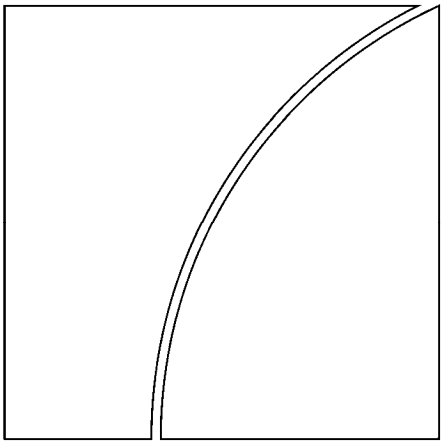
BANK FOR INTERNATIONAL SETTLEMENTS

BIS Quarterly Review

June 2011



International banking and financial market developments

BIS Quarterly Review
Monetary and Economic Department

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Notations used in this Review

e	estimated
lhs, rhs	left-hand scale, right-hand scale
billion	thousand million
…	not available
.	not applicable
–	nil
0	negligible
$	US dollar unless specified otherwise

Differences in totals are due to rounding.

The term “country” as used in this publication also covers territorial entities that are not states as understood by international law and practice but for which data are separately and independently maintained.

Growth and inflation prospects take centre stage[1]

The devastating Japanese earthquake and tsunami and the associated nuclear crisis in early March resulted in a widespread but brief investor retreat to less risky assets. As uncertainty about the economic impact of these events subsided, investors refocused on global growth and inflation prospects as well as possible monetary policy responses. In May, concerns about euro area sovereign debt and the broader impact of any Greek debt restructuring increasingly weighed on investor sentiment.

As prospects for both global growth and inflation moderated over the period, bond yields declined in major developed countries. Prices of many commodities reached a plateau or even fell, lowering the near-term inflation outlook. Investors continued to expect strong growth in emerging economies, but cut back their growth expectations for the United States. The growth outlook for other major advanced economies remained subdued. Strong growth and continuing inflationary pressures from past increases in commodities prices prompted authorities in a number of emerging economies to tighten monetary policy further. Widening growth and interest rate differentials between emerging and developed economies resulted in a broad-based depreciation of the US dollar and capital inflows to emerging market bonds and equities.

As time progressed market participants became increasingly concerned about an eventual restructuring of Greek government debt. This, in turn, fuelled worries that such a restructuring could generate significant losses for European banks. Concerns about an ensuing slowing of economic growth led to a marked depreciation of the euro during May.

Focus on global growth and inflation follows earthquake shock

Japanese earthquake results in short-lived "flight to safety" …

The devastating 11 March Japanese earthquake, and the resulting tsunami and nuclear crisis, triggered a brief but widespread "flight to safety". In the days immediately following the earthquake, international equity indices fell sharply and government bond yields in all major developed markets declined as

[1] This article was produced by the BIS Monetary and Economic Department. The analysis covers the period to 25 May 2011. Questions about the article can be addressed to jacob.gyntelberg@bis.org, nick.vause@bis.org or goetz.von.peter@bis.org. Questions about data and graphs should be addressed to magdalena.erdem@bis.org or garry.tang@bis.org.

investors sought less risky assets (Graph 1). The first days after the disaster were marked by uncertainty about the severity of its economic repercussions and how these would affect asset returns, driving up implied volatilities in international government bond, equity and credit markets (Graph 2). But these effects largely reversed as uncertainty subsided and the Japanese and international authorities responded to events. By mid-April both international and non-Japan Asia equity indices were around 5% higher than immediately before the earthquake.

… and more persistent losses in certain markets

Even so, the disaster did generate more enduring losses in specific segments of financial markets, notably in the Japanese equity market. In late May, almost three months after the disaster, equity prices of Japanese utilities and financial companies were around 45% and 15%, respectively, below their pre-earthquake levels. This reflected investors' assessment of a much diminished future for nuclear energy in Japan and prospective insurance and credit losses. Equivalent indices for Japanese consumer goods and services sector firms also remained somewhat below pre-earthquake values. Internationally, nuclear energy and insurance companies were generally the sectors most affected, with market values failing to regain pre-earthquake levels. By contrast, valuations in other sectors generally recovered. The effects of the Japanese earthquake and tsunami are discussed in more detail in the box on pages 4–5.

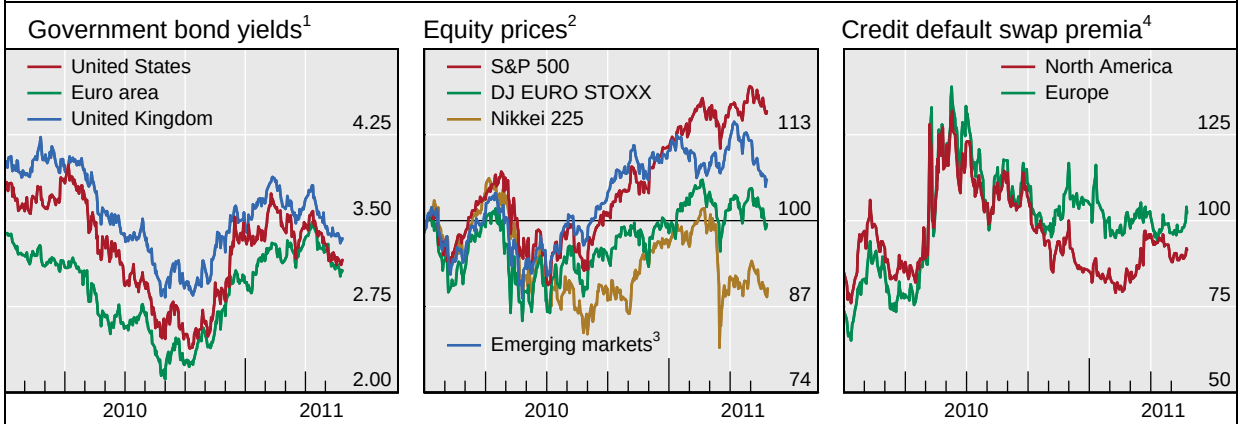
Weakening growth weighs on bond …

Growth and inflation expectations took centre stage as the immediate consequences of the Japanese earthquake for financial markets began to subside. Government bond yields in the United States declined as market participants revised downwards their growth forecasts and pushed back their expectations of a tightening of monetary policy. Yields in other developed economies also fell (Graph 1, left-hand panel), thus reversing the trend of the previous six months.

… equity …

With the notable exception of Japan, major international equity indices were broadly unchanged over the period under review (Graph 1, centre panel). They increased and decreased roughly in step with government bond yields,

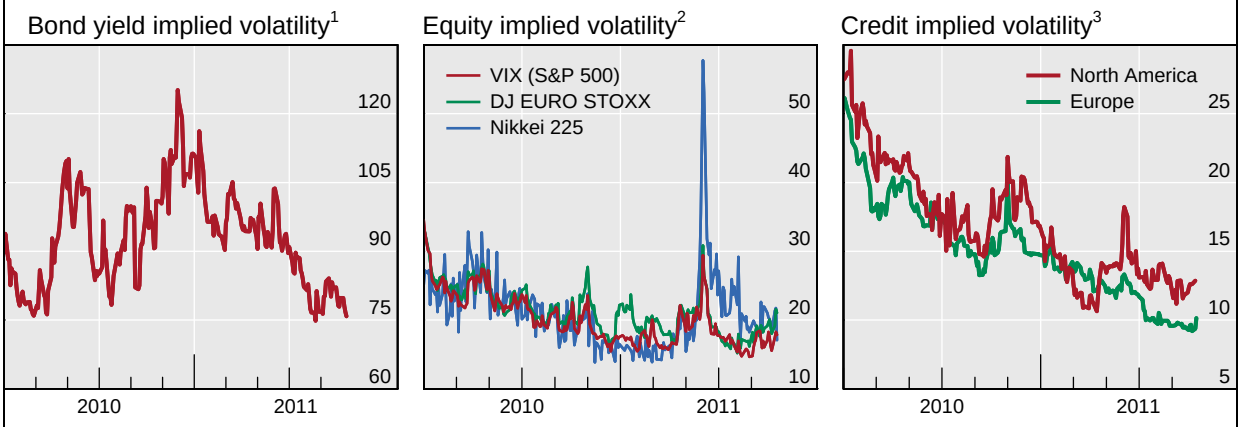
Bond yields, equity prices and credit spreads



[1] Ten-year, in per cent. [2] 4 January 2010 = 100. [3] Average of Asian, European and Latin American emerging market equity indices. [4] Five-year on-the-run mid-spread on CDX North America and iTraxx Europe investment grade CDS indices, in basis points.

Sources: Bloomberg; Markit; BIS calculations. Graph 1

Volatility in bond, equity and credit markets



[1] Merrill Lynch Option Volatility Estimate index; for US Treasury bonds. [2] Volatility implied by the price of at-the-money call option contracts on stock market indices, in per cent. [3] Volatility implied by the price of at-the-money one- to four-month option contracts on CDS indices (CDX High Yield and iTraxx Crossover), in basis points.

Sources: Bloomberg; Datastream; JPMorgan Chase. Graph 2

reflecting the influence of the same driving factors. In addition, growing concerns about public sector indebtedness appeared to depress equity prices in some countries. The escalation of concerns about Greek, Irish and Portuguese government debt in May (see the final section) weighed on equity values of European banks with significant holdings of these assets. It also seemed to undermine equity prices more broadly, with the DJ EURO STOXX index falling by over 5% in May, by increasing prospects for fiscal consolidation in the euro area, which investors saw as a drag on near-term economic growth. In the United States, Standard & Poor's attached a negative outlook to the government's AAA credit rating on 18 April, pointing to the need for fiscal consolidation.

… and credit markets

Changes in credit spreads were modest over the period, but nevertheless show some variation by region (Graph 1, right-hand panel). North American corporate credit default swap premia increased, while those of European companies were broadly unchanged or declined, for both investment grade and lower-rated credits. This probably reflects the divergent trends in growth expectations between the two regions during the review period. The median of forecasters' expectations for US growth in 2011 fell by around 25 basis points, while expectations for growth in Europe were essentially unchanged. Another factor may have been the approaching end of the Federal Reserve's second programme of asset purchases, which raised concerns that rising yields on Treasury bonds may have a negative impact on the prices of risky assets.

Abrupt decline in commodity prices

Commodity prices fall sharply in May …

The prices of a number of commodities fell sharply in early May (Graph 3, left-hand panel), thus reversing the upward trend of the previous two years. However, even before the surprisingly sharp drop, the pace of price increases had been subsiding. The string of bad harvests that had led to a doubling of the

The Japanese earthquake and tsunami

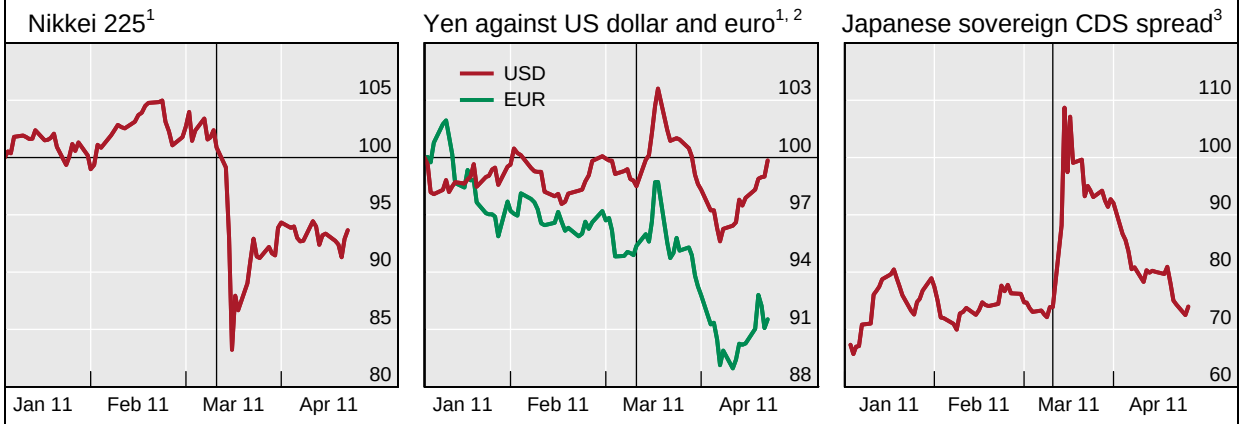
The destruction and human tragedy following the earthquake and tsunami in Japan have been huge. There was an immediate drop in economic activity due to damage to facilities, disruptions to supply lines and power shortages. Recent data releases show that household spending and production have plunged. Damage to the nuclear power plant in Fukushima and ensuing radiation leaks have added to the challenges. The possible implications of these events for the Japanese economy as well as the global economic outlook and financial markets are manifold, and uncertainties associated with these effects continue. Initial assessments by the Japanese Cabinet Office put the damage to the economy's capital stock at around $240 billion, which is more than double the damage following the Kobe earthquake in 1995. GDP declined by 0.9% on the previous quarter in the first three months of 2011. For the year, GDP growth is expected to be about 1 percentage point lower than earlier estimates.

Financial markets reacted very strongly in the immediate aftermath of the disaster (Graph A). The Tokyo stock market plummeted by almost 20% in the first two business days after the earthquake, and Japanese sovereign CDS spreads jumped by 30 basis points, probably reflecting concerns about the extra fiscal burden implied by reconstruction. The foreign exchange market was also very volatile, with the Japanese yen appreciating sharply against the US dollar, reaching a high of 76.3 on 17 March. Reportedly, this was driven by market speculation that Japanese insurance companies would repatriate US dollar funds to meet yen-denominated claims.

The Bank of Japan responded swiftly. To ensure ample liquidity, it offered funding of ¥82.4 trillion in the first week after the earthquake, of which ¥57.8 trillion was actually provided to the market. The Bank also increased the amount of its asset purchase programme by ¥5 trillion, to prevent a deterioration in risk sentiment from adversely affecting output. In response to the yen's sharp appreciation, the Ministry of Finance and the central bank, together with other G7 countries, embarked on a concerted intervention in the foreign exchange market.

On 6–7 April, the Bank of Japan unveiled a ¥1 trillion special lending facility to channel funds to banks for lending to distressed businesses in the affected areas, and broadened the range of eligible collateral assets for money market operations. In addition, the government announced a supplementary budget of ¥4 trillion for reconstruction purposes on 22 April. These measures supported market functioning despite the severity of the shock. Markets calmed quickly after their initial reaction: the stock market recovered somewhat; the yen retreated to trade in the range of 82–83 against the US dollar; and Japan's CDS spread declined.

Market reactions to the Tohoku Pacific earthquake



The vertical line indicates the date of the earthquake.

[1] 3 January 2011 = 100. [2] An increase indicates a yen appreciation. [3] Five-year spread, in basis points.

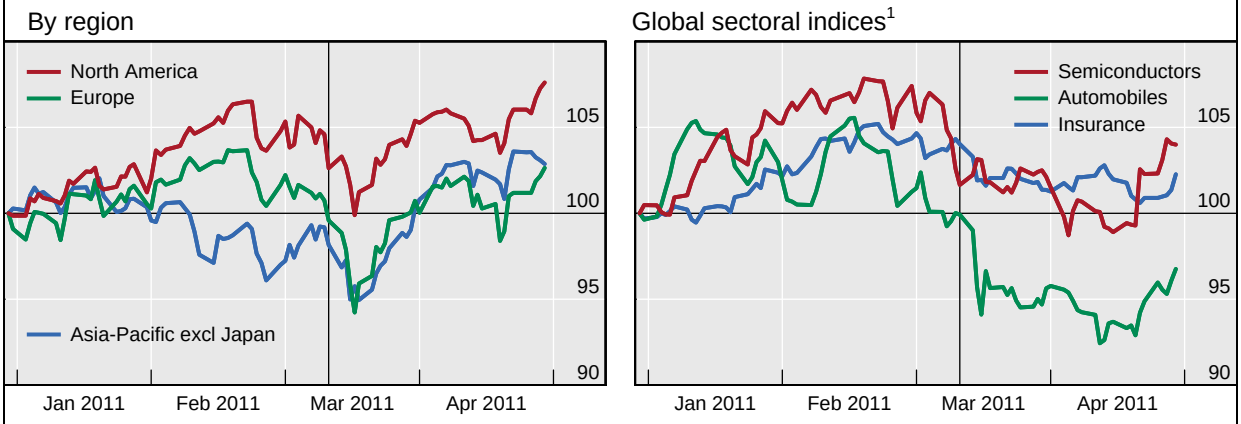
Source: Bloomberg.

Graph A

Outside Japan, the impact on financial markets was limited, and largely confined to sectors seen as being most directly affected by supply chain disruptions or direct loss exposures. A primary concern in financial markets has been that an extended period of power shortages in Japan might adversely affect industrial production through global supply chains, given that Japan is a major producer of components for the semiconductor and automotive industries. Thus, while broad equity market indices have shown signs of resilience (Graph B, left-hand panel), certain sectoral indices fell sharply following the news of the disaster, and have subsequently recouped only part of their initial losses (Graph B, right-hand panel).

MSCI equity indices

In local currency; end-December 2010 = 100



The vertical line indicates the date of the earthquake.

[1] Relative to the MSCI Global index.

Source: Datastream.

Graph B

prices of agricultural commodities in the nine months to March 2011 came to an end, helping to stabilise prices. Weaker industrial production after the earthquake in Japan dampened the prices of industrial metals.

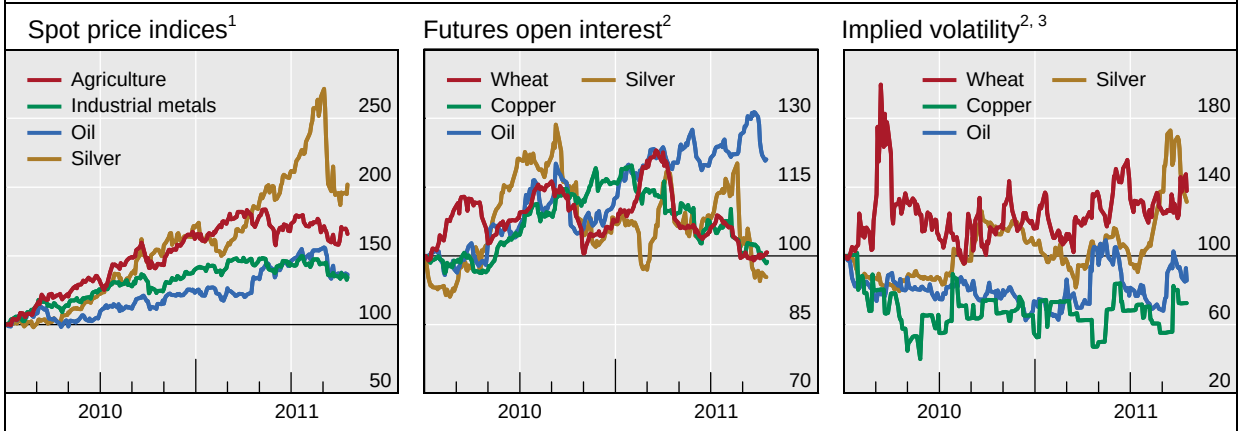
Oil turned out to be the main exception to the stabilisation of commodity prices. Prices rose by around 10% between March and early May as political tensions interrupted Libyan supplies, notwithstanding a commitment from the Organization of the Petroleum Exporting Countries (OPEC) in early March to offset this through an increase in its supply of oil. That said, this commitment may have contributed to reductions in implied volatilities of oil prices in March. Uncertainty about the future of nuclear energy following the disaster in Japan also put upward pressure on oil prices during the period.

... and financial investors withdraw

Prices of most commodities dropped sharply in a few days in early May. Silver prices plunged by 30% while oil prices fell by 10% during the same period. In both markets, increasing margin requirements significantly amplified initial price falls. Previous months' price increases had coincided with sizeable investments by financial investors seeking assets that would appreciate with global inflation. Open interest in commodity futures, which are the main financial instrument through which investors obtain exposure to commodity prices, rose significantly, in particular in the silver market. Moderating perceptions of global inflationary pressures following negative economic news in early May from the United States and Germany may have prompted some investors to close out their positions. Open interest in silver on futures markets

Commodity prices

1 July 2010 = 100



[1] S&P GSCI indices. [2] For copper, LME copper futures; for oil, NYMEX WTI crude futures; for wheat, CBOT wheat futures; for silver, COMEX silver 5000 troy oz. [3] Historical call implied volatilities for first generic futures contracts. For copper, COMEX copper futures.

Sources: Bloomberg; Datastream. Graph 3

fell by 15% on 6 May (Graph 3, centre panel). Since then, implied volatility for silver has risen sharply, suggesting that market participants perceive a risk of further sharp price falls (Graph 3, right-hand panel). In contrast, the implied volatility of oil prices is not especially elevated compared to levels of recent months.

Bond markets, inflation outlook and exchange rates

Near-term inflation outlook moderates …

Throughout the period under review, investors and policymakers remained focused on the inflationary impact of current and past changes in growth and commodity prices. Even though central banks around the world continued to face different growth outlooks for their economies, bond market prices indicated that near-term inflation expectations declined somewhat across the major mature economies between early March and late May. As growth expectations retrenched from April onwards, US, euro area and UK market-implied near-term inflation rates also fell (Graph 4). At the same time, the uncertainty surrounding near-term inflation developments earlier in the year dissipated somewhat. Implied near-term inflation volatility, inferred from the prices of two-year options on inflation, trended down for much of the period, particularly for the United States (Graph 4).

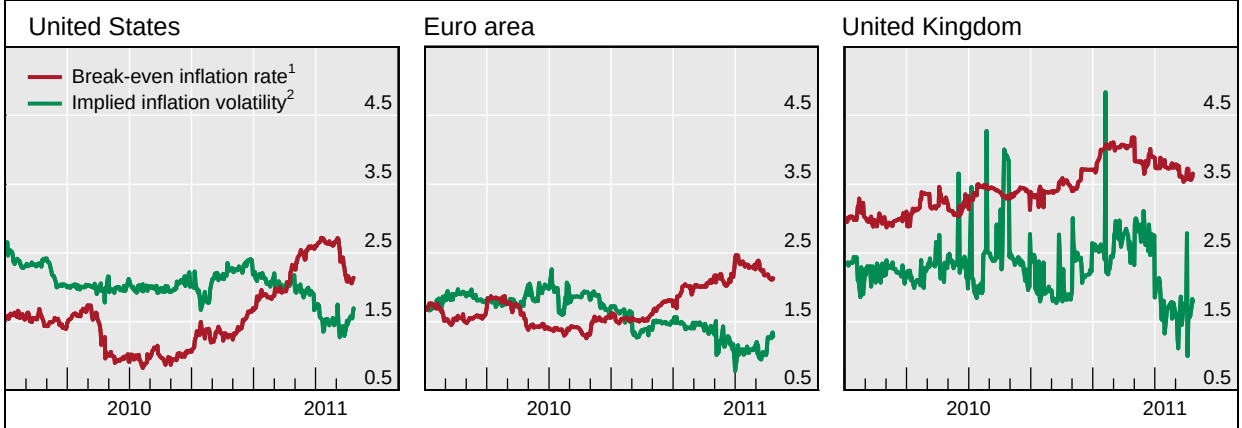
… and inflation uncertainty declines

Investors price in later US and UK policy rate hikes

Market participants pushed back the expected timing of the first increase in policy rates in the United States and the United Kingdom. The Federal Reserve kept the federal funds rate target unchanged throughout, despite increases in market-implied near-term inflation until mid-April. Afterwards, the moderating outlook for short-term inflation and the renewed commitment to keep rates low for an extended period, made at the first ever press conference on 27 April following a meeting of the Federal Open Market Committee, led investors to reprice the odds of an early increase in interest rates. By late May, market-implied forward rates indicated that market participants expected policy

Short-term break-even inflation rates and inflation volatility

In per cent



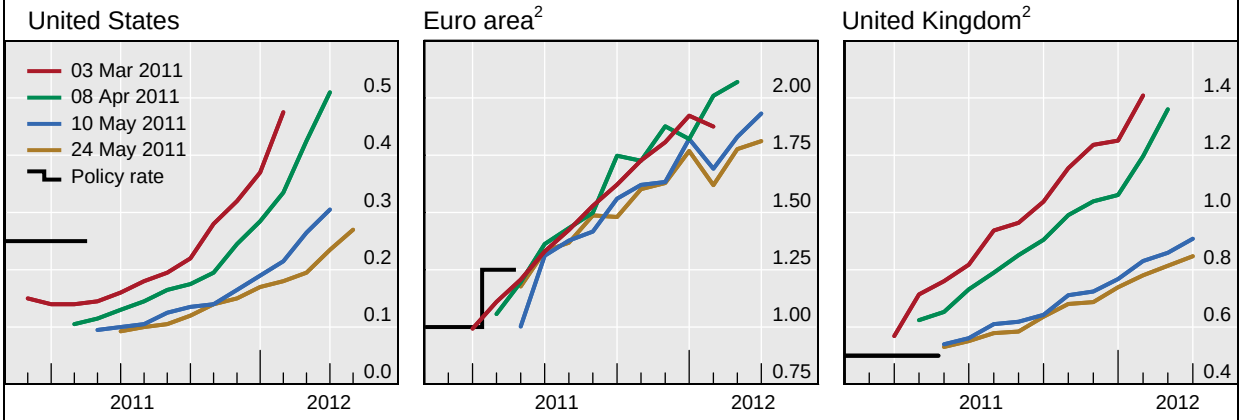
[1] Based on two-year inflation swap prices. [2] Backed out from two-year inflation cap prices, using the model of F Black, "The pricing of commodity contracts", *Journal of Financial Economics*, 3, 1976, pp 167–79, assuming a flat term structure of implied forward volatilities in the pricing of the series of caplets embedded in the cap.

Sources: Bloomberg; BIS calculations. Graph 4

rates to remain stable until late 2011 (Graph 5, left-hand panel). The Fed's decision to keep policy accommodative at its April meeting also led to declining US government bond yields and a weakening of the dollar. By contrast, oil prices and equity prices rose, sending benchmark equity indices to near three-year highs.

