating operational risk is to ensure that systems and controls meet minimum requirements. The impact of operational risks can be reduced by ensuring that there are effective *ex post* contingency plans to continue a system's operations at alternative sites.

There is also *financial risk*, or the possibility of insolvency of the SSS. This arises if the SSS takes credit risks, either by acting as principal in lending or implicitly through the operation of a net settlement process.³ Other financial shocks could be caused by a severe loss of revenue or a significant increase in costs. The likelihood of financial failure can be reduced by ensuring the system has an adequate capital base and by adopting credit risk controls. Procedures to replace a failed system rapidly with a safe and efficient substitute are an example of an *ex post* mitigant.

There are several other types of risk which affect members of SSSs. Participants using a commercial bank to finalise payment obligations face settlement bank risk, or the possibility of a failure of that bank. This risk can be mitigated *ex ante* by using central bank accounts to settle the cash leg of a securities transaction.

Members of an SSS also face principal risk: the risk that DvP arrangements are inadequate and assets are delivered to a defaulting counterparty before receipt of payment (or vice versa). Replacement cost risk is the risk that securities are not delivered by the seller on the due date and the buyer has to replace the transaction at the current market price. Shortening the length of the settlement cycle, the time between the execution of a trade and its settlement, reduces the time in which a counterparty default or delivery failure could take place.⁴

(1) For the purposes of this article, a SSS is defined as the central securities depository or international central securities depository in each country.

(2) Linking these steps ensures 'delivery versus payment' (DvP) – the principle whereby final delivery of securities occurs if and only if payment of funds also occurs.

(3) In net settlement systems, credit can effectively be provided by the SSS as agent for other participants in the system. In the event of a failure of a participant with a net debit position, the remaining participants could face a shortfall in funds or securities.

(4) Although shortening the settlement cycle has *ex ante* benefits for a counterparty default, it is possible that it could lead to an increase in the likelihood of an operational shock if there are delays and inefficiencies in processing trade information.

Table 1
Settlement shocks and the risk mitigants available to SSSs^(a)

Shock	Description	<i>Ex ante</i> mitigants	<i>Ex post</i> mitigants
Operational failure	A system outage could cause liquidity problems for all participants in the market.	Systems and controls (11)	Continuity plans (11)
Financial failure	A financial failure of an SSS could cause liquidity problems for all market participants.	Credit risk controls (9) Capital base	Replacement procedures
Settlement bank failure	The clients of the settlement bank would not be able to settle and would suffer liquidity problems and, potentially, credit losses.	Central bank money (10)	
Counterparty default ^(b)	Could cause disruption in the markets if sufficient losses are suffered.	Settlement cycle (3) Risk-based access criteria (14)	DvP (7) Timing of finality (8) ^(c)
Replacement cost ^(b)	Market participants face costs resulting from changes in market prices.	Trade confirmation (2) Settlement cycle (3) Risk-based access criteria (14)	Securities borrowing (5) Timing of finality (8) ^(c)

Source: Bank of England.

- (a) The risk mitigants in this table are similar to the recommendations published by the Committee on Payment and Settlement Systems (CPSS) and the Technical Committee of the International Organisation of Securities Commissions (IOSCO) in 2001. A working group of the Committee of European Securities Regulators (CESR) and the European System of Central Banks (ESCB) recently developed EU standards from these recommendations. The figures in brackets are the numbers of the relevant recommendations in CPSS and IOSCO (2001) and the standards in ESCB and CESR (2004).
- (b) Counterparty default and replacement cost risk can also be mitigated by the use of a central counterparty (CPSS and IOSCO recommendation 4). In a few cases, the SSS also acts as a central counterparty.
- (c) The timing at which a transaction is finally settled affects the impact of a counterparty default or the replacement cost. System participants that know the effect of the default early in the day will be able to resolve any problems more quickly than participants with information late in the day.

Settlement also entails important *legal risks*: losses can arise if the legal framework is incompatible with the practices in an SSS or its implications are uncertain. This article does not consider legal issues further as the associated risks are not readily quantifiable.

The settlement shocks in Table 1 could have the potential to disrupt financial markets and the wider economy, particularly if the shock was prolonged. For example, central banks use SSSs to take delivery of collateral used by banks to obtain intraday liquidity in payment systems and in market operations to implement monetary policy.¹

The UK financial system is exposed to systems in other countries. First, UK market participants trading in foreign securities use the relevant system(s) in that country. They access the foreign SSS either directly by becoming a remote member, or indirectly – through a custodian, international central securities depository, or via links with the UK SSS – CREST. Second, the increasing consolidation and interoperability in the securities market infrastructure mean that problems in foreign systems can affect the UK SSS.² Third, disruption in foreign securities markets could affect UK payment systems, as UK banks can obtain intraday credit based on collateral

held in both CREST and foreign SSSs. The Bank accepts foreign collateral for its intraday credit operations, either through the accounts with the international central securities depositories or via the Correspondent Central Banking Model.³

For a comprehensive assessment of the settlement process, all of the arrangements used to settle securities across borders, such as custodians and links between SSSs, should be considered. Furthermore, the final impact of any settlement shock might include disruption to the wider economy if the shock causes a SSS member to default on commitments with its counterparties. But, as a first step, this article focuses only on the initial impact of shocks in SSSs on UK market participants, ignoring other entities involved in the process and these potential second-round effects on the financial markets.