Market participants also revised their expectations about when the Bank of England might respond to rising inflation and increase policy rates. Market-implied forward rates indicate that investors put significant odds on a rate hike at the meeting of the Monetary Policy Committee in early March (Graph 5, right-hand panel). They pushed back the expected timing of the first rate hike when the expected increase did not materialise. In the subsequent months, market participants continued to revise their expectations in response to moderating inflationary pressures.

Implied forward interest rates[1]



[1] For the United States, federal funds futures; for the euro area, EONIA forward rates; for the United Kingdom, SONIA forward rates. [2] One-month rates implied by overnight index swaps.

Sources: Bloomberg; BIS calculations. Graph 5

In Europe, signs of a more robust recovery early in the period reinforced expectations that inflation had reached levels high enough to prompt increases in the ECB policy rate (Graph 5, centre panel). This contrasted with the pattern seen during most of 2010, when the expected timing of rate hikes had been repeatedly pushed further into the future. By early March, implied forward interest rates indicated that the first euro area tightening move was likely to occur in April. In line with expectations, the ECB on 7 April raised the main refinancing rate by 25 basis points to 1.25%. The hike had been signalled in speeches, and forward rate developments during March indicated that the move was broadly anticipated by market participants. By mid-May, implied forward interest rates indicated that the next ECB policy tightening was expected in July. At its May meeting, the Governing Council kept the policy rate at its new level, which the ECB characterised as "still accommodative".

Real bond rates decline

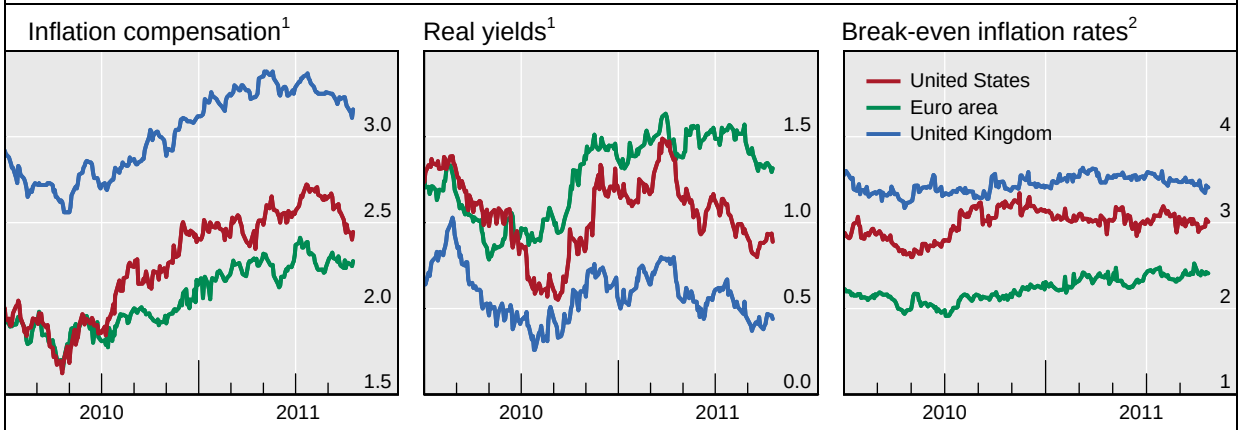
The combination of a weaker recovery and the prospect of postponed monetary policy tightening drove the decline in long-term government bond yields across major mature economies. In the UK case, the decrease in nominal yields reflected both a gradual decline in compensation for inflation and falling real rates (Graph 6, left-hand and centre panels). In contrast, declines in both the euro area and US 10-year nominal yields were due mainly to lower real yields. Finally, bond market implied inflation expectations for the euro area, the United Kingdom and the United States remained stable (Graph 6, right-hand panel). On balance, therefore, investors appeared to view the very gradual normalisation of monetary policy priced into futures markets as still consistent with stable longer-run inflation.

Tighter monetary policy in emerging markets

Monetary policy in most emerging market economies was on an entirely different track from that in the major advanced economies. The central banks of China, India, Brazil and several other emerging markets all tightened policy in response to inflationary pressures from commodity markets and strong economic activity. The People's Bank of China further increased bank reserve requirements by a total of 150 basis points during the review period, bringing

Decomposition of 10-year government bond yields

In per cent

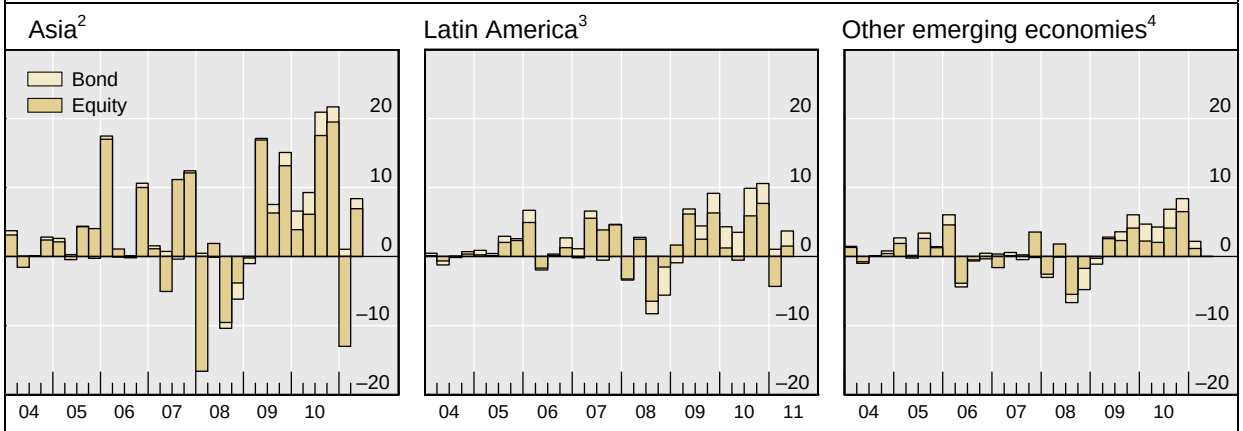


[1] Contribution to 10-year nominal yield from inflation compensation and the real yield over 0–10 years. All rates are zero coupon rates. [2] Five-year-ahead five-year break-even inflation rates from inflation swaps.

Sources: Bloomberg; national data; BIS calculations. Graph 6

Capital flows into emerging markets[1]

In billions of US dollars



[1] Sums of weekly data up to 18 May 2011 across the economies listed. [2] China, Chinese Taipei, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. [3] Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. [4] The Czech Republic, Hungary, Poland, Russia, South Africa and Turkey.

Source: EPFR. Graph 7

the ratio to 21%. The Reserve Bank of India raised its repo rate by a total of 75 basis points to 7.25%. And the Central Bank of Brazil increased the SELIC target rate to 12%. Real policy rates however remained below zero in several countries.

High growth and interest rate differentials drive capital flows and currency markets

Differing monetary policy trajectories and growth paths between developing and developed markets help explain shifts in capital flows into emerging markets and movements in exchange rates. Emerging market bond and equity funds saw inflows during April and May, after flows in the opposite direction in the first quarter of the year (Graph 7). The US dollar depreciated against many currencies for much of the review period (Graph 8, left-hand and centre panels).

Fiscal concerns return to euro area government bond markets

Sovereign debt concerns return

Investor attention returned to the sustainability of public finances in the euro area, particularly in Greece, Ireland and Portugal. Yields on Greek, Irish and Portuguese government bonds rose during April and May, mainly driven by more negative assessments of the countries' repayment capacities (Graph 9, left-hand panel). Also, during the period as a whole, sovereign CDS spreads increased more at the shorter end of the maturity spectrum (Graph 9, centre panel). This development is consistent with the view that a credit event in the near term was perceived as more likely by investors.[2]

Credit spreads soar …

All three countries were downgraded by major credit rating agencies during the period. The cost of credit protection on sovereign debt advanced through April, with spreads of CDS referencing one-year debt shooting up to over 2,000 basis points for Greece, 800 basis points for Ireland and 720 basis

[2] Credit events specified by CDS contract clauses include default on scheduled payments and involuntary debt restructurings.

points for Portugal. Although CDS spreads have a mixed record as predictors of default, the rapid increase in short-term spread levels underscored the rise in investors' near-term concerns. A series of missed deficit targets in Greece added to the negative investor sentiment, prompting bond yields to rise significantly in the space of a few weeks.

With large fiscal deficits and continued low growth, Portugal became the third euro area sovereign to seek financial assistance on 6 April. The request came after a fiscal austerity package was voted down in parliament and the prime minister resigned on 23 March, pushing Portuguese bond yields noticeably higher.

... despite policy efforts

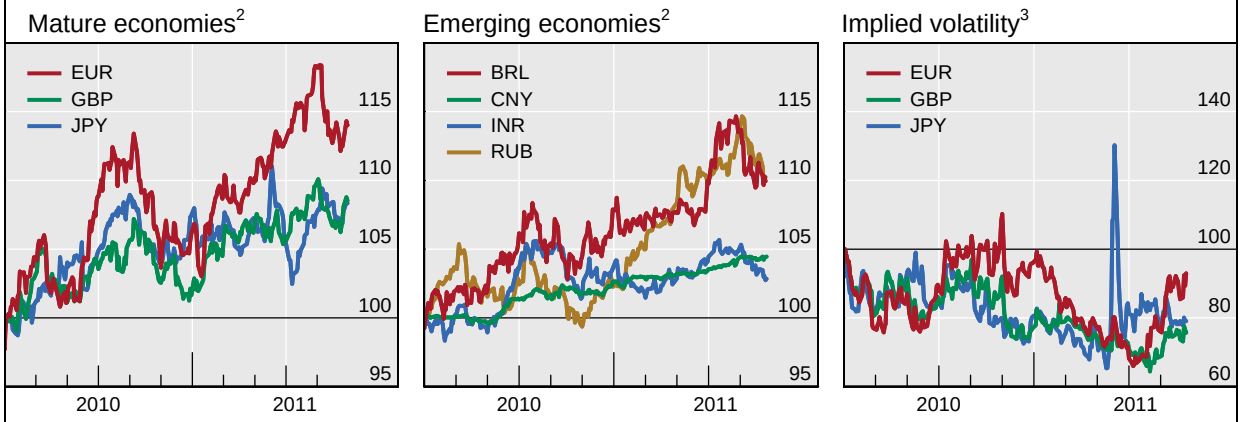
Credit spreads remained elevated even as policymakers successfully negotiated a three-year programme for Portugal. While both bond yields and credit spreads continued to reflect significant investor concerns, they also indicated that market participants were increasingly taking a more differentiated view across euro area sovereign borrowers. For most of the period until the end of May this decoupling was most visible for Italy and Spain, whose spreads over German government bonds remained relatively stable. In the case of Spain, this probably reflects the perceived progress in implementing fiscal adjustments and banking reforms. Progress on the consolidation of Spanish "cajas" (savings banks) has also allowed recapitalisation needs to be better gauged, thereby reducing investor uncertainty.

Another positive development was seen for Ireland. Here the mandated stress tests of Irish banks in late March pointed to bank recapitalisation needs of €24 billion, notably less than originally provisioned for in the support programme. This outcome met with a mildly positive sovereign bond market reaction and lower bank CDS spreads (Graph 9, right-hand panel), suggesting that market participants regarded the stress tests as credible.

Concerns about Greek debt reach new highs

At the same time, developments in Greece continued to test both policymakers and investors. By mid-May, Greek government bond yields as well as credit spreads reached new highs, apparently reflecting market

Exchange rates against the US dollar[1]

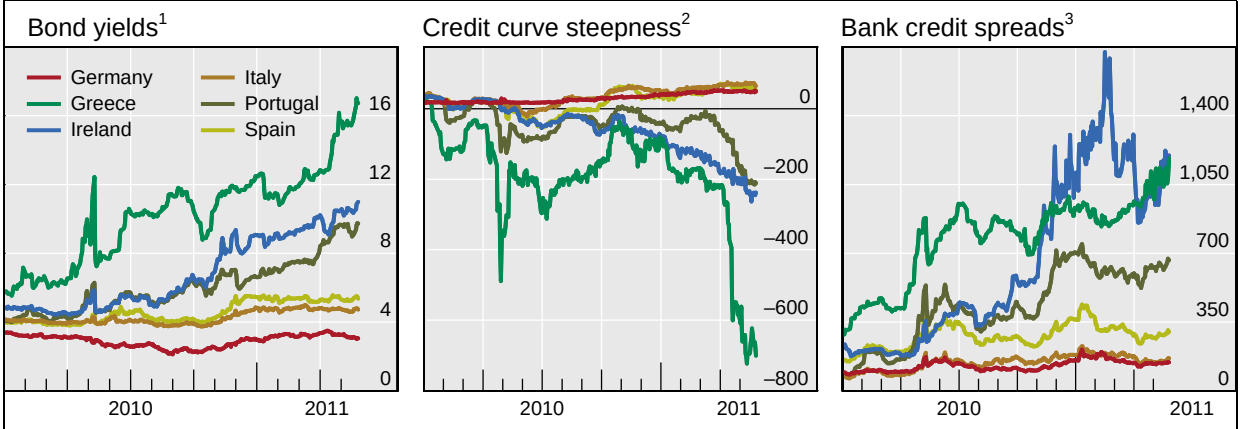


BRL = Brazilian real; CNY = Chinese renminbi; EUR = euro; GBP = pound sterling; INR = Indian rupee; JPY = Japanese yen; RUB = Russian rouble.

[1] 1 July 2010 = 100. [2] An increase indicates an appreciation against the US dollar. [3] One-month option implied volatility.

Source: Bloomberg. Graph 8

Euro area sovereigns and banks



[1] Ten-year government bond yields, in per cent. [2] Difference between 10-year and two-year CDS spreads, in basis points. [3] Equally weighted average of senior five-year CDS spreads of selected banks.

Sources: Bloomberg; Markit; BIS calculations. Graph 9

participants' view that a voluntary restructuring could occur in the near term. This perception in part reflected statements by European policymakers, even though no formal decisions had been taken and programme reviews were still under way. Towards the end of May, concerns about euro area sovereign debt and the broader impact of any Greek debt restructuring increasingly weighed on investor sentiment.

The cost and composition of funding for euro area banks has continued to reflect the deterioration in sovereign creditworthiness. In addition, domestic and foreign exposures to government bonds continued to raise concerns about European banks (see the Highlights section). Credit spreads for banks in fiscally strained European countries remained well above those for other banks (Graph 9, right-hand panel). Also, Greek, Irish and Portuguese banks continue to have limited access to private market funding, with small-scale debt issuance confined to covered or guaranteed bonds, and have become reliant on central bank liquidity, which funds 18%, 8% and 7% of their total assets, respectively.

Euro drops on debt concerns

The intensifying concerns about Greek, Irish and Portuguese debt also had repercussions for the euro area as a whole. The euro depreciated against many currencies in May, and uncertainty about near-term movements in the exchange rate increased markedly, as reflected for example in the implied volatility of the euro-dollar rate (Graph 8, right-hand panel).

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Highlights of the BIS international statistics

The BIS, in cooperation with central banks and monetary authorities worldwide, compiles and disseminates several datasets on activity in international banking and financial markets. The latest available data on the international banking market refer to the fourth quarter of 2010. The discussion on international debt securities and exchange-traded derivatives draws on data for the first quarter of 2011. OTC derivatives market statistics are available up to end-2010. There are three boxes in this chapter. The first gives details on breaks in series caused by the transfer of claims to "bad banks" in a number of countries. The second presents data on the maturity structure of EME sovereign debt. The third discusses the statistical implications of central clearing of OTC derivatives.

The international banking market in the fourth quarter of 2010[1]

The aggregate cross-border claims of BIS reporting banks declined during the fourth quarter of 2010, largely as a result of a significant fall in lending to residents of the euro area. By contrast, the cross-border claims of BIS reporting banks on residents of emerging market economies (EMEs) increased for the seventh consecutive quarter. Data from the BIS consolidated banking statistics suggest that most of the growth in the stock of international claims on EME residents that has taken place during the past couple of years can be attributed to increased short-term lending.

Global cross-border lending falls[2]

The aggregate cross-border claims of BIS reporting banks declined during the fourth quarter of 2010. The bulk of the $423 billion (1.4%) contraction was due to a $378 billion (1.9%) fall in interbank lending (Graph 1, left-hand panel). The rest was accounted for by a $45 billion (0.4%) drop in claims on non-banks.

Cross-border lending to advanced economies shrinks …

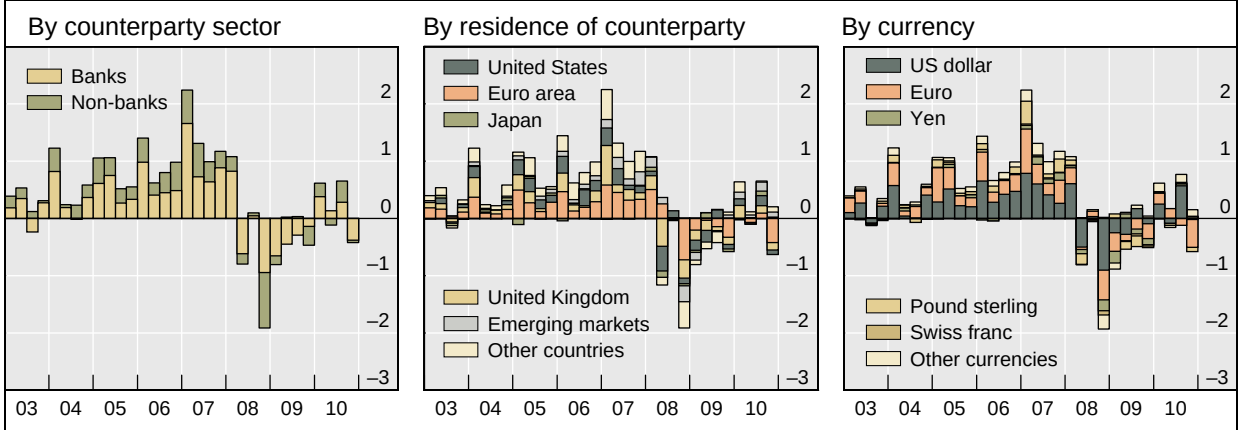
Banks reported declines in their cross-border claims on most major advanced economies (Graph 1, centre panel). Lending to residents of the euro

[1] Queries concerning the banking statistics should be addressed to Stefan Avdjiev.

[2] The analysis in this and the following subsection is based on the BIS locational banking statistics by residence. In this dataset, creditors and debtors are classified according to their residence (as in the balance of payments statistics), not according to their nationality. All reported flows in cross-border claims have been adjusted for exchange rate fluctuation and breaks in series.

Changes in gross cross-border claims[1]

In trillions of US dollars



[1] BIS reporting banks' cross-border claims include inter-office claims.

Source: BIS locational banking statistics by residence. Graph 1

area shrank the most (by $422 billion or 4.0%). Nearly half of that decrease ($208 billion) was due to a fall in intra-euro zone cross-border claims. Cross-border lending to residents of the United Kingdom and the United States also declined, by $126 billion (2.5%) and $80 billion (1.5%) respectively. By contrast, claims on residents of Japan increased by $23 billion (3.0%).

The currency composition of the cross-border lending flows in the fourth quarter largely mirrored the counterparty residence breakdown (Graph 1, right-hand panel). Namely, claims denominated in euros shrank the most (by $490 billion or 4.3%). Nearly three quarters of that fall was accounted for by a $359 billion drop in euro-denominated cross-border claims on residents of the euro area. Claims denominated in sterling and US dollars also declined, by $71 billion (4.2%) and $17 billion (0.1%), respectively. Conversely, yen-denominated claims increased (by $31 billion or 2.6%) for the fourth consecutive quarter.

Cross-border claims on emerging markets continue to grow

... while that to emerging markets continues to grow

The cross-border claims of BIS reporting banks on EME residents went up for the seventh consecutive quarter (Graph 2). The $91 billion (3.3%) expansion was the result of a $74 billion (5.2%) rise in interbank claims and a $17 billion (1.2%) increase in claims on non-banks. Cross-border claims rose in all EM regions except emerging Europe, where they contracted for the eighth time in the last nine quarters.

Cross-border lending to Asia-Pacific continued to grow (Graph 2, bottom right-hand panel). Once again, most of the lending flows were directed towards China: claims on its residents rose by $46 billion (16%). Banks also reported significant increases in their claims on India ($9.7 billion or 5.5%) and Thailand ($6.0 billion or 18%). Conversely, claims on Korea shrank by $20 billion (9.0%).

Cross-border claims on residents of Latin America and the Caribbean also continued to expand (Graph 2, top right-hand panel). The $24 billion (4.8%) rise in lending to the region was led by large increases in claims on residents of Mexico ($7.7 billion or 7.2%) and Brazil ($7.6 billion or 3.2%). Banks also

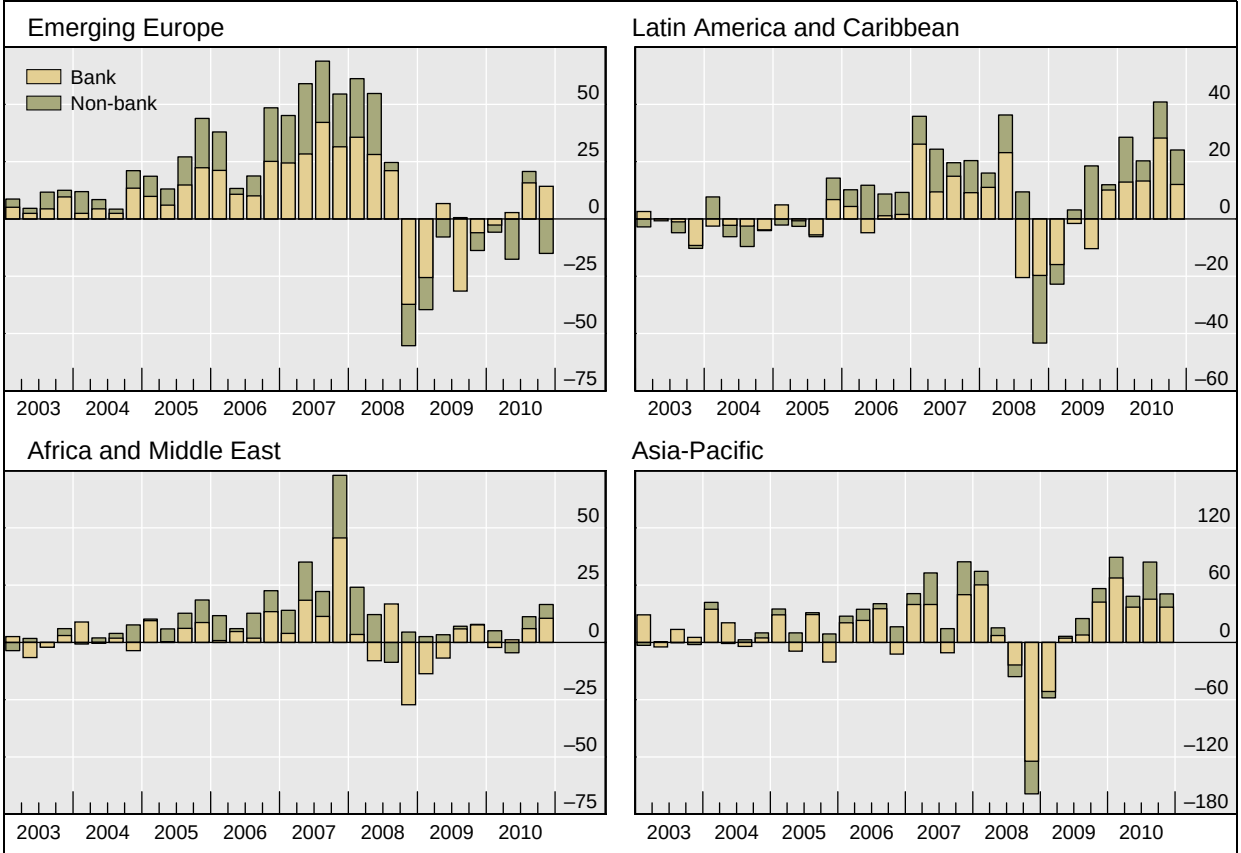
reported sizeable growth in their cross-border lending to Colombia ($3.0 billion or 24%) and Uruguay ($2.2 billion or 69%).

Cross-border claims on residents of Africa and the Middle East recorded their largest expansion since the first quarter of 2008 (Graph 2, bottom left-hand panel).[3] The $17 billion (3.4%) overall increase was led by an $11 billion (5.4%) rise in interbank claims. Cross-border lending to residents of Qatar and Saudi Arabia grew the most, by $6.2 billion (11%) and $4.5 billion (5.5%), respectively.

Emerging Europe was the only EM region that saw a decline in cross-border claims on its residents during the period (Graph 2, top left-hand panel). Claims on banks in the area actually rose by $14 billion (3.6%). However, that increase was more than offset by a $15 billion (4.0%) fall in claims on non-banks. Cross-border lending to Hungary shrank the most (by $13 billion or 15%). Claims on residents of Poland also fell considerably (by $4.9 billion or 3.8%). In addition, banks reported declines in their claims on all three Baltic countries – Lithuania ($1.4 billion or 8.3%), Estonia ($0.9 billion or 5.9%) and Latvia ($0.4 billion or 2.4%). By contrast, cross-border lending to Turkey

Changes in cross-border claims on residents of emerging markets[1]

By counterparty sector, in billions of US dollars



[1] BIS reporting banks' cross-border claims (including inter-office claims) in all currencies.

Source: BIS locational banking statistics by residence. Graph 2

[3] Note that the latest available data on cross-border lending to the residents of Africa and the Middle East refer to the fourth quarter of 2010, ie before some countries in the region began to experience sociopolitical turmoil.

surged by $11 billion (7.8%). The expansion in claims, which was the fifth in a row and the largest on record, occurred despite the fact that the country's central bank decreased overnight borrowing rates during the period in an effort to discourage further capital inflows and simultaneously increased reserve requirements in an attempt to slow down credit growth. BIS reporting banks also increased their cross-border claims on residents of the Czech Republic (by $3.0 billion or 6.7%), Ukraine (by $2.2 billion or 9.3%) and Romania (by $1.9 billion or 3.3%).