Method

The framework outlined here analyses a country's SSSs according to 'SSS relative riskiness' (SRR), an estimate of the impact of disruption in SSSs on UK markets.

SRR is defined as the product of the impact and probability of a settlement shock, and can be proxied

(1) The implications for monetary policy are not discussed further.

(2) An example of consolidation is the merger of CRESTCo and the Euroclear group in September 2002. Interoperability can be achieved by the use of links between SSSs in different countries.

(3) The Correspondent Central Banking Model is a mechanism whereby securities held in a SSS in one country can be used to collateralise intraday credit in another country. European Central Bank (2003) provides more information.

by the product of 'exposure at settlement shock' (EAS) and a 'settlement system rating' (SSR):

$$SRR_i = EAS_i \times SSR_i$$

where i denotes each of the countries assessed (around 90 in total).

EAS is an estimate of the UK financial system's exposure to a system; it is assumed that the impact of a shock is proportional to this exposure. SSR is an overall assessment of the quality of the *ex post* and *ex ante* risk mitigants used in a SSS, and thus is related to the probability and impact of a settlement shock.

This method is similar to that devised by Buckle, Cunningham and Davis (2000), which ranked countries according to 'expected default loss', the product of the size of credit exposures of UK lenders to borrowers in each country and the credit risk attached to them. But in that study 'expected default loss' was derived from the market assessments of default risk embodied in credit ratings and credit spreads.

'Exposure at settlement shock'

Investors are more exposed to settlement shocks the greater the volume of securities that they settle, so it would be desirable to measure the UK financial system's exposures using the volume of UK market participants' securities settlement in each SSS around the world. However, this information is not publicly available. The approach taken here is to proxy exposures using the Co-ordinated Portfolio Investment Survey (CPIS).¹ The CPIS includes statistics on the level of the UK's foreign portfolio investment (equities, debt and money market instruments) by country.

There are three main caveats to consider when interpreting these data. First, as country data on flows are not published, figures on the volume of securities settled are estimated using data on the level of securities owned. This implicitly assumes that investors with larger holdings settle securities more frequently. However, this may not necessarily be the

case. For example, pension funds and unit trusts hold large stocks of securities, but probably need to settle these securities less frequently than banks and securities firms, which tend to trade more often. Calculating the change in the level of exposure over a given period would not measure the relevant settlement activity either. The change in the net value of purchases and sales made is not the same as the total gross value of securities settled, and would include any revaluations following changes in asset prices.

Second, the CPIS allocates data to countries according to the location of the issuer, rather than the system in which the securities are settled. This means that UK investment in bonds issued by a French company, but settled in the international central securities depositories, Euroclear Bank or Clearstream Banking Luxembourg, is allocated to France, not Belgium or Luxembourg. The UK exposures to Belgium and Luxembourg are likely to be significantly under-estimated by the CPIS data.

Third, the CPIS excludes direct investments, defined as a holding of 10% or more of the ordinary shares or voting power of an enterprise. This means that merger and acquisition activity is not included.

Exposures to the UK SSS are estimated using data on the UK economy's domestic portfolio investment. These statistics are published by the Office for National Statistics each quarter.

The resulting data are heavily concentrated (Chart 1). Over half of the total exposures of the economy to settlement systems are with the UK SSS. Almost one-third of total exposures are with other developed countries in Europe; approximately 15% of exposures are with non-European developed countries and offshore centres; and only around 3% of exposures are with developing countries.²

Settlement system ratings

How are the *ex ante* and *ex post* risk mitigants used to reduce the probability and impact of various settlement shocks to be addressed? Again, precise data are not available. But one way of quantifying

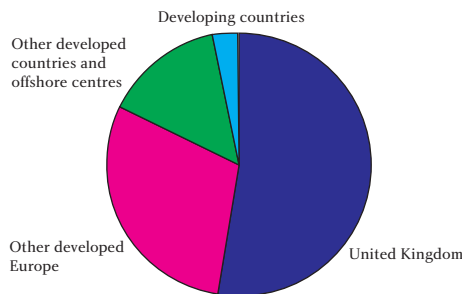
(1) IMF (2002) explains this survey in more detail. Only end-year data are published in the CPIS. Quarterly estimates can be produced by extrapolating forward from the latest annual data using the growth rates implied by the data on UK banks' consolidated external portfolio investment claims. These quarterly estimates are grossed to the UK's total foreign portfolio investment, published by the Office for National Statistics.

(2) Although these results are calculated for the end of 2004 Q2, they would not change significantly if different dates were chosen.

them is to use the 'Risk Exposure Assessments' (REAs) produced by Thomas Murray as part of the Capital Market Infrastructure Risk Ratings service.

Chart 1

UK exposures to SSSs^{(a)(b)}



Sources: IMF, ONS and Bank calculations.

(a) Data are for the end of 2004 Q2.

(b) Country groups are those defined by the BIS.

The REAs assess the risk exposures of market participants using the SSSs in different countries. The REAs consider six types of risk and their mitigants, which are similar to those identified in Table 1:

- Operational risk includes the impact of an operational error and a system's ability to resume processing following disruption. The factors assessed are equivalent to the mitigants used to counter operational shocks.
- Financial risk contains an assessment of whether a SSS's capital and financial resources are sufficient. Capital is a risk mitigant for financial failure shocks.
- Counterparty risk includes an evaluation of the DvP procedures used by the system, a mitigant for counterparty default shocks.
- The process and timing of final securities and funds settlement and the length of the settlement cycle are used to determine asset commitment risk. These items are comparable to the risk mitigants for settlement bank, counterparty default and replacement cost shocks.

- Liquidity risk comprises an assessment of a failure to deliver securities or cash on time. The factors considered are similar to the risk mitigants for replacement cost shocks.
- Finally, a consideration of the risk of losses associated with the processing of corporate actions (eg the handling of dividends) determines asset servicing risk.

The system rating is calculated as a weighted average of the first five REAs outlined above.¹

The full Capital Market Infrastructure Risk Ratings were not used, for two reasons. First, asset servicing risk is excluded, as the handling of corporate actions is not part of the settlement process. Second, certain shocks have a greater impact on financial markets than others. The weights used in the calculation are selected to reflect the relative potential importance of these settlement shocks to the financial system. The highest weighting is given to operational and financial risk (as these affect all system participants), followed by asset commitment and counterparty risk (as these only affect some system participants – for example, those trading with a defaulting participant or those using a failing bank for settlement of funds) and liquidity risk (this only affects the participant expecting the delivery of assets).²

The settlement system rating is defined as:

$$SSR_i = \frac{\sum_{j=1}^n (r_j \times w_j)}{\sum_{j=1}^n w_j}$$

where r_j and w_j are the REAs and their weights, respectively, j denotes each of the settlement shocks and i is the country being assessed.

The ratings are presented using the scale developed by Thomas Murray (Table 2).³ A lower risk exposure assessment implies that there are higher quality risk mitigants in that system.

(1) The Bank has not independently verified these assessments.

(2) A sensitivity analysis was conducted to determine the precise value of these weights. The overall ranking was not significantly affected when the weights were changed.

(3) The REAs are published using the alphabetic ratings scale (Table 2). These ratings are converted to a numeric scale to calculate SSR. However, the alphabetic ratings scale is still used for presentation.

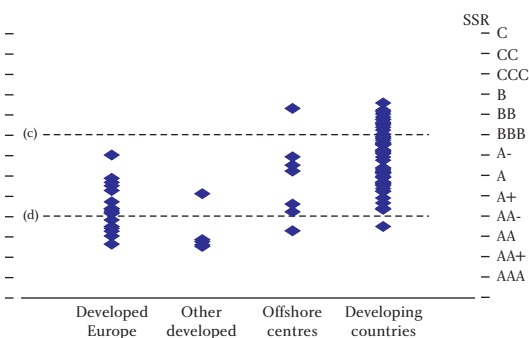
Table 2
Settlement system rating scale

Rating	Risk exposure	Mitigant quality
AAA	Extremely low	Excellent
AA+	Very low	Very good
AA		
AA-		
A+	Low	Good
A		
A-		
BBB	Acceptable	Acceptable
BB	Less than acceptable	Less than acceptable
B	Quite high	Rather poor
CCC	High	Poor
CC	Very high	Very poor
C	Beyond acceptable	Unacceptable

Source: Thomas Murray.

The system ratings are less skewed than the exposure data, with just under a quarter of the systems studied receiving a rating of 'AA-' (very good risk mitigants) or above (Chart 2). Most of these SSSs were located in developed countries. The majority of systems (54%) have an 'A' rating (good risk mitigants). Around one-fifth of systems were rated 'BBB' (acceptable risk mitigants) to 'B' (rather poor risk mitigants). Virtually all of these systems were located in developing countries (the only exception was a system in one of the offshore financial centres). No systems have a rating of 'CCC' (poor risk mitigants) or below.