Increased weight of short-term claims in bank lending to EMEs[4]

The steady stream of financial flows into emerging market economies that has taken place over the past couple of years naturally raises questions about the share of those flows that is subject to sudden withdrawals. Needless to say, no statistical dataset can explicitly capture the intentions behind investors' actions. Nevertheless, the maturity breakdown of banks' international claims available in the BIS consolidated banking statistics on an immediate borrower basis[5] provides useful information on the percentage of bank capital flows into EMEs with a short investment horizon.[6]

Short-term lending drove most of the recent growth in international claims on EMEs

Most of the growth in the stock of BIS reporting banks' international claims on EME residents that took place from the second quarter of 2009 to the end of 2010 was driven by an increase in short-term lending. Approximately $418 billion (or 79%) of the $527 billion overall expansion can be attributed to a rise in claims with maturities of less than one year. By comparison, that group of claims accounted for roughly 49% of the increase in international lending to emerging markets between the start of 2006 and the middle of 2008.

Graph 3 presents a maturity breakdown of the changes in the stocks of international claims on the four major emerging market regions.[7] Changes in short-term claims were most dominant in Asia-Pacific, where they were responsible for approximately 84% of the overall increase in international claims that took place during the latest seven quarters for which data are available. That group of claims also accounted for considerable shares of the respective

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[4] The analysis in this subsection is based on the BIS consolidated international banking statistics on an immediate borrower basis. In this dataset, the exposures of reporting banks are classified according to the nationality of banks (ie according to the location of banks' headquarters), not according to the location of the office in which they are booked.

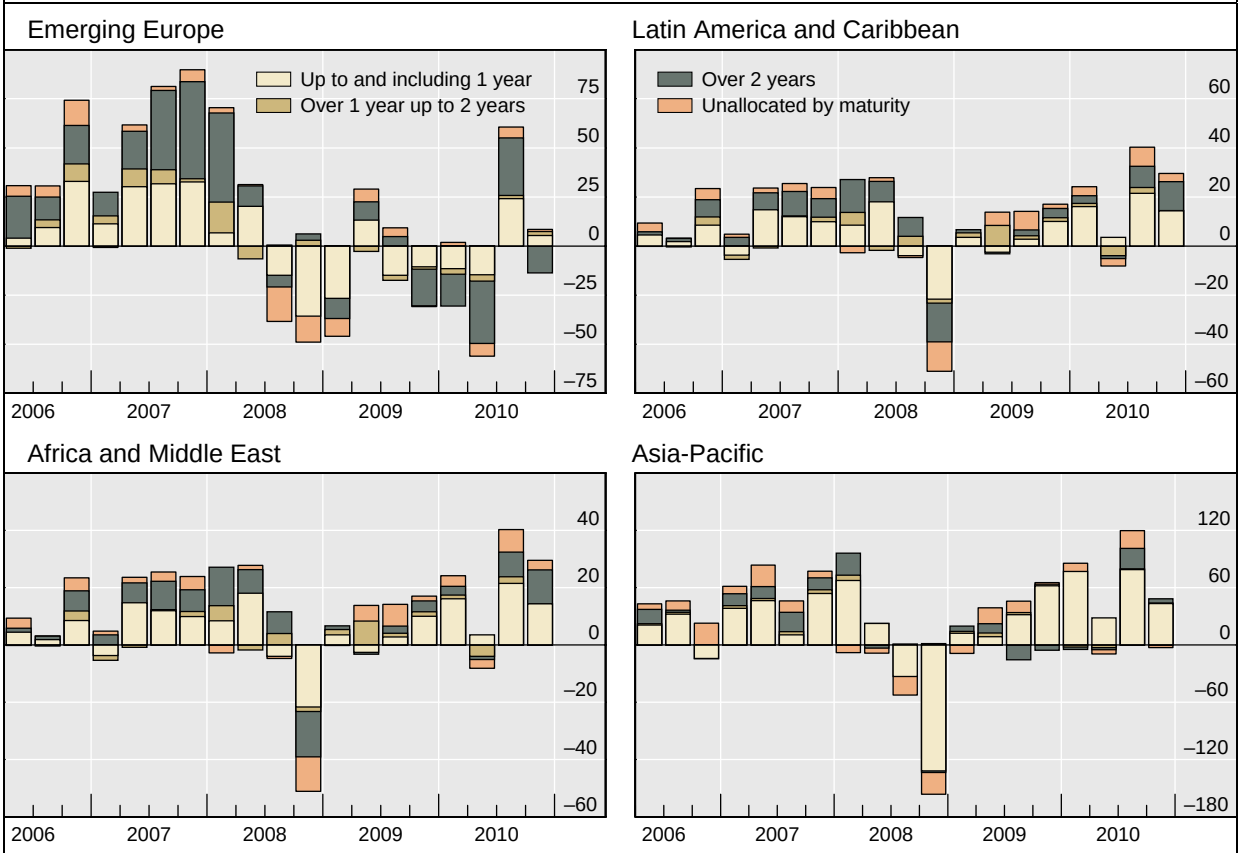
[5] *International claims* consist of cross-border claims (ie claims on entities located in a country other than the country of residence of the reporting banking office) and local claims (ie claims on entities located in the country of residence of the reporting banking office) of foreign affiliates (ie branches and subsidiaries located outside the country in which the reporting bank is headquartered) denominated in foreign currencies (ie currencies other than the official currency of the country of residence of the reporting banking office). International claims do *not* include claims on residents of the country in which the reporting bank is headquartered.

[6] The maturity breakdown of international claims in the BIS consolidated banking statistics on an immediate borrower basis is based on their *remaining* maturity (ie the time to final maturity of claims at the time of reporting).

[7] The BIS consolidated banking statistics do not include a currency breakdown. As a result, the changes in the outstanding stocks of international claims reported above have not been adjusted for exchange rate fluctuations.

Changes in international claims on residents of emerging markets

By maturity, in billions of US dollars



Source: BIS consolidated banking statistics (immediate borrower basis). Graph 3

increases in international lending to residents of Africa and the Middle East (71%) and Latin America and the Caribbean (50%). By contrast, the impact of these short-term claims on fluctuations in the overall stock of international claims on residents of emerging Europe was significantly smaller.

BIS reporting banks' foreign claims on residents of the euro area[8]

In an effort to provide more comprehensive data on the consolidated foreign claims and other potential exposures (on an ultimate risk basis) of reporting banking systems, the BIS has decided to start publishing a new table (Table 9E) in the Statistical Annex.[9] The new table is an extended version of Table 1 on page 15 in "Highlights of the BIS international statistics" in the March 2011 *BIS Quarterly Review*. More specifically, it contains bilateral sectoral breakdowns of the foreign claims of major reporting banking systems

[8] The analysis in this subsection is based on the BIS consolidated international banking statistics on an ultimate risk basis. In this dataset, the exposures of reporting banks are classified according to the nationality of banks (ie according to the location of banks' headquarters), not according to the location of the office in which they are booked. In addition, the classification of counterparties takes into account risk transfers between countries and sectors (see the box on pages 16–17 in the March 2011 *BIS Quarterly Review* for a more detailed discussion and examples of risk transfers).

[9] Available at http://www.bis.org/statistics/consstats.htm.

on the residents of a wide range of countries. It also provides detailed bilateral information on other potential foreign exposures of the same reporting banking systems.

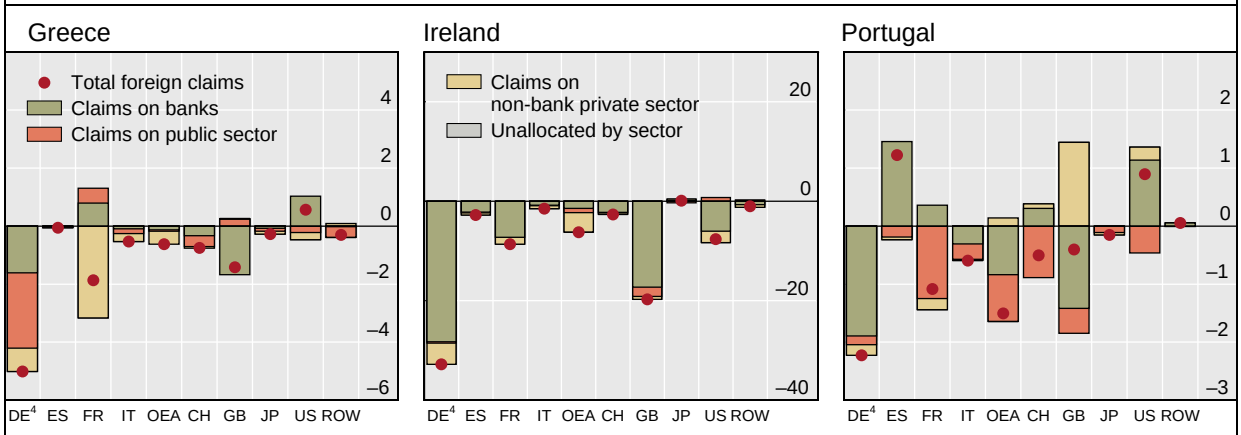
Exchange rate adjusted consolidated foreign claims on the euro area decline

BIS reporting banks' total consolidated foreign claims[10] on residents of the euro area stood at $7,601 billion as of the end of the fourth quarter of 2010. According to our estimates, at constant exchange rates,[11] that group of claims fell by $291 billion (3.5%) during the quarter.[12] Foreign claims on Germany shrank the most (by $87 billion or 4.8%), mainly as a result of considerable declines in claims on the country's banking and public sectors ($54 billion or 8.5% and $45 billion or 8.6%, respectively).

As of the end of 2010, BIS reporting banks had total consolidated foreign claims of $810 billion on residents of Greece, Ireland and Portugal, the three euro area countries that have received external support from the EU and the IMF. Our estimates indicate that, at constant exchange rates, foreign claims on that group of countries shrank by $97 billion during the fourth quarter (Graph 4).

Estimated changes in foreign claims[1] on Greece, Ireland and Portugal during Q4 2010, by bank nationality[2]

At constant end-Q4 2010 exchange rates,[3] in billions of US dollars



DE = Germany; ES = Spain; FR = France; IT = Italy; OEA = other euro area; CH = Switzerland; GB = United Kingdom; JP = Japan; US = United States; ROW = rest of the world.

[1] Foreign claims consist of cross-border claims and local claims of foreign affiliates. [2] Claims of banks headquartered in the respective country are not included, as these are not foreign claims. [3] All claims are assumed to be denominated in euros. [4] Claims of German banks are on an immediate borrower basis.

Source: BIS consolidated banking statistics (ultimate risk basis). Graph 4

[10] *Foreign claims* consist of cross-border claims (ie claims on entities located in a country other than the country of residence of the reporting banking office) and local claims (ie claims on entities located in the country of residence of the reporting banking office) of foreign affiliates (ie branches and subsidiaries located outside the country in which the reporting bank is headquartered). Foreign claims do *not* include claims on residents of the country in which the reporting bank is headquartered.

[11] In order to adjust for the currency fluctuations that took place during the period, we make the (admittedly imperfect) assumption that all foreign claims on residents of the euro area are denominated in euros.

[12] All flow figures in have been adjusted for breaks in series. See Box 1 on page 19 for a detailed discussion of the more significant breaks in series that occurred during the period.

Box 1: Breaks in series in the BIS international banking statistics in the fourth quarter of 2010

Stephan Binder

A break in series refers to a change in reporting methodology or in reporting population during a given period. Reporting banks provide pre- and post-break values for the outstanding stocks of claims as of the end of each period in which such a break occurs.[1] The end-of-period stocks of claims published by the BIS are based on the latest reported post-break values. The changes in the stocks of claims that took place during a period are adjusted for breaks by subtracting the difference between the post- and pre-break values from the difference between the unadjusted stocks of claims as of the end of the current and the previous period. Such adjustments are crucial for understanding the extent to which changes in the stocks of outstanding claims relate to normal business activities of reporting institutions.

Breaks in series had a large impact on the BIS international banking statistics in the fourth quarter of 2010. Some of the largest breaks were reported by German and Irish banks. A large share of these breaks occurred due to transfers of assets and other potential exposures from BIS reporting banks to asset management companies ("bad banks").[2] In general, such asset management companies do not report in the BIS international banking statistics since they are considered to be non-banks. As a consequence, transfers of assets from BIS reporting banks to bad banks result in declines in the foreign exposures reported in the BIS international banking statistics. These are not recorded as changes in stocks, but as breaks in series. In the last quarter of 2010, significant breaks due to such transfers were recorded in both the BIS consolidated and locational banking statistics.

In the BIS consolidated banking statistics, German banks reported a break in series of –$24 billion in foreign claims on an immediate borrower basis and –$18 billion in foreign claims on an ultimate risk basis. In the BIS locational statistics, banks located in Germany reported a break of –$112 billion in unconsolidated cross-border claims. Most of the latter break was due to transfers of inter-office cross-border assets to the domestic asset management company FMS Wertmanagement. Such inter-office positions are excluded from the BIS consolidated banking statistics. That explains the different break sizes in the locational and the consolidated positions reported by Germany.

Another large break was reported by Ireland. The restructuring of a large international banking group and the closure of domestic offices by a foreign bank were jointly responsible for a break of –$174 billion in Irish banks' consolidated foreign claims on an immediate borrower basis and –$170 billion in their consolidated foreign claims on an ultimate risk basis.[3] In the BIS locational statistics, banks resident in Ireland reported a break of –$140 billion in unconsolidated cross-border claims.

Finally, in the case of France, there was a significant break in series that resulted from a change in the methodology used by the reporting central bank. A French bank controlled by a foreign non-bank financial company, whose accounts are prudentially supervised by the competent foreign authority, was reclassified from a consolidated domestic bank to an unconsolidated foreign bank in the French data. This reclassification had no impact on the aggregate BIS consolidated banking statistics. However, it did generate a break in the time series of French domestic banks equal to –$330 billion in foreign claims on an immediate borrower basis and –$336 billion in foreign claims on an ultimate risk basis.

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[1] Historical lists of breaks in series are available at http://www.bis.org/statistics/bankstats.htm for each of the datasets. [2] A "bad bank" is a financial institution created to hold non-performing assets and other potential exposures. [3] These figures represent preliminary estimates. Revisions are likely to follow.

Most of that contraction was due to an $83 billion (15%) decline in foreign claims on residents of Ireland. Claims on banks in the country fell the most (by $66 billion or 42%). Internationally active banks also reported declines in their foreign claims on the Irish non-bank private and public sectors ($14 billion or 3.7% and $2.6 billion or 10%, respectively).

Foreign claims on Greece and Portugal also declined during the period, although by much less than those on Ireland. Nearly half of the $10.3 billion (6.0%) fall in claims on residents of Greece was due to a $5.0 billion (5.8%) decrease in reporting banks' foreign claims on the country's non-bank private sector. By contrast, a $4.6 billion (9.3%) fall in foreign claims on the public sector of Portugal was the main driver of the $4.3 billion (1.9%) overall decline in foreign claims on that country.

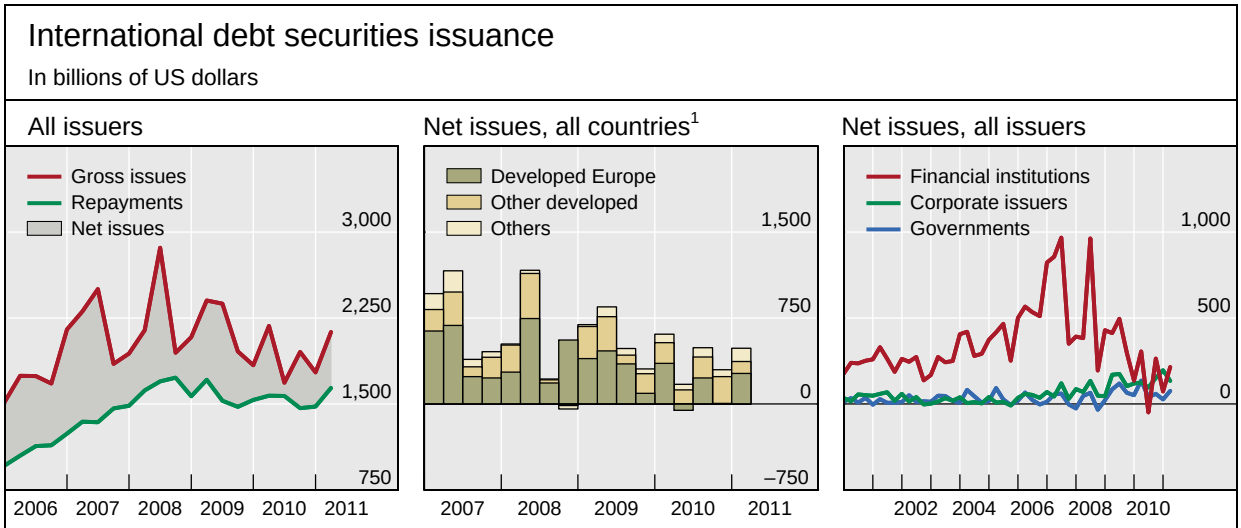
International debt securities issuance in the first quarter of 2011[13]

Rising issuance in the international debt securities markets ...

Activity in the primary market for international debt securities increased in the first quarter of 2011. Completed gross issuance rose by 20% quarter-on-quarter to $2,127 billion (Graph 5, left-hand panel), reflecting a seasonal pickup[14] as well as some increase in the underlying market activity reflecting generally benign market conditions. With somewhat higher repayments, net issuance picked up to $487 billion, from $299 billion in the previous quarter.

... especially by borrowers in advanced European economies

The rise in market activity was largely due to stronger borrowing by residents of developed European economies, where net issuance rebounded to $265 billion (Graph 5, centre panel). This was far higher than the $4 billion



[13] Queries concerning international debt securities should be directed to Andreas Schrimpf.

[14] See J Amato and J Sobrun, "Seasonality in international bond and note issuance", *BIS Quarterly Review*, September 2005, pp 36–9, for an analysis and discussion of seasonal factors in debt securities issuance patterns. As noted by the authors, issuance by European residents, which accounts for a large share of the overall figure, is typically strongest in the first quarter of the year. On an annual basis, completed gross issuance in the first quarter of 2011 actually declined slightly (by 2%) relative to the first quarter of the previous year.

raised in the fourth quarter of 2010, but still short of the levels seen before the financial crisis. Net issuance by residents of other developed economies shrank to $106 billion, from $235 billion in the previous three months. Robust net borrowing activity was observed in EMEs, residents of which raised $51 billion net of repayments. International financial institutions tapped the market to raise $62 billion, the highest amount ever.

Financials raise large amounts

Financial borrowers were the most active in the first quarter of 2011. They accounted for the largest share of net issues ($215 billion), followed by non-financial corporate borrowers ($135 billion) and governments ($76 billion). From a longer perspective, net issuance by financial institutions seems to have stabilised after the sharply lower and highly volatile issuance activity in the aftermath of the financial crisis of 2007–08 (as depicted in Graph 5, right-hand panel). Net issuance by financial institutions resident in EMEs has rebounded sharply from its lows during the crisis and, at $21 billion in the first quarter of 2011, has almost regained the level of $23 billion last seen in the fourth quarter of 2006.

Robust borrowing in the non-financial corporate sector

Robust non-financial corporate borrowing reflected the favourable market conditions in this particular segment of the international debt securities market (Graph 5, right-hand panel). The increase in corporate bond issuance was particularly strong in the United States, where net issuance by corporations has exceeded that by financial institutions in most quarters since mid-2008.

Issuance by European financials bounces back

Financial institutions resident in developed European economies expanded their funding via international debt securities. Completed gross issuance by these institutions increased by 28%. Net issuance stood at $171 billion, after net repayments of $33 billion in the fourth quarter of 2010. Financial institutions located in France raised $66 billion, those in the United Kingdom $40 billion and those in the Netherlands $34 billion (Graph 6, left-hand panel). Spanish ($30 billion) and Italian financial institutions ($19 billion) responded to more favourable market conditions by raising more funds in the international debt securities market. High redemptions by Irish financial institutions ($131 billion) more than offset gross issuance of $61 billion, resulting in net repayments amounting to $70 billion, thus continuing a trend towards net repayments over the previous year. Greek financial institutions borrowed $3 billion, an amount well below their average net borrowing over the past year.

Strong quarter of covered bond issuance

Covered bond markets witnessed strong issuance activity during the first quarter of 2011. Estimated net issuance rose to $64 billion, the largest amount since the fourth quarter of 2008. However, there was some dispersion across countries: French, Italian and Spanish institutions raised $26 billion, $18 billion and $10 billion respectively, whereas German institutions made net repayments of covered bonds worth $27 billion.

Box 2: Maturity structure of domestic central government debt in emerging market economies

Agustín Villar

The Committee on the Global Financial System (CGFS) has collected figures on the maturity structure of domestic central government debt outstanding in emerging market economies (EMEs). They show that the average maturity of such debt outstanding remained stable in most countries between 2008 and 2010 (Table A), notwithstanding the fact that the global financial crisis deeply affected financial markets for issuers, including sovereign borrowers. The distribution of the average (remaining) maturity of the domestic central government debt stock across countries shows three countries with an average maturity greater than 10 years, 10 countries with an average maturity between five and 10 years, and 10 countries with an average maturity of less than five years.

Maturity of domestic central government debt outstanding[1]

Average original and remaining maturity in years[2]

	2005		2008		2009		2010	
	At issue	Re-maining	At issue	Re-maining	At issue	Re-maining	At issue	Re-maining
Latin America	3.4	3.9	14.7	4.8	13.2	4.5	13.2	4.6
Of which:								
Argentina	1.1	12.0	17.9	10.5	16.2	10.0	16.2	9.5
Brazil	…	2.3	…	3.3	…	3.4	…	3.4
Mexico	…	3.4	…	6.5	…	6.4	…	7.2
Asia, larger economies	10.1	7.0	11.5	7.6	11.0	7.5	10.3	7.6
Of which:								
India	14.0	10.0	14.9	10.6	13.8	10.5	11.2	9.8
Korea	6.1	4.1	7.5	4.5	7.6	4.6	8.1	5.0
Other Asia	8.0	5.5	7.6	4.4	7.6	4.3	7.7	4.3
Of which:								
Malaysia	8.6	5.0	9.7	5.3	9.2	5.3	8.7	4.5
Central Europe	6.6	4.0	8.4	4.4	7.7	4.2	7.7	3.9
Of which:								
Czech Republic	8.6	5.7	9.3	5.8	9.6	5.9	9.4	3.4
Hungary	…	4.1	7.1	3.8	5.3	2.7	6.4	2.9
Poland	6.2	3.6	8.6	4.2	7.9	4.1	7.5	4.3
Other	7.3	4.3	8.0	4.1	8.5	4.5	9.3	5.1
Of which:								
Turkey	3.3	1.8	3.9	1.9	4.0	1.9	4.2	2.5
South Africa	16.0	8.1	18.3	9.9	18.0	10.6	18.0	10.6
Total	8.2	5.0	10.0	5.4	9.7	5.2	9.5	5.4
Memo:								
Hong Kong SAR	*6.4*	*4.0*	*6.7*	*3.5*	*6.6*	*3.4*	*6.4*	*3.5*
Singapore	*6.2*	*3.6*	*7.0*	*3.6*	*6.2*	*3.2*	*6.3*	*3.3*
Industrial countries	*10.4*	*5.9*	*11.0*	*5.0*	*10.4*	*5.1*	*10.5*	*5.3*

[1] This table updates Table D4 in *CGFS Papers* no 28, June 2007. It includes bonds, notes and money market instruments. Regional totals are based on the countries listed in Table D4 and weighted by the corresponding amounts outstanding. [2] These estimates should be regarded as indicative and may not be strictly comparable across countries. The detailed country data are available on the BIS website (www.bis.org/statistics/secstats.htm).

Sources: CGFS Working Group Survey; BIS. Table A

Two countries that saw a notable shortening of maturities were the Czech Republic and Hungary. In the Czech Republic, the average maturity of domestic central government debt outstanding fell from 5.8 to 3.4 years between 2008 and 2010. In Hungary it fell from 3.8 to 2.9 years over the same period. This coincided with significant increases in gross government debt, from 30% to 40% of GDP in the Czech Republic and from 72% to 80% of GDP in Hungary.[①]

The amount of EME domestic central government debt outstanding grew to almost $4.3 trillion at the end of 2010 (Table B). More than half of the increase took place in 2009, a year of exceptional government debt issuance in Asia, Latin America and other EMEs as governments tried to pursue a countercyclical fiscal policy. Notwithstanding this government activism, domestic central government debt expanded by less than the overall stock of domestic debt. Other sectors of the economy, including central banks through their issuance of money market instruments, increased their issuance even more than governments, whose share of outstanding domestic debt fell to 48.4% in 2010, from 51.5% in 2007. In Asia, the corporate sector was the most dynamic borrower in domestic debt markets.

Changes in stocks of domestic debt securities:[1] all issuers

In billions of US dollars

	2008	2009	2010	2010 stocks	Annual growth[2]	
					FX-adjusted	At current exchange rates[3]
Asia	574.3	732.5	510.8	5,926.0	13.7	14.1
Of which: central govt	123.2	328.8	192.6	2,384.0	11.9	12.2
Latin America	180.5	119.3	129.0	2,050.0	8.6	9.0
Of which: central govt	53.7	98.4	34.6	1,203.4	6.8	8.6
Central Europe	25.2	39.6	25.3	352.6	9.7	4.8
Of which: central govt	17.1	17.0	8.6	267.1	5.5	0.5
Other EMEs	25.3	66.3	64.6	486.3	14.5	10.5
Of which: central govt	21.3	59.8	56.3	412.3	14.8	9.5
Total	805.2	957.8	729.8	8,815.0	12.4	12.0
Of which: central govt	215.2	504.0	292.2	4,266.8	10.2	9.8

This table updates Table C3 in *CGFS Papers* no 28, June 2007, and includes money market instruments. The detailed country data are provided on the BIS website (www.bis.org/statistics/secstats.htm).