Chart 2
SSS ratings by region^{(a)(b)}



Sources: Thomas Murray and Bank calculations.

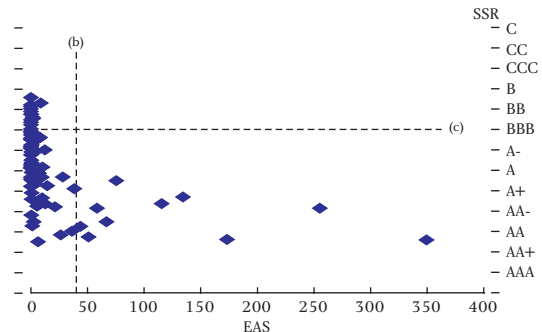
- (a) Data are for 2004 Q2.
- (b) Country groups are those defined by the BIS.
- (c) Lowest acceptable rating (BBB).
- (d) Lowest rating with 'very good' risk mitigants (AA-).

Results

Chart 3 considers exposures to SSSs (EAS) and the rating (SSR) of systems together. The systems most used by UK market participants have either 'very good' or 'good' risk mitigants (right-lower quadrant).

Furthermore, the systems with ratings below BBB ('acceptable risk mitigants') are not used significantly.

Chart 3
Exposures to and ratings of SSSs^(a)



Sources: IMF, ONS, Thomas Murray and Bank calculations.

- (a) Data are for the end of 2004 Q2. Chart excludes United Kingdom to aid presentation. The United Kingdom has an EAS of 1817 and an SSR of AA.
- (b) Mean EAS (calculation includes United Kingdom).
- (c) Lowest acceptable rating (BBB).

The ordering implied by the SRR statistics is driven by the relative importance of the UK's exposures to the systems rather than the quality of risk mitigants.

Unsurprisingly, the domestic SSS (CREST) is clearly the most important system in terms of UK impact (Table 3); on the SRR metric, it is around six times more important than the system ranked second.

Table 3
Key SSSs for United Kingdom markets^(a)

Country	SRR statistic ^(b)
United Kingdom	100.0
United States	16.3
Germany	16.0
Netherlands	9.2
France	8.1
Italy	7.5
Belgium	5.8
Switzerland	3.7
Luxembourg	3.7
Japan	2.8

Sources: IMF, ONS, Thomas Murray and Bank calculations.

- (a) Top ten SSSs by SRR in 2004 Q2.
- (b) Presented as an index where United Kingdom = 100.

Following this, there are three groups of systems, ranked similarly, that are more significant for UK markets than the other SSSs studied. The first group comprises the SSSs in the United States and Germany; the second, the systems in the Netherlands, France, Italy and Belgium; and the third, the SSSs in Switzerland, Luxembourg and Japan.

Belgium and Luxembourg should probably have a higher ranking, as exposures to the international central securities depositories are likely to be greater than estimated by the method of this article.¹

The remaining SSSs are less important; just over half of the systems studied have a ranking statistic below 0.1 (ie these SSSs are estimated to be approximately one thousand times less important than the domestic system).

These results are unlikely to change significantly over time, unless there is an important change in a SSS's procedures (eg major alterations to processing systems or a change in the DvP mechanism) or a substantial reallocation of portfolios to different countries. For example, a decision by UK market participants to increase considerably the amount of trading in developing countries' securities would raise their exposures to settlement systems with lower ratings.

Conclusions

This article has presented a framework for identifying which SSSs are most important for UK markets. It finds that the domestic settlement infrastructure is much more important than foreign systems. This explains why the Bank concentrates on developments

in UK market infrastructure, for example, in *Strengthening financial infrastructure* in the Bank's *Financial Stability Review*.

This analysis also suggests, however, that SSSs in around ten foreign countries are important for UK markets. The Bank, therefore, has an ongoing interest in ensuring that adequate minimum requirements for mitigating risks continue to be met by foreign SSSs. This has been achieved to date through the implementation of recommendations such as CPSS and IOSCO (2001) and G30 (2003). The standards in ESCB and CESR (2004) are intended to be used for the regulation and oversight of EU systems in the near future. The Bank will be participating in the work to implement these standards.

It is possible that, in the near future, minimum risks standards for SSSs could be placed on a statutory basis. The EU Commission (2004) recently stated that 'high-level principles for the authorisation, regulation and supervision of securities clearing and settlement systems' should be included in a directive. If a directive is drafted, the Bank will work to ensure that any such requirements are set at an appropriate level, given the potential settlement risk both domestic and foreign systems pose to UK financial stability.

(1) As explained in the third page of this article, the CPIS data are based on the country of issuer, not the country of settlement.

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