[1] Bonds, notes and money market instruments issued by residents and targeted at resident investors. The changes in stocks have been calculated in original local currencies by country and converted into US dollar amounts at quarterly average exchange rates, to arrive at net changes which exclude the effect of movements in the US dollar on the outstanding stock of debt. [2] Arithmetic mean of 2008–10 growth rates. [3] In US dollar terms.

Sources: National data; BIS. Table B

[①] IMF, *Fiscal Monitor*, "Shifting gears: tackling challenges on the road to fiscal adjustment", April 2011.

Emerging economies continue to borrow

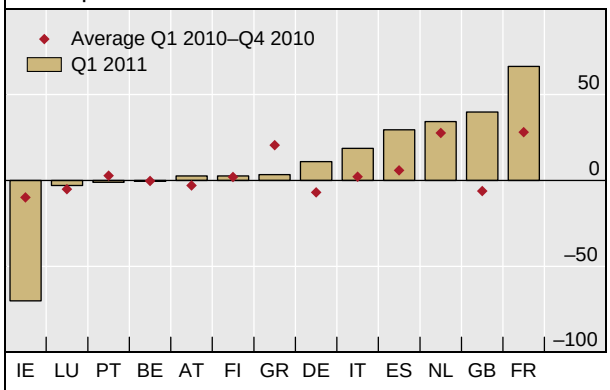
Issuance by borrowers in EMEs remained fairly robust (Graph 6, right-hand panel).[15] Among the emerging market regions, the strongest net issuance in the first quarter of 2011 was by borrowers in Latin America and the

[15] The share of gross issues of international debt securities by emerging market borrowers denominated in non-major currencies (ie other than the US dollar, euro, yen and sterling) amounted to 14% in the first quarter of 2011. While borrowing in non-major currencies has trended up slightly in recent quarters, its share is still well below the peak of 26% reached in the third quarter of 2007.

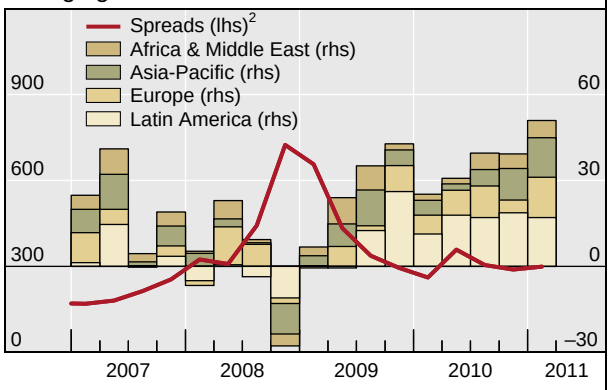
International debt securities issuance

In billions of US dollars

European financial institutions[1]



Emerging markets[1]



AT = Austria; BE = Belgium; DE = Germany; ES = Spain; FI = Finland; FR = France; GB = United Kingdom; GR = Greece; IE = Ireland; IT = Italy; LU = Luxembourg; NL = Netherlands; PT = Portugal.

[1] Net issues, by residence of issuer. [2] Quarterly JPMorgan EMBI Global Composite index, in basis points.

Sources: Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; BIS. Graph 6

Caribbean ($17 billion), led by residents of Mexico ($5 billion) and Venezuela ($3 billion). Borrowing by entities from emerging Europe increased strongly to $14 billion after just $4 billion during the previous quarter. Net issuance in Asia-Pacific amounted to $14 billion in the first quarter of 2011, a $3 billion increase from the previous quarter. In emerging Europe and Asia, borrowers in Russia, Turkey and Korea tapped the market most, raising $4 billion, $3 billion and $7 billion respectively.

Over-the-counter derivatives in the second half of 2010[16]

Positions increase somewhat

Notional amounts outstanding of over-the-counter (OTC) derivatives rose by 3% in the second half of 2010, reaching $601 trillion at end-December (Graph 7, left-hand panel). Much of the increase was a direct consequence of the appreciation of major currencies against the US dollar, the currency in which the data are reported. Gross market values of all OTC contracts fell by 14% (right-hand panel), driven mainly by the 17% decline in the market value of interest rate contracts. Finally, gross credit exposures dropped by 7% to $3.3 trillion, compared with a 2% increase in the first half of the year.[17]

Dollar depreciation masks weak activity in the interest rate segment

In the interest rate segment, the largest risk category in the OTC derivatives market by any measure, notional amounts outstanding went up by 3% to $465 trillion, largely owing to exchange rate effects. Contracts on dollar rates dropped by 8%. Positions increased in the euro (10%), yen (7%), Swiss franc (10%) and Swedish krona (14%), but this probably reflected the appreciation of those currencies against the US dollar rather than any genuine

[16] Queries concerning the OTC derivatives markets should be addressed to Nicholas Vause.

[17] Gross credit exposures take into account legally enforceable bilateral netting agreements. Excluding CDS contracts for all countries except the United States.

increase in activity. Among the major currencies, only the Canadian dollar segment showed a decline. Amounts outstanding of contracts denominated in that currency fell by 4%, despite its 6% appreciation against the US dollar.

Higher positions in short- and long-term FX contracts

Active trading at the shorter end of the FX derivatives market pushed up notional amounts of FX derivatives by 9%, to $58 trillion. Volumes outstanding of contracts with maturities of up to one year went up by 13% and those with maturities of more than five years by 11%. By contrast, amounts outstanding of those with intermediate maturities declined by 6%.

Stable amounts outstanding in the CDS market

Positions in credit default swaps (CDS) remained stable in the second half of 2010. At the end of the year, reporting dealers had contracts with a total face value of $30 trillion on their books, approximately the same as six months earlier. Amounts outstanding with a central counterparty increased from about 10% of the total market at end-June to 15% at end-December 2010 (see Box 3). Positions with non-financial customers plummeted to $0.3 trillion, only about 1% of the total. This compares to a peak of 5% reached at the end of December 2009 (Graph 8, right-hand panel) and just under 3% in the middle of 2010.

The sovereign CDS market bucked the downward trend in notional amounts, posting a 6% increase. This followed a 26% gain during the first half of 2010. Positions in non-sovereign CDS declined by 2% in the second half of the year (after falling by 7% in the previous period).

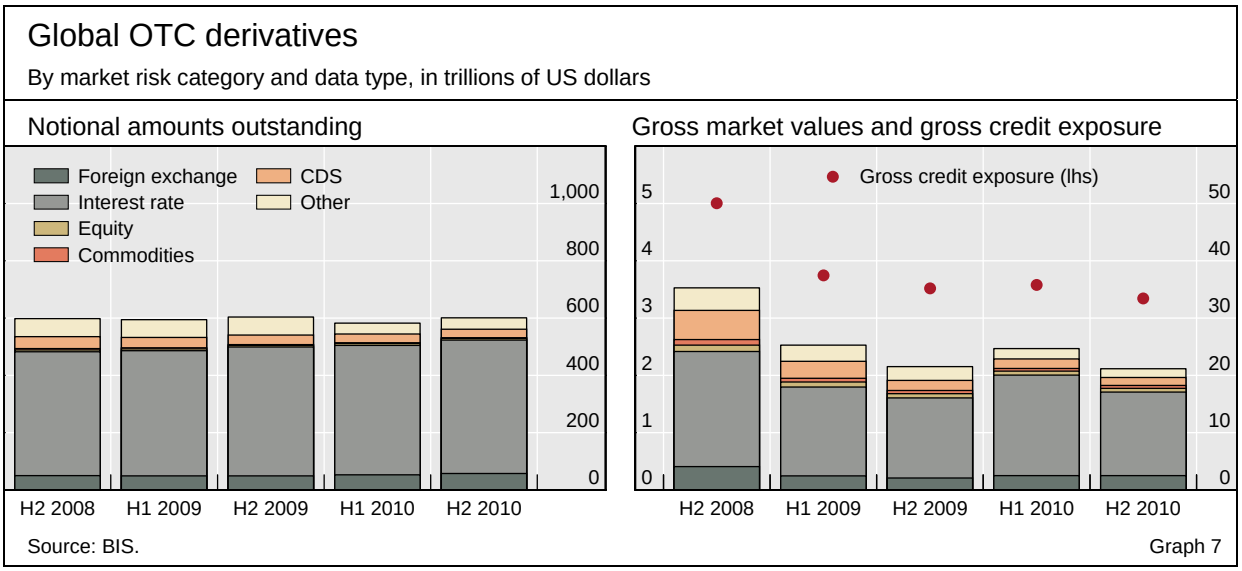
Exchange-traded derivatives in the first quarter of 2011[18]

Higher turnover and open interest in futures and options

Activity on the international futures and options exchanges rose in the first quarter of 2011. Turnover measured by notional amounts increased to $581 trillion, 21% higher than in the previous quarter (Graph 9, left-hand panel). Open interest, also measured in notional amounts, expanded by 24% between end-December 2010 and end-March 2011. Activity grew in all market segments except foreign exchange.

Global OTC derivatives

By market risk category and data type, in trillions of US dollars



Source: BIS.

Graph 7

[18] Queries concerning exchange-traded derivatives should be addressed to Christian Upper.

Turnover in the interest rate segment went up by 23% to $498 trillion. This mainly reflected heavy trading in futures and options on short-term interest rates, whose turnover increased by 23% and 30%, respectively. Trading in contracts on bonds also rose (15%). The growth in activity affected all major

Positioning on a rate hike pushed up turnover in sterling money market contracts

Box 3: Central clearing and OTC derivatives statistics

Nicholas Vause

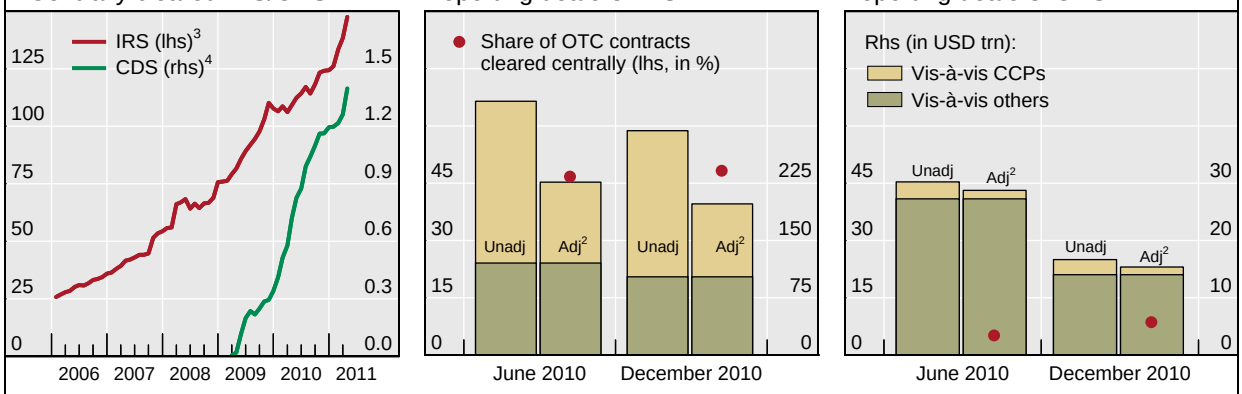
The amount of OTC derivatives cleared centrally has increased considerably in recent years (Graph A, left-hand panel). This has implications for measuring the size of the OTC derivatives market. Central clearing doubles the outstanding volume of any OTC derivative to which it is applied. This is because it involves replacing a contract between two counterparties, say A and B, with one contract between A and a central counterparty (CCP) and a second contract between B and the CCP.[①] In addition to these rather mechanical effects, clearing contracts centrally also affects volumes outstanding through the increased scope for multilateral netting and through the impact on traders' incentives. In this box, we focus on the direct impact on amounts outstanding.

While central clearing doubles the number of contracts, it does not change the volume of underlying risk that is being transferred by OTC derivatives. If the aim is to measure the size of this risk transfer, then it is appropriate to halve outstanding contract volumes with CCPs. It is also appropriate if the objective is to establish the volume or proportion of contracts in OTC derivatives markets that is centrally cleared.

However, if one is interested in counterparty risk, then the total volume of outstanding derivatives contracts, ie without halving the amounts cleared with CCPs, is the relevant figure. Although CCPs are intended to have very low default probabilities, these are not zero.[②] It is therefore necessary to count all contracts to which they are a counterparty, along with all other contracts, when evaluating the total volume of counterparty risk in OTC derivatives markets.

Graph A shows the growing importance of CCPs in OTC interest rate and credit derivatives markets and the effect that halving CCP positions can have on contract volumes in these markets.

Central counterparties in interest rate swap and credit default swap markets



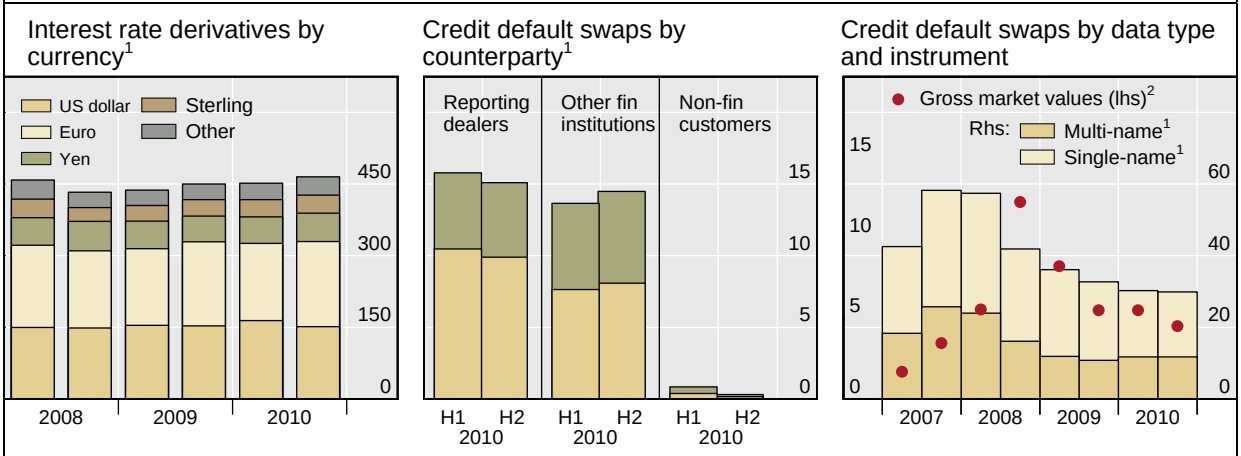
[1] Interest rate swaps (IRS) and credit default swaps (CDS); notional amounts outstanding, in trillions of US dollars. [2] Volume of CCP contracts is halved. [3] Approximated by IRS cleared by SwapClear. [4] Approximated by CDS cleared by ICE Trust and ICE Clear Europe. Note that these data overstate outstanding volumes by the amount of contracts that have terminated during the period.

Sources: IntercontinentalExchange; LCH.Clearnet; TriOptima; BIS. Graph A

① For a fuller description of the mechanics of central clearing, see N Vause, "Counterparty risk and contract volumes in the credit default swap market", *BIS Quarterly Review*, December 2010. ② For an investigation of the risk faced by CCPs, see D Heller and N Vause, "Expansion of central clearing", in this issue.

Global OTC derivatives

In trillions of US dollars and in per cent



[1] Notional amounts outstanding. [2] As a percentage of the notional amount outstanding.

Source: BIS. Graph 8

currencies except the Japanese yen (Graph 9, centre panel). Particularly large increases were recorded in the short-term sterling segment, where futures turnover surged by 57% and options turnover by 113% as traders took positions on the changing odds of a Bank of England policy rate increase. In Japan, the odds of a rate change remained low throughout the period, which could explain the 20% drop in turnover at both the long and the short end of the interest rate market.

Stock price increases lift dollar turnover of equity index contracts

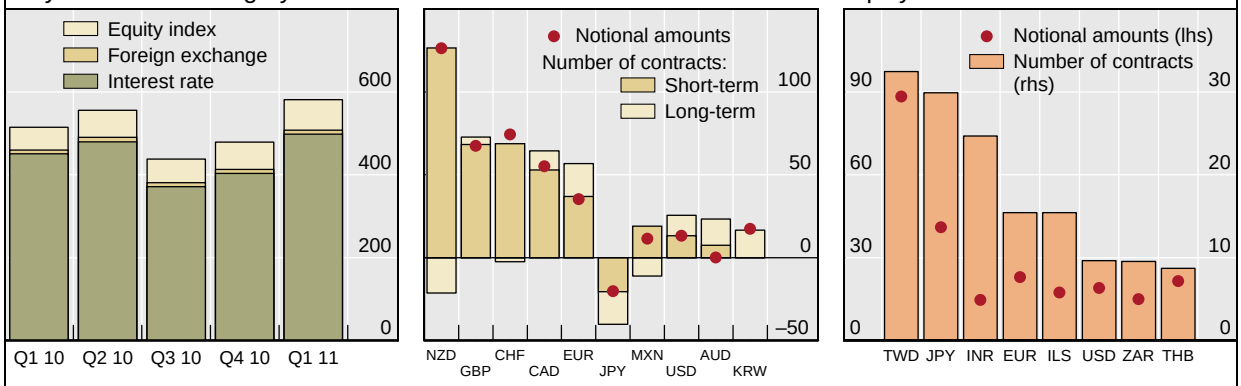
Trading in futures and options on stock prices indices grew moderately in the first quarter of 2011. Turnover measured by notional amounts rose smartly by 12%, but this overstates the underlying increase in activity. When measured in terms of the number of contracts traded, turnover inched up by merely 4%. That said, there were sizeable discrepancies across regions: trading in stock price indices denominated in Japanese yen surged by 30% (number of contracts) and 41% (notional amounts) over the quarter as a whole (Graph 9, right-hand panel). Much of this rise took place after the severe earthquake and tsunami that hit the east coast of Japan on 11 March. Trading in contracts denominated in euros also picked up significantly (number of contracts: 15%, notional amounts: 23%). Sizeable growth in turnover also took place in a number of emerging markets, such as Israel (15% and 17%), India (25% and 15%), Thailand (9% and 22%), Chinese Taipei (32% and 88%) and South Africa (10% and 15%).

Stable turnover in FX futures and options

Activity in the foreign exchange segment of the international derivatives markets remained stable at $10 trillion in the first quarter of 2011, but this masks sizeable differences across currencies. Turnover in contracts on the Japanese yen went up by 29%. Most of this was short-term trading; open interest rose by merely 9%. Turnover in futures and options on sterling and the Swiss franc rose by 20% each. By contrast, turnover in the Brazilian real (which is traded predominantly on exchanges) fell by 17% and that in the euro by 6%.

Turnover on the international derivatives exchanges

By market risk category[1] | Interest rate[2] | Equity index[2]



AUD = Australian dollar; CAD = Canadian dollar; CHF = Swiss franc; EUR = euro; GBP = pound sterling; ILS = Israeli new shekel; INR = Indian rupee; JPY = Japanese yen; KRW = Korean won; MXN = Mexican peso; NZD = New Zealand dollar; THB = Thai baht; TWD = New Taiwan dollar; USD = US dollar; ZAR = South African rand.

[1] Notional amounts, in trillions of US dollars. [2] Growth rate between Q4 2010 and Q1 2011, in per cent.

Sources: FOW TRADEdata; Futures Industry Association; BIS calculations. Graph 9

Stronger activity in commodities contracts except in China

Lower trading on Chinese exchanges weakened overall activity on the international commodity exchanges during the first quarter of 2011. Worldwide turnover measured in terms of the number of contracts (notional amounts are not available) of commodity derivatives contracted by 20% as trading on Chinese exchanges halved, partly because contract sizes increased. If one excludes China, turnover in commodity derivatives increased by 14%, with limited variation across commodity types.

Petra Gerlach

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The global output gap: measurement issues and regional disparities[1]

The global output gap seems to be negative but closing. According to structural estimates, the gap is still wide, particularly in the advanced economies. However, these measures may overestimate potential output, eg by not accounting for the fact that certain investments may have turned out to be unproductive. Purely statistical estimates, on the other hand, suggest that the global output gap has already closed in both the advanced and the emerging market economies, but statistical measures are subject to an end-point problem that too often makes them signal a closed gap at the current edge.

JEL Classification: E32.

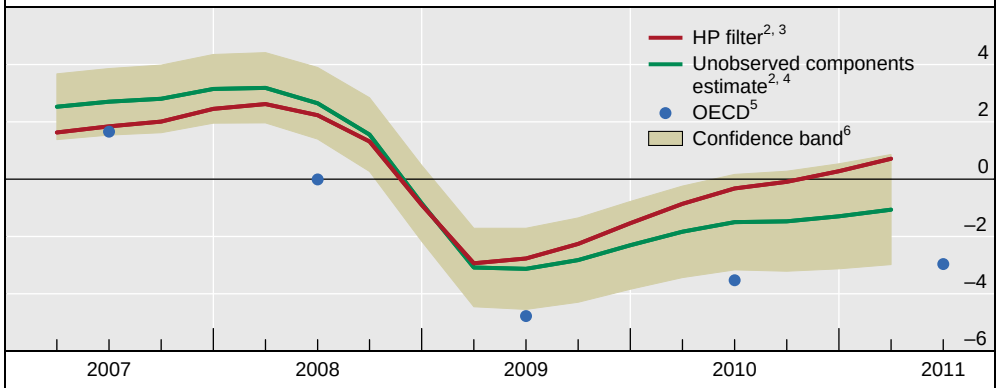
Introduction

Is the global economy back on track? Some measures of the global output gap, especially those that capture the state of the business cycle, suggest that it is. Graph 1 shows the different estimates reached using different measures. The global output gap computed from country data published by the OECD indicates that there is still considerable slack in the economy; the OECD also forecasts a negative output gap for 2011. By contrast, the widely used Hodrick-Prescott (HP) filter suggests a slightly positive gap. An unobservable components (UC) model lies between the two but exhibits large uncertainty.

This special feature tries to explain why different approaches lead to such divergent estimates of how much slack there is in the global economy at the current juncture. The range of measures available, and the different results they yield, are illustrated using data from the euro area and the United States. In this analysis, the crucial question is the degree to which the crisis has affected potential output, and we discuss the difficulties involved in attempting to assess potential at turning points of the business cycle. We also review aggregation issues and regional disparities. The article concludes with a discussion of possible interpretations of current estimates of the global output gap.

[1] I thank Bilyana Bogdanova and Gert Schnabel for excellent research assistance and Piet Clement for his help on the history of the term “output gap”.

Global output gap[1]



[1] Weighted average based on 2005 PPP-converted GDP weights of Argentina, Australia, Brazil, Canada, China, Chinese Taipei, the Czech Republic, Denmark, the euro area, Hong Kong SAR, Hungary, India, Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand, Norway, Peru, Poland, Singapore, South Africa, Sweden, Switzerland, Thailand, Turkey, the United Kingdom and the United States. [2] First quarter of 2011 partly estimated using forecasts for GDP growth from JPMorgan Chase. [3] Based on a world aggregate; trend calculated using Hodrick-Prescott filter with standard specification. [4] Based on a world aggregate; using unobserved components. For details, see the appendix. [5] Aggregation of national output gaps as calculated by the OECD; forecast for 2011. Includes Australia, Canada, the Czech Republic, Denmark, the euro area, Hungary, Japan, Mexico, New Zealand, Norway, Poland, Sweden, Switzerland, the United Kingdom and the United States. [6] 95% confidence band computed from the unobserved components estimates.

Sources: OECD, *Economic Outlook*; JPMorgan Chase; national data; BIS estimates. Graph 1

What exactly is the output gap and how can we measure it?

In 1962 Arthur Okun published an article on what would later be called Okun's law. His idea was to link the unemployment rate to a measure of the shortfall of actual GNP from potential income, the "GNP gap". Okun emphasised that this potential was not the maximum output an economy could achieve but, rather, the output which could be realised without giving rise to inflationary pressure (Congdon (2008)).

The term potential output had already been in use for some time before Okun wrote his article. *The Economist* reported in 1911 that

> [i]n the North of England [...] there is still a potential output, a legacy of the last boom, far in advance of the demand, in certain kinds of work.

That said, it took more than 50 years, and the appearance of Okun's paper, before *The Economist* used the term output gap for the first time, in 1964.

Output gaps are widely used ...

Central banks have been looking at measures of the output gap for a long time as one of many information variables in the policy process. In 1993, John B Taylor showed that the Federal Reserve's interest rate setting was well described by a simple rule in which changes in the federal funds rate target are related to movements in inflation relative to an inflation objective and in the output gap (Taylor (1993)). While central banks' interest rate setting relies, of course, on a much wider set of data and is in no way mechanical, the Taylor

rule has been widely used by academics and market participants alike.[2] The popularity of the Taylor rule has ensured that estimates of the output gap, and thus of potential output, are in high demand.

... but not clearly defined

Potential output represents different things to different economists. Classically oriented scholars use the term in Okun's sense, where potential is the sustainable level of output that an economy could achieve in the absence of shocks. By contrast, proponents of modern macroeconomic models that rely on microeconomic foundations (so-called dynamic stochastic general equilibrium (DSGE) models) define potential output as the output the economy would produce in the absence of nominal frictions.[3] Such frictions include price and wage stickiness – ie the fact that prices and salaries are not adjusted from day to day. Thus the output gap in DSGE models does not capture the business cycle but rather the effect of nominal rigidities.[4]

In what follows we concentrate on output gap estimates that attempt to measure the business cycle. We review two broad approaches, one statistical, the other structural. As an illustration, we present output gap measures for the euro area and the United States, two economies for which data are readily available.

Statistical approaches

Statistical measures compute the gap mostly from actual GDP

Statistical approaches to measuring the output gap try to derive potential output from actual output (real GDP). One immediate stumbling block is that initial releases of GDP data often need to be corrected. As a consequence, real-time statistical estimates of the output gap are often revised.

The most widely used statistical measure of the output gap is the HP filter, which models (the logarithm of) potential output essentially as a weighted average of a straight line and actual (log) GDP. (The appendix presents computational details.) There are a number of other statistical filters. For instance, band-pass filters remove short-term and very long-term fluctuations from actual GDP to identify the business cycle component of output. And UC models treat both potential output and the output gap as latent variables for which nothing is known but some time series properties. They typically assume that potential grows over time, at a rate that may vary, while the output gap is mean reverting. Of course, such underlying assumptions determine, to a large extent, the estimates reached.[5]

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[2] Also, many central banks compute Taylor rates as one of many cross-checks in their policy decision-making process.

[3] The real business cycle model – the predecessor of DSGE models – assumes no nominal frictions. As a consequence, actual output always equals potential output in this class of model.

[4] In fact, potential output can vary with the business cycle in DSGE models, for instance if consumers' preferences adjust to shocks (Mishkin (2007)). Not surprisingly, standard statistical measures of the output gap, which assume no such variation, do not perform well in estimated DSGE models (Neiss and Nelson (2005)).

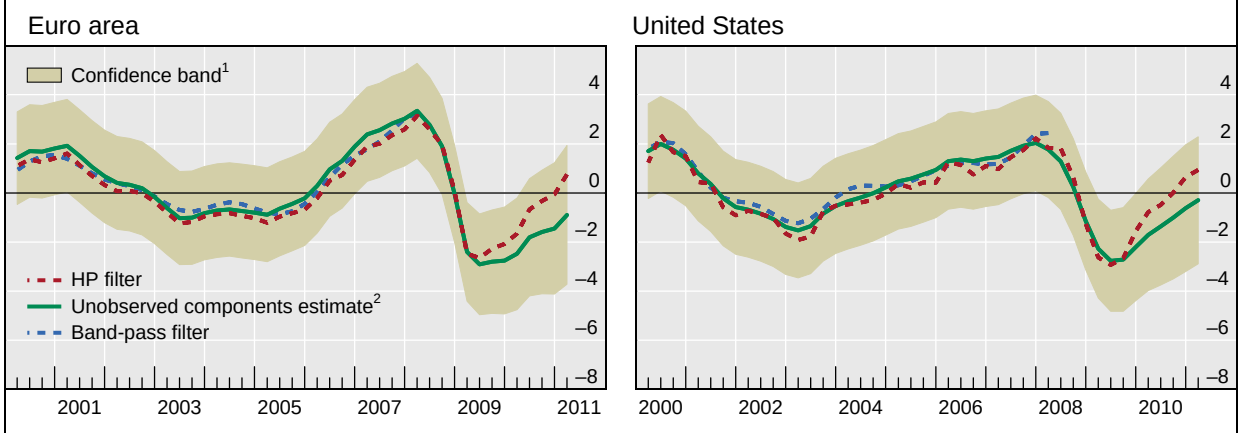
[5] UC models can also include other data, such as inflation and unemployment, to estimate the output gap.

Graph 2 shows statistical output gap estimates for the euro area and the United States. A 95% confidence band constructed from the UC estimate spans over 5 percentage points at the current edge in both economies and illustrates the large uncertainty surrounding output gap estimates. While the UC gap is negative in both the euro area and the United States, the HP gap is slightly positive. This runs counter to other indicators of activity and is probably due to an end-point problem.

Real-time HP estimates too often signal a closed output gap. To compute potential output and the output gap for some point *t* in the past, the HP filter uses data from before and after time *t*. This approach ensures that a temporary drop in the growth rate of actual GDP at time *t* is identified as a period with essentially unaffected potential GDP growth and a negative output gap. For a real-time estimate of the output gap, with no future data available, the HP filter becomes one-sided and looks only at data up to time *t*. It then mechanically attributes part of the drop in actual growth to a decline in potential growth. Intuitively, the HP filter treats the latest data point as the "new normal" and yields an output gap estimate close to zero.[6]

End-point problems are especially severe at turning points of the business cycle. The red line in Graph 3 shows the HP estimate of the US output gap using today's data.[7] The green line is computed using the same data, but omitting any observations after time *t* in arriving at the estimate for time *t*. Thus, the first observation is computed using data up to the first quarter of 1976; the second point adds the observation for the second quarter of that year; and so on. The deviation between the two lines captures the effect of the

Statistical measures



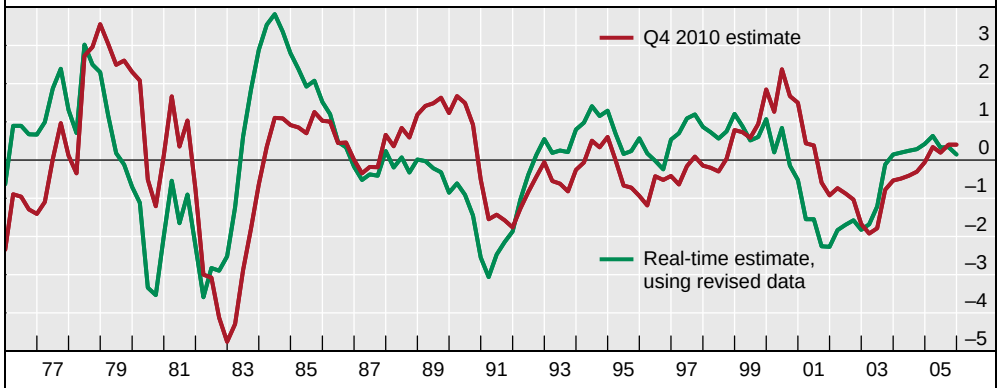
[1] 95% confidence band computed from the unobserved components estimates. [2] For details, see the appendix.

Sources: National data; BIS estimates. Graph 2

[6] In principle, the end-point problem can be alleviated by forecasting future GDP values, thus allowing for a reversion of potential output to its long-term trend, and then applying the filter.

[7] We show output gap estimates up to 2005 since the end-point problem becomes visible only ex post. Note that this is not a genuine real-time estimate since it ignores the impact of data revisions. This impact can be large, but estimates using proper real-time data from the Federal Reserve Bank of Philadelphia (not shown in the graph) indicate that data revisions are not correlated with the business cycle. On data revisions, see Orphanides and van Norden (2002).

End-point problems in the HP measure of the US output gap



[1] Real-time estimates use data only up to time *t* and thus exhibit the end-point problem. All output gaps computed using data from 1959 onwards.

Sources: Federal Reserve Bank of Philadelphia real-time data bank; BIS estimates. Graph 3

end-point problem and is particularly large at turning points of the business cycle. At the current juncture, the HP filter may therefore exaggerate the extent to which the global economy has recovered from the crisis.

Structural approaches

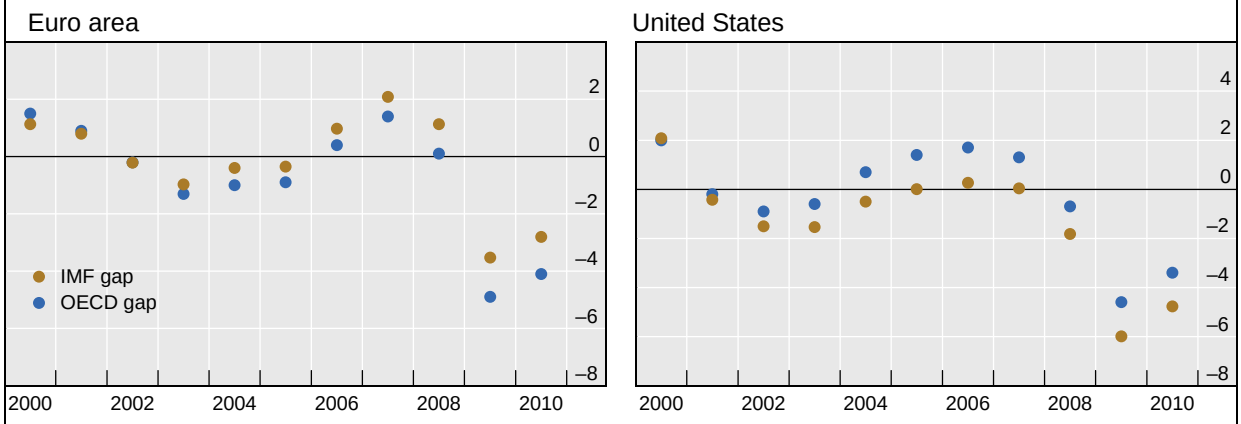
Structural measures use mostly capital and labour data

Structural approaches make assumptions about how much output, in principle, a certain combination of capital and labour in the economy could produce. This solves the end-point problem inherent in statistical approaches, although, of course, data revisions continue to matter. Structural estimates of potential output rely on a particular production function (often a Cobb-Douglas production function) and require a quantification of the technological knowledge in the economy (total factor productivity). Structural measures often also make use of information from other variables related to the business cycle, such as unemployment and inflation, which the Phillips curve suggests respond to the output gap. The advantage of a production function approach is that it is based on data that are not mechanically linked to actual GDP – a bottom-up approach.

Current structural estimates from the IMF and the OECD signal a large negative output gap for the euro area and the United States (Graph 4). This suggests that the structural models have not corrected potential output downwards as much as the purely statistical estimation methods have.

Of course, the crisis may not have affected potential output much. Yet one can also think of structural reasons why it might have (see also OECD (2010)). For instance, productive capital may be smaller than measured because capital equipment in some sectors (eg in construction) has become superfluous, and higher capital costs may reduce investment and thus cause capital to depreciate faster. The contribution of labour may have decreased because certain labour skills have become less useful. Total factor productivity, finally,

Structural measures



Sources: IMF, *World Economic Outlook*; OECD, *Economic Outlook*. Graph 4

might be decreasing if there has been less investment in research and development.[8]

Identifying and quantifying changes in the structure of the economy takes time. Thus, while statistical measures may suggest changes in potential output at the current edge too fast, structural models may do so too slowly. There are apparently no real-time datasets of production function estimates of the output gap. However, one can track how structural output gap estimates have changed over time in central bank reports. One interesting example is the measurement of the Swedish output gap after the Nordic financial crisis in the early 1990s. In 1996, the Riksbank estimated a production function output gap of –6% for 1993. By 2011, this trough had been revised upwards, to –5%. It seems plausible that this correction is due to a downward revision of the structural estimate of potential output.[9] Hence, it is possible that structural measures today exaggerate potential output and paint too gloomy a picture of the output gap.

Has the global output gap closed?

The analysis above illustrates that measuring the output gap is difficult even when extensive data are available. Data problems render the estimation of output gaps even more complicated for emerging market economies and, by extension, for the world as a whole. Survey data are scarce, and estimating structural models is fraught with uncertainties. How to assess labour supply, for instance, in countries with a large potential labour pool in rural areas? To some extent, statistical estimates such as the HP filter may be preferable in such situations, since they capture past GDP dynamics without taking a stance on the underlying trends in capital, labour and technology.

[8] On the other hand, efficiency may have increased due to the streamlining of processes in response to the crisis.

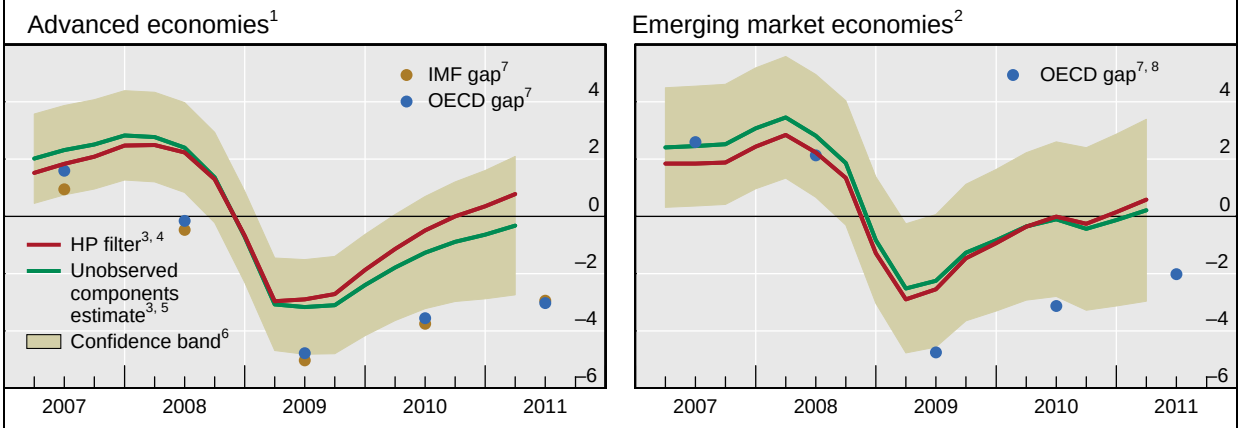
[9] See Riksbank (1996) and (2011). Of course, central banks keep improving their economic models, which also can lead to revisions of structural output gap estimates. It is noteworthy that the HP estimate already suggested a gap of about –4.5% in 1996, and still does so today.

Aggregation of national data is not straightforward

The process of aggregating national data can add to the uncertainty of global output gap estimates. One issue is whether one should first aggregate national data and then compute the global output gap, or first compute national output gaps and then aggregate them to obtain a global figure. A second issue is whether to use market exchange rates or PPP-adjusted rates in converting national GDP data to US dollar figures. Conversion using purchasing power parity corrects for different costs of living across countries and is advisable if the goal is a comparison of the standard of living. Converting the data using actual exchange rates reflects countries' purchasing power in the global economy, so that emerging market economies get a relatively small weight in the aggregation. For the purpose of constructing a global output gap, there is no clearly superior aggregation method. Fortunately, it turns out that aggregation-related differences are negligible at the current juncture.[10]

A final caveat in interpreting the global output gap is that aggregation may mask regional disparities. Recent press commentary has emphasised the risk of economic overheating in emerging markets and contrasted this with the slow recovery in the major advanced economies.[11] To evaluate how much dispersion there is in the current economic recovery, it is useful to look separately at output gap estimates for the advanced and the emerging market economies (Graph 5). Somewhat surprisingly, the HP output gaps are slightly

Regional output gaps



All aggregations using 2005 PPP-converted GDP weights.

[1] Australia, Canada, Denmark, the euro area, Japan, New Zealand, Norway, Sweden, Switzerland, the United Kingdom and the United States. [2] Argentina, Brazil, China, Chinese Taipei, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Poland, Singapore, South Africa, Thailand and Turkey. [3] First quarter of 2011 partly estimated using forecasts for GDP growth from JPMorgan Chase. [4] Based on a country group aggregate; trend calculated using HP filter with standard specification. [5] Based on a country group aggregate; using unobserved components. For details, see the appendix. [6] 95% confidence band computed from the unobserved components estimates. [7] Aggregation of national output gaps as calculated by the IMF and the OECD; forecasts for 2011. [8] The Czech Republic, Hungary, Mexico and Poland.

Sources: IMF, *World Economic Outlook*; OECD, *Economic Outlook*; JPMorgan Chase; national data; BIS estimates Graph 5

[10] Both procedures yield an HP filter-based global output gap of 0.7% This result obtains under both market and PPP exchange rates. For the global output gap computed from OECD data, the market rate based gap is –3.5%, slightly below the PPP-converted estimate of –3.0%, which is the one shown in Graph 1.

[11] Chapter II of BIS (2011) discusses the recent dispersion in real output growth across economies.

positive for both groups, indicating an evenly spread recovery. Again, this seems to reflect, in part, an end-point problem, with the HP filter treating the latest data point as the new normal. The structural output gap computed from OECD data is large and negative for the advanced economies, as is an output gap measure calculated using structural estimates from the IMF. The OECD-calculated gap is also negative for the emerging market economies, but the latter has been closing somewhat faster than that of the advanced economies. However, the fact that structural estimates of potential output adjust slowly to sectoral changes may exaggerate the size of the current gap.

In sum, both statistical and structural output gap estimates measure the business cycle accurately only long after the fact. For policy purposes, it is important to look at a broad range of measures and to be aware of the shortcomings of the different approaches. Today, the overall message of the different measures is that the global output gap is negative but closing.

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Appendix
Details on statistical filters

The Hodrick-Prescott filter identifies as (log) potential output the series y_t^{pot} that minimises

$$\sum_{t=1}^{T}(y_t - y_t^{pot})^2 + \lambda\sum_{t=2}^{T-1}(\Delta y_{t+1}^{pot} - \Delta y_t^{pot})^2 ,$$

with y_t the logarithm of real GDP and λ the smoothing parameter. This parameter indicates how important the goal of obtaining a constant growth rate of potential is relative to the goal of having potential output not deviating much from actual. The graphs in this feature use the standard smoothing parameter for quarterly data of 1600. The output gap is given by $y_t - y_t^{pot}$.

The band-pass filter removes high- and low-frequency movements from y_t to obtain a series gap_t that shows variations at business cycle frequency, which for quarterly data is normally set as a range of 6 to 32 quarters. Technically, this is achieved by computing a moving average with leads and lags, of which typically 12 of each are included for quarterly data. Thus,

$$gap_t = \sum_{j=0}^{12} w_j y_{t-j} + \sum_{j=0}^{12} w_j y_{t+j} ,$$

with w_j predefined weights. The inclusion of leads means that there is no band-pass estimate available for the last 12 quarters, which explains the early end of the blue line in Graph 2.

The unobserved components estimates presented in the text are obtained from a state space model where

$$y_t = y_t^{pot} + gap_t ,$$
$$y_t^{pot} = \mu_t + y_{t-1}^{pot} + e_t^{y} ,$$
$$\mu_t = \mu_{t-1} + e_t^{\mu}$$

and

$$gap_t = c_0 + c_1 gap_{t-1} + c_2 gap_{t-2} + e_t^{gap} ,$$

with μ_t the time-varying growth rate of potential and the e_ts independently and normally distributed innovations.

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Rating methodologies for banks[1]

The three major rating agencies are reassessing banks' credit risk in the light of the recent crisis. So far, this has resulted in material downgrades, especially of European and US institutions, and increased agreement about banks' overall level of creditworthiness and their greater dependence on public support than in the past. The agencies are also making efforts to enhance the transparency of bank ratings and the role of official support. Agency assessments of regulatory initiatives may affect policymakers' communication with financial markets.

JEL classification: G21, G24, G28.

In the wake of the global financial crisis, the role of the major credit rating agencies and the ratings they assign to financial institutions have come under increased scrutiny. The crisis highlighted risks that had been underestimated, brought into greater relief the value of government assistance and led public authorities to commit to an overhaul of banks' regulatory and support frameworks. In response, one agency has recently proposed significant changes to its bank rating methodology, seeking public comment. Another has recalibrated the relative importance attached to rating factors.

A close look at data on bank credit ratings and agency publications leads to three key findings. First, all three major rating agencies (Fitch Ratings, Moody's Investors Service and Standard & Poor's) consider the creditworthiness of large European and US banks to have worsened materially since the onset of the crisis. Second, rating agencies are currently in greater agreement about banks' creditworthiness than in mid-2007, reflecting shifts in estimates of government support. Third, ongoing revisions to agencies' methodologies and assessments of the financial landscape seem likely to lead to further downgrades in the banking sector.

Changes to ratings methodologies can be a double-edged sword for prudential authorities. By adopting a system-wide perspective on financial risk and paying closer attention to measures aimed at reducing official support to banks, agencies seem so far to be in sync with recent policy initiatives. But

[1] We would like to thank Jimmy Shek for excellent research assistance, Claudio Borio, Stephen Cecchetti, Michael Davies, Dietrich Domanski, Stephen Shevoley and Christian Upper for useful comments on earlier drafts of the article, and Emir Emiray for help with the graphs and tables. The views expressed are our own and do not necessarily reflect those of the BIS.

policymakers may face credibility issues in future if ratings contradict official statements – eg about the authorities' own assessments of banks' health or the design of bank resolution plans – and markets focus on these ratings.

In the rest of this article, we proceed as follows. In the first section, we discuss in general terms the information that ratings convey about creditworthiness. In the second, we examine the relationship of ratings and other credit risk indicators observed before the recent crisis to banks' performance during the crisis. In the third, we put this relationship in context by discussing reasons why accurate assessments of banks' creditworthiness may be inherently difficult to obtain. After outlining the bank rating methodology of each of the three major agencies in the fourth section, in the fifth we examine how actual bank ratings differ across these agencies and how they have evolved since the beginning of the crisis. We discuss policy implications in the final section, paying particular attention to the agencies' recent drive towards greater transparency.

Credit ratings: general background

Ratings are expert opinions …

Ratings are opinions about the creditworthiness of a rated entity, be it a sovereign, an institution or a financial instrument. They reflect both quantitative assessments of credit risk and the expert judgment of a ratings committee. Thus, no rating can be unequivocally explained by a particular set of data inputs and formal rules.

… reflecting relative creditworthiness

Ratings convey information about the relative and absolute creditworthiness of the rated entities. Agencies often emphasise that a rating reflects the creditworthiness of the rated entity *relative* to that of others. That said, agencies regularly publish studies that convey the historical association of ratings and indicators of *absolute* creditworthiness, such as default rates and the magnitude of losses at default. Moreover, in the case of structured finance products, ratings are explicitly tied to estimates of default probabilities and credit losses.[2]

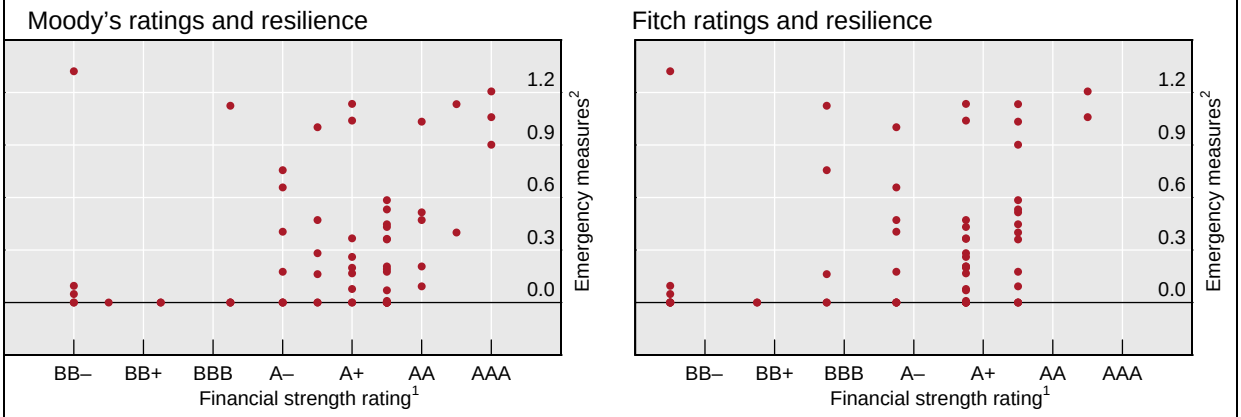
Ratings and other credit indicators prior to the recent crisis

Missed vulnerabilities ahead of the crisis

Ahead of the financial crisis, credit ratings were not particularly successful in spotting the build-up of widespread vulnerabilities in the financial system or in identifying which institutions were most exposed to them. In particular, pre-crisis ratings would have contained useful information had they been lower for banks that subsequently resorted to stronger emergency measures, such as capital-raising and asset sales. However, for a sample of 60 large internationally active banks, the financial strength ratings assigned by two of the major agencies in mid-2007 had a weak and *positive* relationship with

[2] Depending on the agency or type of rated entity, some ratings are intended to convey information about default probabilities while others refer to expected credit losses. This alone limits comparisons across sectors and agencies. More generally, Fender et al (2008) argue that ratings comparability is impaired by the fact that a single rating scale cannot rank the rated entities along multiple dimensions of credit risk simultaneously.

Pre-crisis ratings and in-crisis performance of large banks



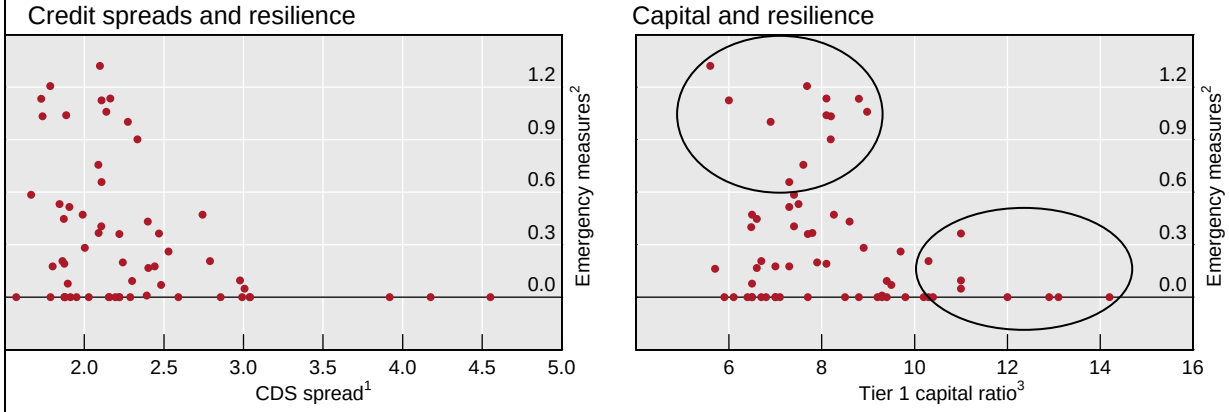
[1] Referred to as "individual rating" by Fitch and "bank financial strength rating" by Moody's. Translated into a standard scale on the basis of mapping tables in Fitch (2010) and Moody's (2007b). [2] Sum of the values of fixed income, capital and hybrid instruments issued and assets sold from mid-2007 to end-2009, divided by total equity in 2006.

Sources: Bloomberg; Fitch Ratings; Moody's Investors Service. Graph 1

banks' subsequent reliance on emergency measures (Graph 1).[3] To be sure, other credit market indicators faired similarly poorly. For instance, bank CDS spreads prior to the crisis are not informative about banks' performance during the crisis (Graph 2, left-hand panel). Even though these CDS spreads might be expected to relate positively to the extent of banks' subsequent reliance on emergency measures, the empirical relationship is weak and *negative*.

Hindsight points to indicators that could have improved the accuracy of pre-crisis ratings. On a system level, there is a general agreement that features of the regulatory environment and financial culture in banks' home and host

Pre-crisis characteristics and in-crisis performance of large banks



[1] On log scale. [2] Sum of the values of fixed income, capital and hybrid instruments issued and assets sold from mid-2007 to end-2009, divided by total equity in 2006. [3] In per cent.

Sources: Bankscope; Bloomberg; Markit. Graph 2

[3] Likewise, mid-2007 financial strength ratings exhibit no relation to banks' profitability in 2008 and 2009, scaled by banks' equity in 2007. These results pertain only to the ratings of Moody's and Fitch. Standard & Poor's had published financial strength ratings only for banks in the Asia-Pacific region, whereas our sample is composed mostly of US and European banks.

countries – such as the degree to which exposure to complex financial products was encouraged or tolerated – would have provided useful information. Macroprudential indicators, based on above-trend credit growth and asset price increases, may also have been effective in pointing to a build-up of vulnerabilities.[4] And in terms of bank-level characteristics, both rating agencies and markets could have paid closer attention to the level of high-quality capital. Banks with high Tier 1 capital ratios in 2006 had little or no need for emergency measures during the crisis, while the largest emergency measures were taken by banks with low ratios (Graph 2, right-hand panel). It is thus not surprising that rating agencies are reviewing their assessments of banks' risk in the light of the crisis.

Why assessing banks' creditworthiness is difficult

Bank ratings need to account for …

The difficulties rating agencies, credit markets and many financial analysts had in forecasting banks' performance during the recent crisis are rooted in unique features of the banking industry.[5] Banks' role as financial intermediaries and their importance for financial stability determine the degree of external assistance they receive and shape the risk factors to which they are exposed. Assessments of bank creditworthiness thus need to account for the degree of external support, gauge the degree of systemic risk and address the inherent volatility of banks' performance.

Accounting for external support: stand-alone versus all-in ratings

Since banks play a key role as financial intermediaries, they often benefit not just from the support of the parent institution – as any other firm would – but also from that of public authorities. The recent crisis illustrated that support can come in different forms: as capital injections, asset purchases or liquidity provisions. When there is a commitment to support the creditworthiness of a bank, be it explicit or implicit, the rating agency has to evaluate not only the *ability* of the parent or sovereign to honour this commitment but also their *willingness* to do so. And even if support can be expected to be strong most of the time, what matters is its availability when the bank needs it. This suggests that the *correlation* between distress of the bank and its underlying source of support should also be examined.

… external support to banks …

Given the importance of external support, rating agencies generally assign at least two different ratings to banks, which in the remainder of this feature we refer to as "stand-alone" and "all-in" ratings. A stand-alone rating reflects the intrinsic financial strength of the institution and, thus, its likelihood of default, assuming that no external support is forthcoming. In addition to accounting for stand-alone financial strength, an all-in rating factors in the likelihood and

[4] See, for example, Borio and Drehmann (2009).

[5] For evidence that uncertainties about banks' creditworthiness lead agencies to disagree more about bank ratings than about the ratings of firms in other industries, see Cantor and Packer (1994) and Morgan (2002).

magnitude of extraordinary external support that the bank may receive if and when it is in distress. While all-in ratings matter to banks' creditors and trading counterparties, stand-alone ratings provide useful information to a prudential authority interested in the underlying strength of institutions.[6] In addition, by comparing the stand-alone rating of a bank with its all-in rating, investors can infer the agency's assessment of external support and, possibly, make adjustments to this assessment for their own use.

Accounting for systemic risk

The recent crisis has underscored the need for a holistic approach to assessing bank risk. In particular, it has become clear that the creditworthiness of a bank depends on vulnerabilities that may build up in different parts of the financial system, as well as on interlinkages in this system. Thus, a bank's rating should not be derived in isolation but should reflect the industrial, financial and economic context of the bank's business.

... banks' financial and regulatory environment ...

Adopting a system-wide perspective is not straightforward. First, there has to be an operational definition of the relevant system, which gives rise to a tension between the desire to be comprehensive and the need to be practical. Should the system comprise only banks or also other financial institutions to which the bank is linked, or should it be expanded even further? And should it be limited geographically to the home country or cover all the countries in which a given bank operates? What is the right approach to analysing internationally active banks that fund themselves in one part of the world while the liquidity of their investments depends on financial conditions in another?

Second, even when the relevant system is defined, there is no agreed formal metric for assessing systemic risk. The literature has proposed a number of model-based measures that are either overly stylised or quite data-intensive and difficult to communicate to the general public. As an alternative to model-based measures, rating agencies often rely on leading indicators based on empirical regularities that signal the build-up of vulnerabilities in the system, such as high credit growth and asset price increases.[7]

Accounting for earnings volatility

... and large uncertainties about banks' performance

Another reason banks' creditworthiness is especially hard to assess is that their earnings performance is highly volatile, not least because of structurally high leverage. For instance, on the back of leverage roughly five times that of firms in other sectors, the volatility of returns on banks' stocks over the past several decades has been consistently higher than that of non-financial stocks (BIS (2010), Chapter VI). Evaluating the outlook for banks' earnings – the key source of loss-absorbing capital – is a critical component of bank credit analysis. It is important to evaluate not only the extent to which a bank's

[6] That said, when one bank has a credit exposure to another bank, it is common practice to use the all-in rating of the second in assessing the risk-weighted assets of the first for regulatory requirements.

[7] See Drehmann and Tarashev (2011) and Borio and Drehmann (2009).

earnings can absorb adverse shocks, but also how far investors would allow the bank to retain more earnings through reduced dividend payouts when raising fresh capital is difficult. Banks that wait too long to increase earnings retention may be particularly unstable, as the speed at which distress unfolds can overwhelm banks' concurrent earnings capacity. Agencies use this argument to explain why they consider banks that consistently retain a greater share of their earnings during tranquil times as more creditworthy.

Agency methodologies

This section discusses sequentially the rating methodologies of the three major rating agencies. The discussion is condensed in Table 1.

Fitch Ratings[8]

Fitch's assessment of external support …

The Fitch methodology provides stand-alone ratings (which the agency calls "individual ratings") and, for ease of comparison, a mapping table for translating them into the scale of the more granular all-in ratings ("issuer default ratings"). To enhance the transparency of all-in ratings, Fitch also publishes separate ratings on a five-point scale designed to capture the likelihood and magnitude of external support either from the state or from an institutional owner ("support ratings"). In cases where these support ratings reflect potential assistance from the state, Fitch announces a support rating floor utilising the same scale as the all-in ratings scale. The all-in rating is then the higher of the stand-alone rating and the support rating floor.

… will become more transparent

Fitch intends to make the link between its stand-alone and all-in bank ratings more transparent than in the past. In mid-2011, it will convert its nine-point stand-alone ratings scale into a 19-point scale that corresponds exactly to that of all-in ratings. The new stand-alone scale will provide both more granularity on Fitch's financial strength assessments and clarity on the specific benefits of support.

Even though Fitch was the first major rating agency to engage in explicit assessments of systemic risk and to provide ratings for national banking systems, these assessments are used as input to its sovereign ratings rather than directly in the calibration of individual bank ratings. In 2005, Fitch introduced two systemic risk measures, each of which characterises the economic and financial stability of a country. The first incorporates a bottom-up approach, as it equals the system-wide average of individual banks' stand-alone ratings. The second is based on macroprudential indicators designed to capture abnormal growth of bank credit to the private sector and unusually strong asset price increases, drawing explicitly on Borio and Lowe (2002). A combination of weak scores on both measures is viewed as most worrisome.

[8] This subsection draws on Fitch Ratings (2005, 2010, 2011).

Rating methodologies for banks			
	Fitch	Moody's	Standard & Poor's[1]
Stand-alone assessments (intrinsic financial strength)	Focus on off-balance sheet commitments, funding and liquidity risk	Emphasis on forward-looking assessments of capital ratios, based on embedded expected losses	Focus on risk-adjusted performance and ability to grow capital from profits
All-in ratings (with external support)	Distinct ratings of sovereign support provide a floor	Based on a joint default analysis of banks and providers of support	Anticipated support increases with the bank's systemic importance
System-wide assessment			
Country rating	Based on: - macro indicators - average bank rating	None	Based on: - macro indicators - industry and regulatory environment
Does systemic risk affect banks' ratings?	Not explicitly; anticipated support increases with the bank's systemic importance but falls in times of generalised distress	Not explicitly; anticipated support increases with the bank's systemic importance	Yes, through: - macro indicators for countries where the bank operates - assessments of the industry and regulatory environment in the home country
Last major changes	2005: systemic risk analysis	2007: joint default analysis in support assessment	2011: overhaul of the rating methodology. Greater emphasis on: - system-wide risks - link from earnings to capital

[1] Refers to the agency's proposed methodology for bank ratings, as outlined in Standard & Poor's (2011). Table 1

Moody's Investors Service[9]

Moody's ratings for banks have reflected ...

In 2007, ahead of the financial crisis, Moody's introduced a new bank rating methodology, called joint default analysis (JDA). Motivated by studies showing that the default frequency of banks was consistently lower than that of non-bank corporates with similar ratings, JDA analysed more systematically the external support available to banks. The methodology takes stand-alone ratings (called "bank financial strength ratings") as its starting point. Then, in order to arrive at all-in ratings ("issuer ratings"), it sequentially assesses four types of support – operating parent, cooperative group, regional government and national government – and adjusts the stand-alone rating accordingly. For each type of support, the all-in rating reflects the guarantor's capacity to provide support (as captured, for example, by its rating), its willingness to

[9] This subsection draws on Moody's Investors Service (2007a, 2007b, 2009).

provide support and the probability that it is in default when the bank needs support (or the joint default probability).

In contrast to the other two agencies discussed here, Moody's does not publish a specific summary measure of banking system risk. That said, publications of the rating agency implicitly acknowledge that background assessments of a bank's role in, and exposure to, systemic risk are natural inputs when estimating the extent of support from national authorities. On the one hand, given the fiscal costs involved, the agency expects national authorities to be *less able* to provide support to a bank that shares common exposures with the rest of the system and thus is more likely to need support at a time of general distress. On the other hand, it expects them to be *more willing* to provide support when the institution is more systemically important, since its failure could have stronger adverse knock-on effects on other banks.

... changing perceptions of government support

Moody's reaction to the global financial crisis has been to recalibrate the relative importance attached to certain rating factors. A notable example is the weight on support from national authorities, which changed as the crisis evolved. During most of the crisis, the willingness of national authorities to provide all-encompassing support turned out to be stronger than Moody's had originally expected. This translated into a wider gap between all-in and stand-alone ratings.

At the same time, the depth of the crisis has raised questions about the ability of some sovereigns to provide support and has prompted the international policy community to express clearly the intent to wean banks off extraordinary support. Thus, in recent publications, Moody's has forecast a decline in the weight it will assign to government support in the future. In particular, in reviewing the level of systemic support available for banks in non-AAA sovereigns, it has described in detail the parameters that affect its assessment of governments' ability to provide support. In many cases, the revisions are likely to worsen all-in ratings.

Lessons from the crisis have also led Moody's to revise its assessment of stand-alone strength. The agency has indicated its intention to put a greater emphasis on forward-looking assessments of bank capital ratios, based on analyses of expected losses for risk assets in stress scenarios.

Standard & Poor's[10]

Standard & Poor's is the agency that has proposed the most significant revisions to its methodology since the financial crisis, though they are not yet final. In addition, it plans to enhance the transparency of its bank ratings, broadening the set of banks for which it publishes stand-alone credit risk assessments (called "stand-alone credit profiles"). This will allow investors to gauge the role of support in determining Standard & Poor's all-in ratings ("issuer ratings").

S&P intends to overhaul its bank ratings methodology

The stand-alone risk profiles that Standard & Poor's intends to assign to banks will be based on so-called anchor profiles, which themselves draw on

[10] This subsection draws on Standard & Poor's (2010, 2011). The latter publication contains criteria proposals that are still being reviewed and are likely to be finalised in late 2011.

Banking Industry Country Risk Assessments (BICRA). First, the agency will assess the industry and economic/financial risks in a given country and combine them to form the BICRA. Then, focusing on a particular bank, it will obtain: (i) the industry risk component of the BICRA score of the bank's home country; and (ii) a weighted average of the economic/financial risk components of the BICRA scores of all the countries in which the bank operates. Combining the two will lead to the bank's anchor profile. Finally, bank-specific strengths and weaknesses will guide the mapping of the anchor profile into the bank's own stand-alone risk profile.

Standard & Poor's has also signalled changes to its bank-specific analysis. Among other things, it intends to align stand-alone risk profiles better than in the past with the degree of uncertainty surrounding banks' performance. The agency plans to accomplish this by placing less emphasis on diversification benefits and more on the risks related to off-balance sheet derivatives and structured finance instruments. Earnings analysis will focus on risk-adjusted performance and ability to use retained profits to increase the bank's level of capital. In addition, in determining the role of extraordinary external support in all-in ratings (including both government and group support), Standard & Poor's will pay particular attention to banks' systemic importance and governments' tendency to support banks. All else equal, greater systemic importance would lead to a better all-in rating.

The proposed revisions to Standard & Poor's methodology are likely to change its bank ratings significantly. In a preliminary analysis of a sample of 138 banks, the agency found that 42% experienced no rating change, around 33% were downgraded by one notch or more, and 22% were upgraded by one notch or more. According to Standard & Poor's, the greater emphasis on system-wide risk factors would affect the geographical distribution of potential rating actions. In particular, Asian (excluding Australian and New Zealand) banks would tend to be upgraded, while European banks would tend to be downgraded.

Ratings differences

Disagreements among rating agencies ...

We collected data on ratings that Moody's, Standard & Poor's and Fitch assigned to 70 large banks before the recent financial crisis (mid-2007) and after it (April 2011), and examine these ratings from two perspectives. First, we look for indications that methodological differences across the rating agencies have resulted in different ratings of the same banks. (Given the two points in time we consider, we can only identify differences among the agencies that have manifested themselves *after* the most recent change in Moody's methodology and *before* Standard & Poor's implementation of its recent proposal.) Second, we investigate how bank ratings have evolved since the crisis began. We pay special attention to differences across geographical regions and countries and to agencies' assessments of external support.

Differences among rating agencies

Ratings differences across agencies are rather pronounced in our sample. In fact, cases where all three agencies assign the same all-in rating comprise only

8% of the banks jointly rated by the agencies. At the same time, a full 33% of these banks have ratings that span a gap of two notches or more.[11]

... have diminished since the crisis

Rating agencies have disagreed not only at the level of individual banks but also in systematic ways across banks. At least at the two points in time we consider, Moody's has consistently assigned higher all-in and stand-alone ratings than the other two major agencies (Table 2). The all-in ratings assigned by Moody's in mid-2007 were roughly 1.5 notches higher on average than those assigned by Standard & Poor's and Fitch. This difference has recently declined, and stood at around one notch in April 2011. By contrast, the wedge between the stand-alone ratings assigned by Moody's and Fitch (the other agency publishing similar ratings) has remained quite stable since 2007, ranging between 1.3 and 1.4 notches. Taken together, these findings suggest that the convergence in all-in ratings is due to evolving views of external support, as opposed to banks' inherent financial strength.[12]

Comparing pre- and post-crisis ratings

Downgrading of banks ...

The financial crisis has resulted in significant downgrades of many large banks by all major agencies, which is hardly a surprise. Over the last four years, the all-in ratings assigned by Standard & Poor's to 62 banks in our sample have declined on average by six tenths of a notch, from an average rating of A+ to an average rating between A and A+ (Table 3). The declines have been similar on average in the case of Fitch. Moody's has moved even more sharply since the crisis began, lowering bank all-in ratings by twice as much as the other two agencies.

Differences across rating agencies[1]

Averages of notch differences

	All-in ratings		Stand-alone ratings	
	Mid-2007	April 2011	Mid-2007	April 2011
Moody's vs Fitch	1.59 (54)	0.82 (56)	1.26 (64)	1.44 (62)
Moody's vs S&P[2]	1.63 (57)	1.04 (57)	– –	– –
Fitch vs S&P[2]	0.12 (60)	0.28 (60)	– –	– –

A stand-alone (or financial strength) rating is referred to as an "individual rating" by Fitch and as a "bank financial strength rating" by Moody's. An all-in rating, which accounts for financial strength and external support, is referred to as a "long term issuer default rating" by Fitch and an "issuer rating" by Moody's and Standard & Poor's. Stand-alone ratings are translated into the all-in ratings' (standard) scale on the basis of mapping tables in Fitch (2010) and Moody's (2007). Then ratings are translated into numbers as follows: AAA = 20, AA+ = 19, AA = 18, …, C = 0. A notch is the difference between two consecutive ratings.

[1] The number of banks, for which a particular average is calculated, is reported in parentheses. [2] S&P stand-alone ratings not available.

Sources: Fitch Ratings; Moody's Investors Service; Standard & Poor's. Table 2

[11] For the numerical examples, we convert ratings into numbers as follows: AAA = 20, AA+ = 19, AA = 18, …, C = 0. A notch is the difference between two adjacent ratings.

[12] In the case of covered bonds, ratings differences in 2007 arose primarily from differences of opinion concerning the protection offered by the cover and its structure rather than from different assessments of bank default risk. See Packer et al (2007).

Bank ratings before the crisis and now[1]

Averages across banks

	Mid-2007			April 2011			Change (number of notches)		
	S&P[2]	Moody's	Fitch	S&P[2]	Moody's	Fitch	S&P[2]	Moody's	Fitch
All-in ratings	A+ (65)	AA (58)	A+/AA– (62)	A/A+ (65)	A+/AA– (61)	A+ (63)	–0.6 (62)	–1.28 (58)	–0.54 (61)
Stand-alone ratings	– –	A (70)	A– (64)	– –	BBB+/A– (70)	BBB (62)	– –	–1.54 (69)	–1.75 (62)

[1] See Table 2 for a definition of stand-alone and all-in ratings and an explanation of how they are mapped into numbers. The number of banks for which a particular average is calculated is reported in parentheses. [2] S&P stand-alone ratings not available.

Sources: Fitch Ratings; Moody's Investors Service; Standard & Poor's. Table 3

... notably in Europe and the US

The downgrading of the global financial system masks some striking differences across geographical regions. All three major agencies have substantially lowered the ratings of US and European banks, reflecting these institutions' position at the epicentre of the global financial crisis (Table 4). By contrast, the rating agencies lowered their assessments of the creditworthiness and financial strength of Asia-Pacific banks very little, if at all.

Increased value of official support

The recent crisis also prompted the three agencies to reassess the external support available to banks. As the crisis unfolded, all-in ratings fell by less on average than stand-alone ratings. Thus, despite questions concerning the willingness and capacity of sovereigns to provide support to banks going forward, they currently contribute to a greater gap between stand-alone and all-in ratings than in mid-2007. Again, this is a phenomenon driven principally by banks in Europe and the United States, where external support has improved ratings by three notches on average most recently, from about two in 2007. At the country level, the percentage change in the ratings improvement due to external support has been largest for US and UK banks (Graph 3).

Rating changes, by region[1]

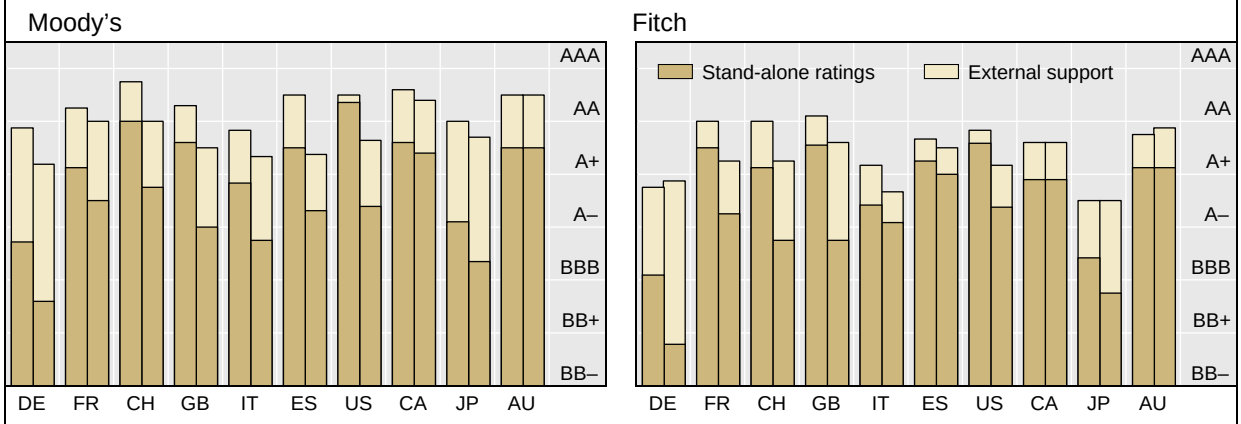
Averages across banks

	Europe[2]			United States			Asia-Pacific[3]		
	S&P[4]	Moody's	Fitch	S&P[4]	Moody's	Fitch	S&P[4]	Moody's	Fitch
All-in ratings	–1.06 (33)	–1.69 (35)	–0.83 (36)	–1.83 (6)	–1.71 (7)	–1.33 (6)	0.40 (15)	–0.33 (9)	0.36 (11)
Stand-alone ratings	– –	–2.39 (36)	–2.80 (32)	– –	–3.93 (7)	–2.42 (6)	– –	0.44 (18)	–0.25 (16)

[1] Between mid-2007 and April 2011. See Table 2 for a definition of stand-alone and all-in ratings and an explanation of how they are mapped into numbers. The number of banks for which a particular average is calculated is reported in parentheses. [2] Refers to banks headquartered in 13 European countries. [3] Refers to banks headquartered in Australia, China, India and Japan. [4] S&P stand-alone ratings not available.

Sources: Fitch Ratings; Moody's Investors Service; Standard & Poor's. Table 4

Stand-alone ratings and the importance of external support[1]



DE = German banks (8; 8); FR = French banks (4; 2); CH = Swiss banks (2; 2); GB = UK banks (5; 5); IT = Italian banks (3; 3); ES = Spanish banks (4; 3); US = US banks (7; 6); CA = Canadian banks (5; 5); JP = Japanese banks (5; 3); AU = Australian banks (4; 4). The first figure in parentheses refers to the number of banks rated by Moody's, and the second to the number rated by Fitch.

[1] For each country, the first bar plots average ratings in mid-2007, and the second those in April 2011. The stand-alone rating plus the rise due to external support equals the all-in rating. See Table 2 for a definition of stand-alone and all-in ratings and an explanation of how they are mapped into numbers for the calculation of averages.

Sources: Fitch Ratings; Moody's Investors Service. Graph 3

The future of bank ratings

The downgrading of the banking sector, which started during the course of the recent financial crisis, is likely to continue. The key reasons for this are lessons learned from the recent crisis about systemic risk and the volatility of banks' performance, weakened finances of some sovereign providers of support, and policy initiatives to wean banks off official support.

Downgrading banks for such reasons could put strain on the sector in the short term, but would also place it on a long-term path towards a sustainable risk profile. In the short term, downgrades can reduce banks' capital-raising capacity, just as they emerge from the crisis with weakened balance sheets and the need to meet stricter regulatory requirements. That said, ratings that reflect changes to regulatory and support frameworks and accurately capture banks' vulnerabilities would help strengthen market discipline and align risk with funding costs. This would lead to a healthier banking sector in the long term.

Of course, changes to bank ratings – be they driven by a methodological overhaul or a simple recalibration of the ratings model – will be consequential only to the extent to which they affect financial decisions. The financial crisis has given rise to policy initiatives that aim to weaken the reliance of regulators and investors on rating agencies.[13] That said, it is not obvious that market players, especially those facing expertise constraints, will find viable alternatives to ratings provided by the major agencies.

[13] See, for example, Dodd-Frank Act (2010) and Financial Stability Board (2010).

To the extent that rating agencies maintain their pre-crisis role in the financial landscape, they will influence the effectiveness of prudential authorities' communication with financial markets. More transparent ratings will convey more explicit assessments of the external support available to banks. Any doubts expressed about policy initiatives to restrict external support and to put in place effective resolution schemes could undermine official statements to the contrary. Conversely, convincing agencies of the irreversibility of these policy initiatives could contribute to a smooth transition to new regulatory and support frameworks for banks.

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The predictive content of financial cycle measures for output fluctuations[1]

The financial cycle refers to fluctuations in perceptions and attitudes about financial risk over time. It is often marked by swings in credit growth, asset prices, terms of access to external funding, and other financial developments. A single measure that summarised such indicators would simplify analysis of the financial cycle, with benefits for both systemic risk assessment and stabilisation policy. It is not obvious, however, how best to select and combine the many potentially relevant indicators or how the usefulness of the resulting measure might be assessed. One criterion is predictive power. This special feature reviews the power of three differently composed measures to predict output fluctuations up to two years ahead. One of the measures is found to have substantial predictive content for output forecasting at short horizons. However, this result seems to arise mainly from the inclusion of indicators strongly related to actual financial system stress, rather than from swings in more generalised perceptions and attitudes about financial risk.

JEL classification: E32, E51.

The concept of the financial cycle is central to the study of systemic risk and stabilisation policy. It generally refers to swings in perceptions and attitudes about financial risk. These changes are often marked by corresponding swings in credit growth, asset prices, terms of access to external funding, and other indicators of financial behaviour.[2] Financial cycles contribute to output fluctuations both in normal times and during financial crises. The influence of interest rates on the financial cycle also makes it relevant to the study of the monetary policy transmission mechanism.

However, the financial cycle is not well defined empirically. No single variable corresponds closely in concept to the financial cycle. Instead, it is latent in quantities and prices set in many financial and non-financial markets. In practice, policymakers track the financial cycle by looking at a broad range

[1] I am grateful to Claudio Borio, Stephen Cecchetti and Christian Upper for useful comments on earlier drafts of this article, and to Emir Emiray for able research assistance.

[2] See the discussion of the financial cycle in, for example, Borio et al (2001).

of indicators.[3] A single measure that summarised these indicators would be useful in the same way that the output gap can represent the common movement in many economic indicators and embody the business cycle in macroeconomic analysis.

This article looks at issues related to the construction of financial cycle measures by studying three recently developed indicators of quarterly financial activity in the United States. These are the financial conditions index developed by Hatzius et al (2010; HHMSW);[4] the credit/GDP gap used in the countercyclical capital buffer guidance issued recently by the Basel Committee on Banking Supervision (2010; BCBS);[5] and the financial cycle measure from my earlier work with a co-author (Domanski and Ng (2011; DN)). Only DN was designed expressly to measure the financial cycle as defined here. However, HHMSW and BCBS have related aims, and it is worth noting the different design choices and their consequences.

The specific consequence explored here is for the predictive content of the three measures for US GDP growth (using final, not real-time, data) up to two years ahead. This is the main criterion used to address the question of which measure is "best" – though of course other criteria are possible and could result in different rankings.

Predictive content is assessed with a forecasting approach in which the observations to be forecast are not used in the estimation of the forecasting equations. The target period for testing predictive content is the six years to March 2010. This period features the run-up to the recent global financial crisis and deep recession. However, the analytical setup abstracts from crises as such and is instead cast more generally in terms of output fluctuations (up and down, large and small). This approach reflects policymakers' interest not only in predicting financial crises (which was the context in which BCBS was developed), but also in understanding the role of the financial cycle in output fluctuations unaccompanied by financial crises. The financial cycle's contribution to growth volatility even absent a crisis remains relevant for policy seeking to address financial imperfections.

The rest of the article proceeds as follows. The next section outlines the three measures in more detail. The subsequent section presents the results of the evaluation of the predictive content of the three measures for output growth. The final section discusses the results and draws conclusions.

Three financial cycle measures

Recent theoretical and empirical papers suggest candidate indicators for inclusion in summary financial cycle measures. These cover credit and asset prices (eg Claessens et al (2009)), credit spreads (Cúrdia and Woodford

[3] See the review by Čihák (2006) of the typical contents of financial stability reports.

[4] HHMSW was downloaded from Mark Watson's website.

[5] I am grateful to Mathias Drehmann for providing the data for BCBS.

(2010), Gilchrist et al (2009)), leverage and liquidity (Adrian and Shin (2008), Geanakoplos (2010)), surveyed bank lending standards (Lown and Morgan (2006)) and banks' non-core liabilities (Shin and Shin (2011)).

Financial cycle measures can be based on broad …

Of the three measures considered here, HHMSW uses variables covering the broadest range of financial concepts (see Table 1 for a list). This broad approach is related to its creators' intention to measure "the current state of financial variables that influence economic behavior" (Hatzius et al (2010, p 1)), rather than the fluctuations in perceptions and attitudes about financial risk that lie at the heart of the definition of the financial cycle used in this article.[6] In particular, HHMSW includes financial variables that one would expect to be significantly affected by the emergence of acute financial system stress, such as the Libor-OIS spread, the TED spread (spread between interbank and short-term US government debt interest rates) and idiosyncratic bank stock price volatility. It also includes the real effective exchange rate, which is likely to be affected by monetary policy. However, unlike some other financial conditions indices, it does not include short-term interest rates other than in spread form.[7]

Financial concepts represented in HHMSW and DN

Concept represented	HHMSW	DN
Intermediated credit growth	X	X
Equity prices	X	X
Property prices	X	X
Corporate credit spreads	X	X
Commodity prices	X	X
Term spread – short-term	X	
Term spread – medium- to long-term		X
Lending standards	X	X
Loan-to-deposit ratio		X
Securities issuance	X	
Aggregate money	X	
Exchange rate	X	
Acute financial system stress indicators:		
VIX	X	
TED spread	X	
idiosyncratic bank stock price volatility	X	
Libor-OIS spread	X	
bank CDS spread	X	
Others	X	

Table 1

[6] Some other examples of financial conditions indices in the same spirit are those of Beaton et al (2009), Brave and Butters (2011), Guichard et al (2009) and Swiston (2008).

[7] FCIs that include short-term interest rates seem to aim at a concept more akin to the general availability and cost of funding, which is clearly strongly driven by monetary policy, rather than at the financial cycle concept as defined here.

HHMSW is the least-squares estimate of the single underlying financial "factor" assumed to underlie their chosen variables.[8] The factor model statistical framework is a popular approach to summarising the common variance in many variables (see Box 1). It offers the promise of condensing the information in dozens or hundreds of variables into a few summary variables (or, as here, into one). The technique essentially weights each underlying variable according to the similarity of its fluctuations to those of the other variables. Variables that have overlapping cycles are weighted more heavily. This corresponds to the aim of constructing financial cycle measures that summarise the common cycle in a range of financial variables. HHMSW accounts for about 40% of the variance in the variables it summarises.

... or narrow sets of underlying financial indicators

The second measure, DN, is computed from variables whose fluctuations would, in its authors' judgment, mostly reflect ebbs and flows in risk sentiment rather than other influences. In particular, it excludes any variables likely to reflect acute financial system stress or be heavily influenced by monetary policy. The variables meeting these criteria represent a narrower set of financial concepts than those in HHMSW (Table 1). They were combined using a factor approach similar to that for HHMSW.

In principle, if the factor model specification correctly characterises the relationship between the financial variables and the financial cycle, this tighter judgmental preselection should add information (provided the judgment is correct) and result in a more accurate estimate of the financial cycle. The resulting financial cycle measure should then be a better variable for testing the relationship between the financial cycle and output fluctuations, as is done in the next section.

DN accounts for about 50% of the variance in its underlying variables, a higher proportion than for HHMSW. This result is consistent with the preselection of a more homogeneous set of variables than those for HHMSW. The higher explained variance indicates that a single underlying cycle is statistically more evident in the variables used for DN, compared with those used for HHMSW. The source documents for DN and HHMSW report the factor model estimates of the relative weights on the respective underlying variables, and show that although both DN and HHMSW have high weights on credit spreads, lending standards, stock prices and credit, HHMSW also has high weights on indicators of acute financial system stress.

The third measure, BCBS, is intended to help "gauge the build-up of system-wide risk" (BCBS (2010, p 8)), rather than to measure the financial cycle as defined here, although the two ideas are clearly related. BCBS is the deviation from trend of the credit-to-GDP ratio, constructed using a filter and selected as the most suitable guide to the build-up of system-wide risk of a range of variables tested. The construction and selection techniques are documented in Drehmann et al (2010). Its design emphasised simplicity and

[8] The impact of past output and inflation on the financial variables is stripped out by linear regression prior to their use in the factor model. In practice, this step seems to make little difference to the profile of the estimated factor.

Box 1: Factor models

Factor models exploit the fact that variables co-move. They are valid under conditions that are in practice not difficult to satisfy for many interesting economic questions (Stock and Watson (2005)), and are often used in empirical business cycle studies (eg Kose et al (2003)) and in forecasting (eg Stock and Watson (2002)).

A factor model

$X_t = A'F_t + e_t$

decomposes the variance of each of N variables (collected in X_t) into a component due to r common factors (collected in F_t and weighted by A), and an idiosyncratic component (collected in e_t) capturing the rest of the variance. Because the point of the exercise is to (drastically) reduce the number of variables one has to deal with, r is assumed or expected to be much less than N. The common and idiosyncratic components are orthogonal by construction. The factors are also contemporaneously orthogonal to each other. The idiosyncratic components can be serially correlated and cross-correlated "weakly" as defined by Chamberlain and Rothschild (1983). In a general "approximate dynamic" factor model framework (Bai and Ng (2002)), lags of factors can appear in F_t and F_t can follow a vector autoregressive process.

Both HHMSW and DN were estimated assuming a simple static model where F_t comprises a single factor that impacts X_t contemporaneously only and corresponds to the financial cycle.[①] The variables in X_t were rendered stationary where necessary by differencing, and then standardised.[②] With a balanced panel as in DN, F_t can then be estimated as the first principal component of X_t. With an unbalanced panel, as in HHMSW, it can be estimated iteratively.

In principle, the factor model framework allows as many variables in X_t as desired as long as the conditions on the serial and weak cross-correlation of the e_t are satisfied. But in the practical reality of small samples, preselection of variables (and other factor modelling choices) can make a difference to forecasting performance (Eickmeier and Ng (2010)). The results in the main text suggest, for example, that the use of a single static factor model to characterise the common variance in the variables in HHMSW is too restrictive, and better forecasting performance is achieved if the variables measuring acute financial system stress are split out.

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① Bai and Ng (2002) provide formal information criteria for choosing r. Hatzius et al (2010) tested for r and other structural features in an approximate dynamic factor model framework, and found that the one-factor static model performed best in out-of-sample forecasting compared with more complicated specifications. ② A non-trivial issue is that different ways of achieving stationarity emphasise variance at different frequencies in the raw data. This is particularly relevant for financial variables such as credit, which in almost all economies exhibits a strong upward trend (even as a ratio to GDP). The simple differencing approach has the advantage of transparency, but tends to emphasise higher-frequency variance.

transparency, which meant a strong preference for parsimony (only two variables ultimately used) compared with the more numerous variables and concepts used for HHMSW and DN.[9] A further difference was that the selection process involved not only judgment about the likely relevance of the candidate variables (as in DN and HHMSW) but also quantitative testing for

[9] That said, the Basel Committee guidance on the buffer also cautions that BCBS should be supplemented with other aggregate indicators such as asset prices, credit spreads and macro variables, on the basis that using a wider range of variables helps in judging whether developments in BCBS are consistent with financial stability. Such a caveat underscores the desirability of a systematic and transparent way of combining the financial cycle information in a wide range of variables, even if such comprehensiveness in the indicator needs to be traded off against transparency and simplicity.

predictive content for financial crises.[10] However, as with DN but not HHMSW, the variance of none of the candidate variables considered during the process of construction and selection of BCBS was likely to be dominated by the state of a crisis actually in progress. BCBS is thus closer in spirit to the concept of the financial cycle than HHMSW, at least in terms of the upswing phase of the financial cycle. For the downswing phase under stress conditions, Drehmann et al (2010) emphasise that BCBS tends to lag the emergence of actual financial system stress, meaning that other variables are needed to measure this phase.

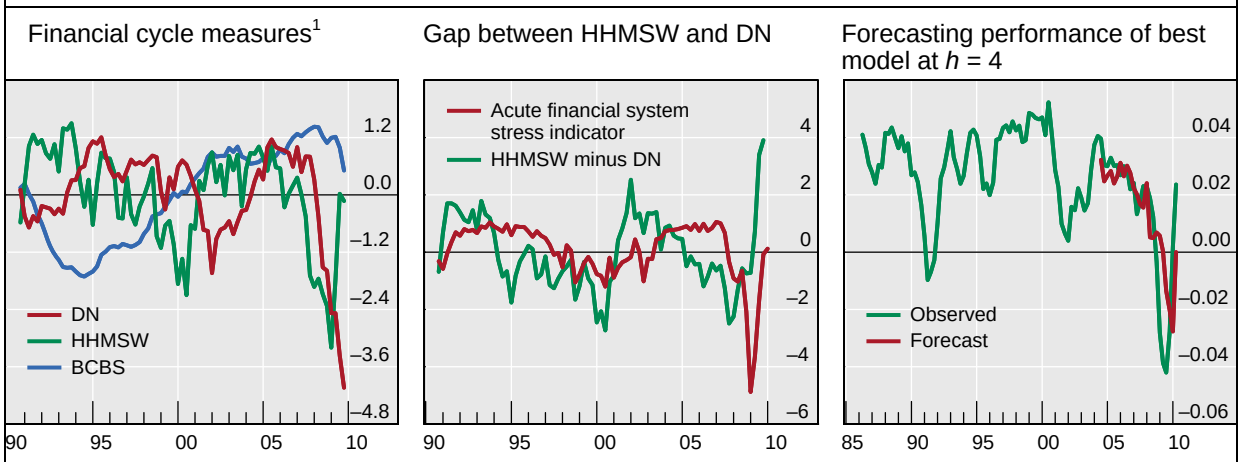
Preselection of underlying indicators can make a big difference to the resulting measures ...

The choices about design and underlying variables make a big difference to the profiles of the resulting measures (Graph 1, left-hand panel). DN matches quite well the documented episodes of financial cycles in the United States, such as the aftermath of the savings and loan crisis (early 1990s), the dotcom euphoria and bust (1998–2001) and the period leading up to and including the latest financial crisis (2004–). HHMSW exhibits a little more high-frequency volatility, probably owing to its inclusion of variables such as the VIX that are volatile at high frequencies. The effect of using a high degree of smoothing in the filter used to construct BCBS is evident in its much longer periodicity, of about 20 years, compared with about eight or nine years for DN and HHMSW. This reflects the calibration of BCBS to the frequency of financial crises.

... especially if variables related to acute financial system stress are included

Although DN and HHMSW differ materially over the whole sample, they diverge most obviously at the end (Graph 1, centre panel). This is the consequence of the inclusion in the latter of variables relating to acute financial system stress. The centre panel of Graph 1 plots an acute financial system stress indicator constructed as the first principal component of the TED spread, idiosyncratic bank stock price volatility and the VIX, all of which ranked within

Financial cycle measures, their composition and their predictive content



[1] All measures normalised such that an increase indicates greater risk-seeking tendency.

Sources: Basel Committee on Banking Supervision (2010); Hatzius et al (2010); author's calculations. Graph 1

[10] The testing for predictive content for large, relatively rare events (crises) meant, among other things, that the smoothing parameter was set to extract cycles that are long relative to typical business cycle lengths.

the top eight by weight of the 45 variables used in HHMSW.[11] The acute financial system stress indicator is clearly able to explain the large pickup in HHMSW at the end of the sample, when these variables recovered (following massive policy intervention) from their large and sharp increases during the crisis. By contrast, at the end of the sample, DN indicates the financial cycle at extreme and increasing levels of pessimism about financial risk, consistent with reports of the general sentiment at the time. Differences between the two measures over the rest of the sample indicate, though, that there is still a major component to be explained by concepts represented in HHMSW but not in DN.

Evaluation of predictive content

A pertinent question for those who might use the three measures in policymaking is how the different choices of design and underlying variables affect their predictive content for output. Earlier work by English et al (2005) found that financial conditions indices had predictive content for the output gap, but all of these indices, like HHMSW, drew on rather broad sets of underlying financial indicators (including some heavily influenced by monetary policy, such as short-term interest rates). The purpose here is to see what difference it makes to exclude such variables, consistent with a narrow definition of the financial cycle.

The measures' predictive content for output fluctuations is one measure of their usefulness for policy

As noted earlier, the three measures considered were constructed for different purposes, so there is no a priori reason to suspect that they should perform well in the current context. Indeed, as discussed in Borio and Lowe (2004), the predictive content for output of measures based on the credit/GDP ratio, such as BCBS, could be expected to be highly non-linear and even non-monotonic. Nevertheless, given the apparent similarity of the concepts that the three measures are intended to represent, it is interesting to compare them side by side against the same criterion. If they turn out to perform well for a policy-relevant purpose different to the one for which they were designed, then so much the better.

Forecasting power is tested for GDP growth two, four and eight quarters ahead (see Box 2 for details). The root mean squared forecast errors (RMSFEs) of equations are calculated with the financial cycle measures and macroeconomic variables (output growth itself, inflation and the real federal funds rate) as predictors, and compared with benchmark specifications using macroeconomic variables only as predictors. The test period for forecasting performance is Q2 2004 to Q1 2010 (24 quarters), using equations estimated on data starting at the latest in Q3 1991 (depending on the specification) and not including data to be forecast.

[11] See the table of factor model weights in Hatzius et al (2010, p 40). Data for the VIX, the TED spread and idiosyncratic bank risk were obtained from Mark Watson's website.

Box 2: Setup for testing predictive content

Predictive content is tested for using simple quarterly time-series linear forecasting equations. Such a setup is simpler than the analysis by Borio and Drehmann (2009) of the predictive content of BCBS and other variables for a binary variable indicating the occurrence or not of a financial crisis. Among other things, the setup in this feature does not require a definition of crisis.

The target variable (the regressand in forecasting equations) Z_t in the forecasting exercise is four-quarter growth in GDP, that is, $Y_{t+h} - Y_{t+h-4}$, where Y_t is log GDP and h = 2, 4, 8 is the forecasting horizon.[①] The target period for forecasts is Q2 2004 to Q1 2010 (24 observations).

The forecasting exercise does not use observations to be forecast in the estimation of the forecasting equations. The forecast errors are generated by first estimating a forecasting model using data up to t–1, using the estimated model to forecast Z_t, and then repeating with an observation added to the end of the sample, until all the observations in the test period are used.

The forecasting models were estimated by OLS. All lags on the predictor variables (the regressors) up to p = 0 to 4 were included in alternative specifications. Starting dates for the estimation sample depend on p and on the predictor variables in the specification. Sample starting periods were set to maximise sample length, in the interests of improving the accuracy of the estimates in each case.[②] The latest estimation sample starting period was Q3 1991 and used at least 43 observations, depending on h, p and which observation from the test period was being forecast.

The benchmark forecasting model, a "macro only" model, featured as predictor variables annual growth itself, quarterly GDP deflator inflation and the ex post real federal funds rate. p for the benchmark model at each horizon was selected on the basis of best performance on the test period in terms of root mean squared forecast error (RMSFE), with a search from p = 0 to p = 4.

To the macro predictor variables was then added HHMSW, BCBS or DN either by themselves, or accompanied by the acute financial system stress indicator shown in the centre panel of Graph 1, with all lags up to p = 0 to 4.

Significance tests for lower model RMSFE compared with benchmark at a given horizon over the test period were conducted using a one-sided Diebold and Mariano (1995) (DM) test. The DM test was implemented using the procedure outlined in Sheppard and Patton (2009), estimating the variance of the DM test statistic using Newey and West's (1987) estimator with the number of lags set to h – 1. Diebold and Mariano (1995) view this usage of the Newey-West estimator as a "reasonable" benchmark for multi-step-ahead forecasting.

Note that this exercise is not a true out-of-sample test of the forecasting ability of models using the financial cycle measure designs examined here. For example, I used as predictors the full-sample estimates of both DN and HHMSW. A more realistic, and tougher, test would be to estimate the measures without using data from the period being forecast, before using them as predictors in the estimated forecasting equations. It would also be closer to a true out-of-sample test to use real-time output data, and to choose a single p for each iteration. These enhancements would, however, be more computationally intensive and add another dimension of complication to the interpretation of the results.

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① Note that, because of the lags in the target variable definition, the effective lead on the instantaneous growth rate is h–2 rather than h. Hatzius et al (2010), who also assess their financial conditions indices for predictive content, use $Y_{t+h} - Y_t$ as the target, which also reduces the effective lead, by h/2. Such choices, while not ideal econometrically, help reduce noise in the target variable. ② The earliest possible sample start was 1977, reflecting the availability of the federal funds rate data. Going back this far raises issues of unstable parameters arising from structural change, undermining the goal of achieving better estimates in the forecasting equations (that assume no structural change). In practice, varying the sample starting periods from 1977 to 1991 (where that was possible) did not matter very much to the forecasting performance or to the relative ranking of the models.

The results (Table 2) make clear that output growth over the test period is difficult to forecast. The performance of the benchmark model is similar to that of a random walk model at all three horizons. The RMSFEs for the test period

are large, with much of the sharp fall in output during the period remaining unexplained even by the best forecasting model (Graph 1, right-hand panel).

Including financial cycle measures in the prediction equations significantly improves forecast performance at very short, but not at longer, horizons. This is indicated in Table 2 by relative RMSFE below one. This means that, at the shorter horizons h = 2 and h = 4, financial cycle measures have some

GDP growth forecasting performance[1]

RMSFE relative to benchmark, except where indicated

Horizon h = 2					
Random walk RMSFE	0.019				
"Macro only" benchmark RMSFE	0.019				
	lags p allowed in forecasting model =				
Forecasting model predictors – macro plus:	0	1	2	3	4
HHMSW only	0.91	0.65**	0.84	0.93	0.87
DN only	1.21	0.99	1.12	1.16	1.15
BCBS only	1.05	0.91**	0.95	0.96	0.96
HHMSW, acute stress indicator	0.96	0.53**	0.51**	0.54**	0.58**
DN, acute stress indicator	0.84	0.77**	0.83**	1.04	1.24
BCBS, acute stress indicator	1.01	0.79***	0.83***	0.81**	0.87**
Horizon h = 4					
Random walk RMSFE	0.026				
"Macro only" benchmark RMSFE	0.030				
	lags p in forecasting model =				
Forecasting model predictors – macro plus:	0	1	2	3	4
HHMSW only	0.70	0.70	0.78	0.79	0.77
DN only	0.93	0.96	0.97	0.99	1.01
BCBS only	0.93	0.92	0.96	1.03	1.04
HHMSW, acute stress indicator	0.70	0.51*	0.58	0.64	0.73
DN, acute stress indicator	0.93	0.98	1.13	1.35	1.54
BCBS, acute stress indicator	0.91	0.88	0.86*	0.85	0.94
Horizon h = 8					
Random walk RMSFE	0.025				
"Macro only" benchmark RMSFE	0.028				
	lags p in forecasting model =				
Forecasting model predictors – macro plus:	0	1	2	3	4
HHMSW only	1.02	1.03	1.06	1.05	1.06
DN only	1.13	1.16	1.32	1.50	1.68
BCBS only	1.14	1.23	1.29	1.09	1.04
HHMSW, acute stress indicator	0.97	0.95	1.01	1.13	1.16
DN, acute stress indicator	1.22	1.37	1.46	1.49	1.66
BCBS, acute stress indicator	0.93*	0.95	1.02	1.16	1.31

[1] *, ** and *** indicate that the corresponding forecasting model achieved a significantly lower RMSFE than the benchmark model at the 10%, 5% and 1% levels, respectively.

Table 2

predictive content for the component of output fluctuations not explained by macroeconomic variables (though at h = 4 few of the RMSFE improvements are significant). In some cases, the improvement in forecasting performance is quite sensitive to p, suggesting that overfitting could be a concern.

By contrast, very few models improve forecasting performance relative to the benchmark at h = 8. The only model that is able to improve statistically (but not economically) significantly on the benchmark RMSFE at this horizon is the model using BCBS and the acute stress indicator with p = 0. This longer horizon is more relevant for policy actions (such as macroprudential interventions) that are needed to anticipate and mitigate the likelihood of medium-term output fluctuations due to upswings in the financial cycle, as opposed to actions reacting to events happening now or in the very short term of the next few quarters.

Acute financial system stress variables have material predictive content at very short, but not longer, horizons

The inclusion of the acute financial system stress indicator shown in the centre panel of Graph 1 as an additional predictor generally improves forecasting performance further at horizons h = 2 and h = 4. This is the case even for HHMSW, which already includes these variables in its construction. There could be two reasons for this result. First, the timing of the effects of acute financial system stress on growth may not be the same as that of the other variables included in HHMSW. Second, their relative predictive content may differ from the weights obtained from the factor estimation.

The results from including the acute financial system stress indicator also suggest that some of the greater predictive content at short horizons of HHMSW relative to the other two measures may be due to it capturing (however imperfectly) acute financial system stress. These variables are likely to be relevant for confirming that a crisis is, in fact, emerging and will lead within one or two quarters to a recession. The results suggest that they shed less light on the likelihood of output fluctuations more than a year ahead (before any systemic financial stress has actually appeared). That said, it is notable that the inclusion of the acute financial system stress indicator can generate a small improvement in forecasting performance at h = 8 with models including BCBS.

Discussion and conclusions

The results reported in the previous section suggest that choices about the types of variables to include in a summary measure of the financial cycle can make a big difference to the profile of the resulting measure. That said, there is little difference in the predictive content of the three measures for output fluctuations more than a year ahead. Given the lags in policy implementation and transmission, this longer horizon is the most relevant for policy seeking to prevent financial crises and their associated large output losses. Of course, such policy need not be predicated on indicator variables that have a linearly stable relationship with output fluctuations. BCBS, for example, is intended to support policy to build defences against the build-up of system-wide risk, rather

than to head off actual crises or their output consequences within precisely defined time frames.

Indicators for acute financial stress should be treated separately from those for general financial risk sentiment

The relatively good short-term forecasting performance of HHMSW compared with the other two measures appears to reflect the influence of the indicators of acute financial system stress that it incorporates. At least for the purposes of understanding the consequences of financial developments for output, it is therefore worth treating acute stress indicators separately from variables reflecting more general financial risk sentiment. However, while such short-term predictive content might be useful for confirming the likely adverse growth consequences of a financial crisis already in progress, it is less useful for preventing crises in the first place.

The (marginally) best performance of forecasting models that use BCBS for medium-term forecasting is somewhat surprising, given the simplicity of the measure and the different objectives for which it was tailored. But the result nevertheless underscores the importance of credit in macroeconomic dynamics. DN was designed to capture a broader set of indicators for general financial risk sentiment (while not as broad as HHMSW), but forecasting models using DN performed very poorly relative to the others.

The generally poor forecasting performance of all of the models suggests that any relationship between the financial cycle and output fluctuations is unlikely to be as simple as the linear relationship assumed here (for simplicity and generality). It is widely accepted that financial crises contribute to very large output fluctuations, and the short-term forecasting results presented here are consistent with that proposition. However, they shed little light on the relationship between output fluctuations and financial cycles that do not lead to crises, for which better models are needed that can forecast the output fluctuations due to the financial cycle a year or more ahead. Models could take account of, for example, non-linearities, state dependence and the possibility that the relationship between output fluctuations and the financial cycle might have changed over time due to increasing global economic and financial integration.

The choice of a test period that includes the recent extreme global recession sets the bar high. This period may be so untypical that it is a poor test for the predictive content of financial cycle measures in more normal business and financial cycles. This proposition should be tested using more data on normal cycles.

Better financial cycle measures with predictive content over longer horizons are still needed

Finally, the finding that preselection matters for the predictive content for output fluctuations of factor model-based financial cycle measures suggests that it is worth continuing to try to refine such measures. Better measures would facilitate the study of how financial cycles behave. Structural empirical models that bring financial cycles and macroeconomic dynamics together would assist in determining the right responses to financial cycle developments. For example, financial cycle developments due to shocks emanating from the financial system itself might require different responses to those that are simply propagations of shocks from elsewhere in the economy.

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Expansion of central clearing[1]

By the end of 2012, all standardised over-the-counter (OTC) derivatives will have to be cleared through central counterparties (CCPs). We estimate the financial resources that different CCPs would need to clear safely the full volume of interest rate swaps and credit default swaps currently held by major derivatives dealers. Our results suggest that these dealers already have sufficient unencumbered assets to meet initial margin requirements, but that a few may need to increase their cash holdings to meet variation margin calls in a timely way. We also find that the potential costs of individual or multiple dealer defaults for CCPs and their non-defaulting clearing members are likely to be small relative to their equity as long as CCPs factor into initial margin requirements the extent of tail risk and time variation in risk of different types of derivatives. Finally, clearing different types of OTC derivatives in a single CCP could reduce both margins and collective loss-absorbing resources.

JEL classification: G24, G28.

The nature of counterparty exposures in over-the-counter (OTC) derivatives markets is widely considered to have exacerbated the recent financial crisis. Trading in this market is decentralised, and exposures were often inadequately collateralised. Their bilateral character both led to the possibility of default cascades and made it difficult to assess the overall risks taken on by market participants.[2]

Clearing trades centrally can mitigate these structural weaknesses. This involves a central counterparty (CCP) standing between the parties to bilateral transactions and taking on their respective counterparty risks. The more transactions a well collateralised CCP covers, the less likely default cascades

[1] We thank Claudio Borio, Stephen Cecchetti, Jacob Gyntelberg, Philipp Haene, Marc Hollanders, Sarah Josephson, Can Okay, Andy Sturm and Christian Upper for helpful comments. The views expressed are those of the authors and do not necessarily reflect those of the BIS.

[2] See, for example, Acharya and Bisin (2010), and Duffie (2009).

are and the more comprehensive a picture of the distribution of risks can be discerned.[3]

Given their financial stability objectives, authorities are promoting the expansion of central clearing. In September 2009, the G20 Leaders stated that all standardised OTC derivatives should be cleared through CCPs by the end of 2012. At present, central clearing covers approximately 50% of the $400 trillion of outstanding interest rate swaps (IRS), 20–30% of the $2.5 trillion of outstanding commodity derivatives and a little under 10% of the $30 trillion of outstanding credit default swaps (CDS).[4]

This reflects the importance of protecting CCPs, which lie at the heart of counterparty networks, against possible counterparty defaults. To this end, CCPs often demand more collateral on particular counterparty exposures than bilateral arrangements would, despite the multilateral netting benefits. They also require additional collateral from members of the central clearing system to help absorb any residual losses that counterparty defaults might generate. Several authors point out that bilateral clearing arrangements as a whole are significantly undercollateralised and do not take potential contagion effects into account.[5] Against this background, the systematic collateralisation required by CCPs internalises the overall costs of the financial instruments they clear.

In this article, we estimate the financial resources that two separate CCPs operating in different derivatives markets and their dealer members would need if central clearing were expanded in a prudent way to cover the full volume of IRS and CDS held by the major derivatives dealers. These estimates are constructed by considering how a hypothetical CCP might seek to protect itself against the counterparty risk of 14 major derivatives dealers (the "G14 dealers"), which hold hypothetical IRS and CDS portfolios that are representative of true portfolios in a number of ways.

We focus on both IRS and CDS because the G14 dealers hold large volumes of these derivatives, which is relevant from a financial stability perspective. Also, IRS and CDS have different risk characteristics, which can affect the resource requirements for central clearing.[6] In particular, the volatility of market values tends to vary more over time for CDS than IRS. And, at any moment in time, the distribution of possible changes in market values generally has a fatter tail – meaning changes that are "extreme" compared to "normal" changes occur more often – for CDS than IRS (Graph 1).

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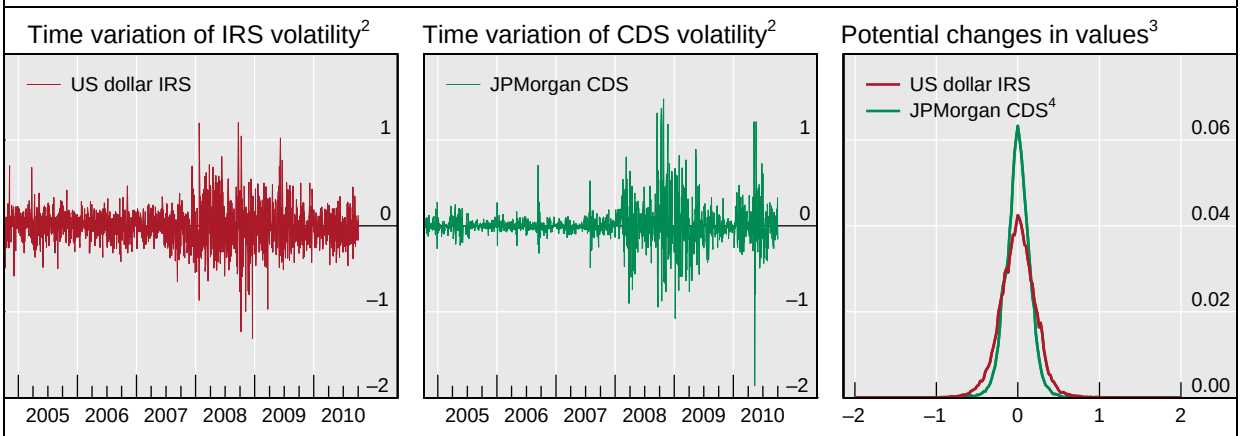
[3] Norman (2011) claims that a meltdown of the global financial system after the collapse of Lehman Brothers in 2008 was avoided largely as a result of the already existing CCPs. CPSS (2007) provides a detailed description of the operation and benefits of CCPs in OTC derivatives markets. See also Heller and Hollanders (2010).

[4] These figures are notional amounts adjusted for the doubling of contract volumes that central clearing introduces by replacing contracts between two parties, say A and B, with one contract between A and a CCP and a second contract between the CCP and B. See FSB (2010).

[5] See, for instance, Singh (2010).

[6] As of end-June 2010, the total gross notional amounts of IRS and CDS held by the G14 dealers were almost 16 times and two times their total assets, respectively.

Risk characteristics of interest rate swaps (IRS) and credit default swaps (CDS)[1]



[1] Four-year US dollar IRS and five-year JPMorgan senior CDS. [2] Daily changes in market value as a percentage of notional amount. [3] Probability density function of possible changes in market values as a percentage of notional amount, conditional on medium levels of IRS and CDS volatility (as prevailing on 14 March 2008). [4] The potential changes in the market value of JPMorgan's CDS are the numbers indicated on the x-axis divided by three.

Sources: Datastream; authors' estimates. Graph 1

The article is structured as follows. In the next section we explain how CCPs manage counterparty risk, including by collecting collateral for initial margins, variation margins and non-margin buffers such as default funds. In the following section, we provide estimates of potential losses on hypothetical G14 dealer IRS and CDS portfolios. We then detail the resources needed by dealers to meet margin requirements consistent with these potential losses, as well as the additional resources that CCPs would need to handle any residual costs of individual or multiple dealer defaults. In the following section, we suggest that CCPs could reduce risks to these non-margin resources by ensuring that initial margins are set in a way that takes into account time-varying volatility and fat-tailed risk distributions. We close by showing that, when these techniques are adopted, expansion of central clearing within or across asset classes can reduce the resources needed by dealers and CCPs.

CCP risk management practices[7]

CCPs manage counterparty risk through participation constraints ...

CCPs typically rely on four different controls to manage their counterparty risk: participation constraints, initial margins, variation margins and non-margin collateral.

A first set of measures are participation constraints, which aim to prevent CCPs from dealing with counterparties that have unacceptably high probabilities of default.

... initial margins ...

The second line of defense is initial margins in the form of cash or highly liquid securities collected from counterparties. These are designed to cover most possible losses in case of default of a counterparty. More specifically, initial margins are meant to cover possible losses between the time of default

[7] See, for example, CPSS-IOSCO (2004) for a detailed description of the risk controls of CCPs.

of a counterparty,[8] at which point the CCP would inherit its positions, and the closeout of these positions through selling or hedging. On this basis, our hypothetical CCP sets initial margins to cover 99.5% of expected possible losses that could arise over a five-day period. CCPs usually accept cash or high-quality liquid securities, such as government bonds, as initial margin collateral.

... variation margins ...

As the market values of counterparties' portfolios fluctuate, CCPs collect variation margins, the third set of controls. Counterparties whose portfolios have lost market value must pay variation margins equal to the size of the loss since the previous valuation. The CCP typically passes on the variation margins it collects to the participants whose portfolios gained in value. Thus, the exchange of variation margins compensates participants for realised profits/losses associated with past price movements while initial margins protect the CCP against potential future exposures. Variation margins, typically paid in cash, are usually collected on a daily basis, although more than one intraday payment may be requested if prices are unusually volatile.

... and non-margin collateral

Finally, if a counterparty defaults and price movements generate losses in excess of the defaulter's initial margin before its portfolio can be closed out, then the CCP would have to rely on a number of additional ("non-margin") resources to absorb the residual loss. The first of these is a default fund. All members of the CCP post collateral to this fund. The defaulting dealer's contribution is used first, but after this other members would incur losses. The default fund contribution of the defaulting dealer would be mutualised among the non-defaulting dealers according to a predetermined formula. Some additional buffers may then be available, such as a third-party guarantee or additional calls on the capital of CCP members. Otherwise, the final buffer against default losses is the equity of the CCP.

In order to calculate initial and variation margins, CCPs rely on timely price data that give an accurate indication of liquidation values. Clearing OTC derivatives that could become unpredictably illiquid in a closeout scenario could impose an unacceptable risk on the CCP.

Table 1 summarises the risk management practices of SwapClear, ICE Trust US and ICE Clear Europe, which are currently the main central clearers of IRS and CDS.

Potential losses on IRS and CDS portfolios[9]

We construct hypothetical portfolios for the major derivatives dealers ...

The resources required to clear centrally all IRS and CDS depend on the potential losses that the portfolios of all IRS and CDS market participants could generate. Both markets are dominated by the G14 dealers. Transactions between G14 dealers account for around 70% of outstanding IRS, while transactions between dealers (most of which involve at least one G14 dealer)

[8] Specifically, the last time that the defaulting dealer's portfolio was valued and variation margins were exchanged.

[9] The methodology outlined in this section is described in more detail in Heller and Vause (2011).

Risk management of selected central counterparties

Central counterparty	SwapClear	ICE Trust US	ICE Clear Europe
Owned by	LCH.Clearnet Group Ltd	IntercontinentalExchange Inc	IntercontinentalExchange Inc
Market segment	Interest rate swaps	North American credit default swaps	European credit default swaps
Participation requirements	Equity of $5 billion and a credit rating of A or equivalent[1]	Equity of $5 billion and a credit rating of A or equivalent[1]	
Basis of initial margins	Largest seven-day decline in portfolio market value over past 1,250 trading days	Large five-day decline in portfolio market value, derived from a combination of stress tests and a proprietary model that captures "dynamics of the asymmetric distribution of credit spreads and co-movement amongst CDS products"[2]	
Basis of variation margins	Daily change in portfolio market value[3]	Daily change in portfolio market value[3]	
Basis of default fund	Potential losses from default of single largest clearing member or simultaneous defaults of second and third largest clearing members, as derived from historical and theoretical stress tests[4]	Potential losses from default of "multiple large counterparties", as derived from a combination of stress tests and a proprietary model (as above)	
Size of default fund	$0.9 billion as of February 2011[5]	$3.2 billion as of December 2010	$2.0 billion as of December 2010
Equity	$0.4 billion as of December 2010	$2.8 billion as of December 2010	

[1] Plus other requirements including certain operational and risk management capabilities. [2] The model takes into account possible default, changes in CDS premia and interest rates as well as additional costs that may be incurred when liquidating large portfolios. [3] Intraday variation margin calls may be made in special circumstances. [4] Plus any losses from affiliates of these clearing members and the five lowest-rated members of LCH.Clearnet, who are assumed to also default in these circumstances. [5] This fund is shared by all central clearing operations of LCH.Clearnet. The contribution from SwapClear is $0.2 billion.

Table 1

account for around 85% of outstanding CDS.[10] We construct hypothetical portfolios of IRS and CDS for the G14 dealers and estimate potential losses on these portfolios and, hence, the resources required to clear them with a CCP. A lack of data prevents similar calculations being made for non-dealers, although we offer some rough estimates in a related working paper.[11]

... with a number of real-world characteristics ...

While dealers' IRS and CDS portfolios are proprietary, we can construct representative hypothetical portfolios based on some assumptions. In particular, we require sums across dealers of positions in individual derivatives to match those recorded in trade repositories as of 30 June 2010.[12] Similarly, we require sums across derivatives positions of individual dealers to match those recorded in dealers' financial reports and regulatory filings as of the same day. In addition, we require high degrees of overlap, on average,

[10] These figures also adjust for double-counting (see footnote 4).

[11] Despite the relatively small scale of non-dealers' outstanding positions, the resource requirements to clear these are larger than those required to clear dealers' outstanding positions. This is because non-dealers often have much larger net positions relative to gross positions than dealers. Further details are provided in Heller and Vause (2011).

[12] In particular, TriOptima's Interest Rate Repository for IRS and the Depository Trust & Clearing Corporation's Trade Information Warehouse for CDS.

between the various long and short positions of individual dealers to reflect the fact that dealers intermediate client trades. These were calibrated on the basis of discussions with market participants and helpful disclosures by one particular dealer in its regulatory filings.

Some additional assumptions further constrain our hypothetical CDS portfolios. In particular, we assume that if, after trading with clients, a dealer has a net short position in a certain category of single-name CDS then it hedges this exposure with a net long position of equal magnitude in a related CDS index or other multi-name CDS. Hence, we require that any net short positions in single-name CDS referencing North American companies are matched by net long positions in multi-name CDS referencing North American companies, and similarly for European companies. In addition, in accordance with supervisory requirements, we do not allow dealers to have CDS positions referencing themselves or their affiliates, so these positions are constrained to be zero.

We reduce the number of IRS and CDS in our hypothetical portfolios to keep the analysis manageable and, in some cases, because of a lack of adequate price data. This applied to around 5% of G14 dealers' IRS holdings and about 35% of their CDS holdings. Remaining positions are scaled up, however, so that our hypothetical portfolios remain as large in value as actual portfolios.

... and model potential losses on these portfolios

We then combine these hypothetical portfolios with estimates of potential changes in the market values of their constituents to derive potential portfolio losses. We use a statistical model when estimating potential changes in the market values of portfolio constituents to help ensure that the range of possible changes at any moment in time varies with recent changes in a manner consistent with the past. This allows potential portfolio losses and central clearing resources to be made conditional on prevailing levels of volatility of IRS and CDS. In addition, we fit a continuous probability distribution function to our potential changes in market values of portfolio constituents. This draws on results in extreme value theory which find that rarely observed extreme changes can be predicted using a particular probability distribution function fitted to less extreme observations. This helps us to estimate the risk of portfolio losses exceeding initial margins, which seldom occurs in practice. We also aim to reflect in our estimates appropriate co-movements in the market values of portfolio constituents. These are based on historical correlations, but with the degree of co-movement allowed to rise or fall depending on whether changes are extreme or non-extreme. This has a bearing on the non-margin resources that central clearing might require, as it affects the likelihood that the portfolios of different dealers could simultaneously generate margin shortfalls.

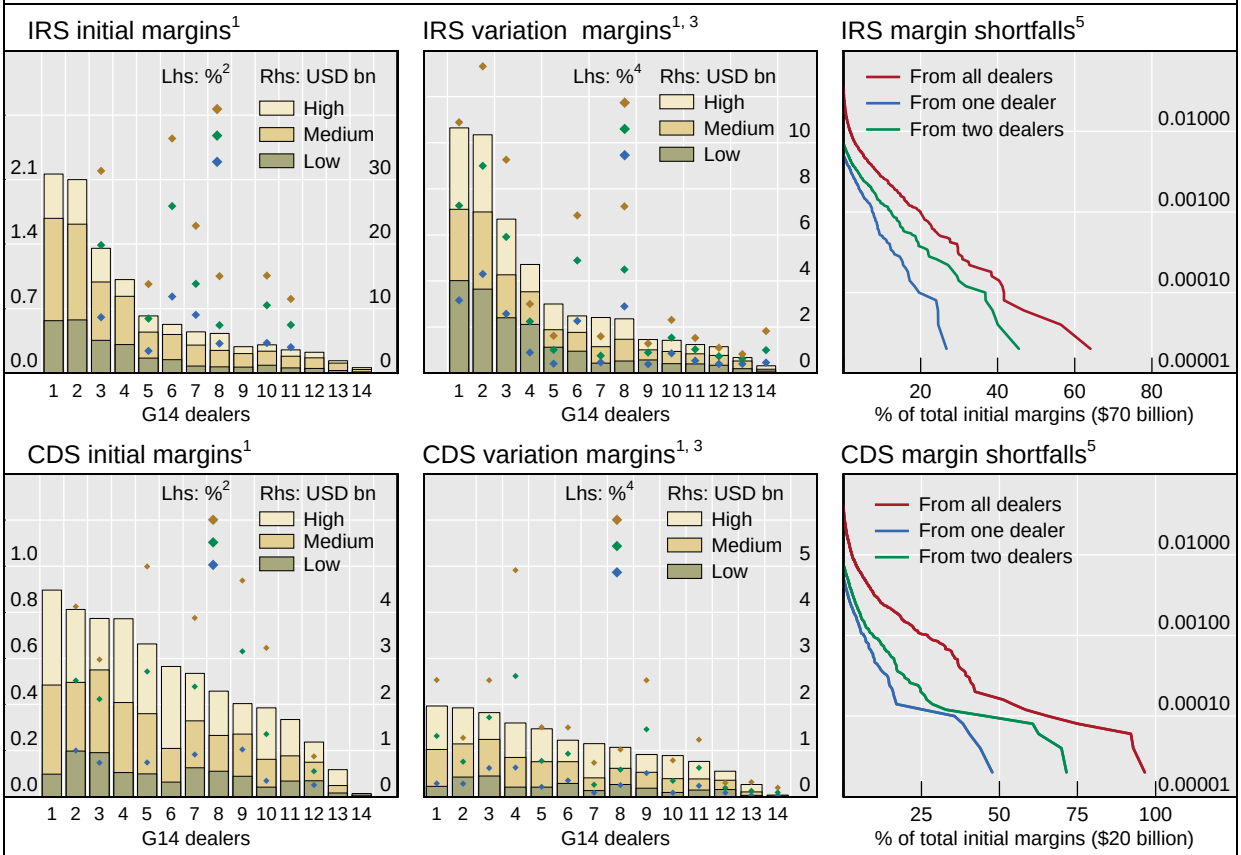
Resources needed to support central clearing of IRS and CDS[13]

Graph 2 shows the initial margin requirements and the worst-in-200-days variation margin calls of our hypothetical CCP. It also contains the non-margin funds that might be needed to clear the hypothetical IRS and CDS portfolios of the G14 dealers.

Appropriate initial margins vary with market volatility ...

As shown in the left-hand panels of Graph 2, estimated initial margins can vary significantly with prevailing levels of market volatility, especially for CDS. The upper left-hand panel shows, for example, that Dealer 7 would need to post $2.1 billion of collateral to clear its hypothetical IRS portfolio in an environment of low market volatility, similar to that prevailing before the recent financial crisis. This would grow by around 50%, to $3.2 billion, if volatility increased to the "medium" level seen early in the crisis, just before the rescue of Bear Stearns. And it would grow by around 150%, to $5.3 billion, if volatility increased to the "high" level seen at the peak of the crisis, amidst the negative market reaction to the US Troubled Asset Relief Program (TARP) and before

Resources to support central clearing of G14 dealers' IRS and CDS portfolios



[1] Shown for different levels of market volatility: low corresponds to 30 June 2006 (before the outbreak of the crisis), medium to 14 March 2008 (just before the rescue of Bear Stearns) and high to 10 October 2008 (around the peak of the crisis). [2] As a percentage of unencumbered assets. [3] One-in-200 largest variation margin call. [4] As a percentage of cash and cost equivalent. [5] Probability of shortfall of indicated size or greater; logarithmic scale. Shown for medium levels of market volatility, but results are similar at other volatility levels.

Source: Authors' estimates. Graph 2

[13] All the results in this article are based on 50,000 samples from the probability distribution functions fitted to potential changes in market values of portfolio constituents.

government recapitalisation of banks began in the United Kingdom. In comparison, the bottom left-hand panel shows that initial margin requirements for the hypothetical CDS portfolio of Dealer 7 would increase by around 160% or 325% from $0.6 billion if the prevailing level of market volatility increased from low to medium or high. The total initial margins that the CCP requires clearing members to post are $33 billion (low), $70 billion (medium) and $105 billion (high) for IRS and $6 billion (low), $20 billion (medium) and $35 billion (high) for CDS.

... but seem affordable, even under high volatility

Nevertheless, it seems unlikely that G14 dealers would have much difficulty finding sufficient collateral to post as initial margin. The diamonds in the left-hand panels show collateral requirements relative to dealers' unencumbered assets, with different colours again representing different levels of market volatility. Even the requirements based on high levels of volatility do not exceed 3% of the unencumbered assets of any dealer for which it was possible to estimate this figure. Although many unencumbered assets held by dealers do not presently qualify as acceptable collateral for initial margins, some of these could be swapped for assets that do qualify.

Some dealers may need more cash to help pay variation margins

By contrast, dealers may need to increase the liquidity of their assets as central clearing is extended. The centre panels of Graph 2 show similar patterns in potential variation margin calls as prevailing levels of market volatility change. In the worst case, variation margins could be several billions of dollars, which would have to be paid in cash within a day. These margin calls could represent as much as 13% of a G14 dealer's current holdings of cash and cash equivalents in the case of IRS. A five-day sequence of large variation margin calls that could be expected with a probability of one in 200 would equate to around 28% of current cash and cash equivalents in the worst case.

These results also have direct implications for the liquidity provisions of CCPs, as they would have to pay variation margins in the case of default of a clearing member. Access to central bank funds in distressed circumstances would help to ensure that CCPs could make substantial variation margin payments in a timely manner.

The potential non-margin resources that our hypothetical CCP might require are shown in the right-hand panels of Graph 2. These panels indicate the total losses in excess of initial margins that the CCP would be exposed to if certain dealers were to default whenever they contributed to these margin shortfalls. The blue lines show the losses that a default fund and other non-margin resources would have to absorb if the dealer capable of generating the largest margin shortfalls were to default whenever it experienced such a shortfall. The green lines show equivalent losses for the two dealers capable of generating the largest margin shortfalls.[14] The red lines show the losses to be absorbed by non-margin resources if all dealers contributing to margin

[14] These also happened to be two of the three dealers required to post the largest initial margins.

shortfalls were to default in such circumstances.[15] To facilitate comparison across IRS and CDS, these potential losses are scaled by the total initial margins paid by all dealers to control for the different size and riskiness of the two sets of cleared portfolios.

Possible calls on default funds are small relative to the equity of fund contributors

As a proportion of total initial margins, our hypothetical CCP would require more non-margin resources to clear CDS than IRS, reflecting the greater tail risk of CDS. With a probability of one in 10,000, non-margin resources at risk from the failure of one particular dealer, two particular dealers or any dealer with sufficiently adversely affected portfolios would respectively be 20%, 37% and 42% of total initial margins for IRS, and 36%, 46% and 65% of total initial margins for CDS. If prevailing levels of volatility were high, these figures would equate to $21 billion, $39 billion and $44 billion for IRS, and $13 billion, $16 billion and $23 billion for CDS. By comparison, the G14 dealers contributing to default funds had equity of around $1.5 trillion as of 30 June 2010.

An important consideration for financial stability is that CCPs should be able to cope with multiple simultaneous defaults, as well as the default of the single largest clearing member. Experience from the recent financial crisis suggests that multiple dealers suffering large losses and defaulting at around the same time is within the realm of possibility. Given the scale of clearing members' equity relative to the resources that a CCP would need to protect itself against multiple dealer defaults, it seems both prudent and feasible to collect these resources via default fund contributions. Indeed, the standard-setting bodies for CCPs are currently considering whether to require that CCPs' financial resources should provide protection against default of the two clearing members that could potentially cause the largest credit exposures. The current international standards only require CCPs to protect themselves against the failure of the single participant to which they have the largest exposure.[16]

Determination of adequate initial margins

We draw two lessons for CCP risk management: ...

The results also suggest two lessons that could help CCPs to ensure that the initial margins that they collect are adequate.

First, CCPs could benefit from raising and lowering initial margin requirements as levels of market volatility change, or, in order to dampen undesirable procyclical effects, setting stable initial margins according the highest level of market volatility. The left-hand panels of Graph 2 show that appropriate initial margins can vary significantly with prevailing levels of volatility, and Graph 3 shows that prevailing levels of volatility can change markedly over time periods as short as a few weeks, especially for CDS. As discussed above, G14 dealers appear to have enough unencumbered assets to meet initial margin requirements commensurate with even the highest levels of

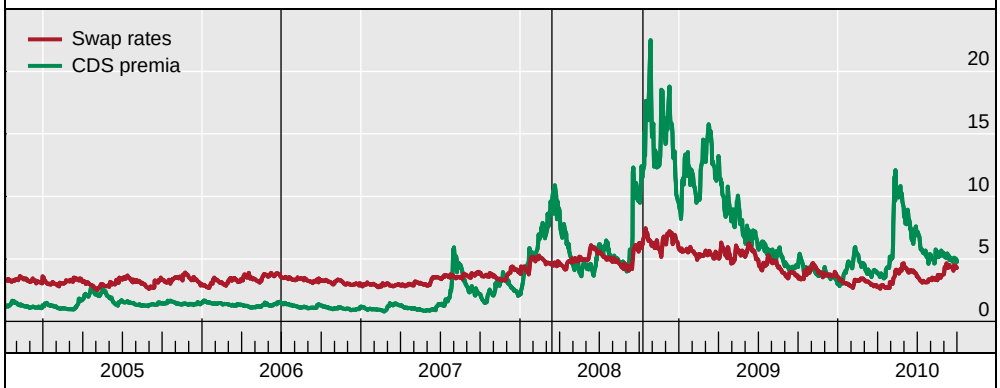
... initial margins should reflect time variation in risk ...

[15] The red lines therefore show the maximum losses that the CCP could incur. This would only occur if all dealers holding positions that were adversely affected by price movements defaulted.

[16] See CPSS-IOSCO (2004), Recommendation 5 and CPSS-IOSCO (2011), Principle 4.

Volatilities of swap rates and CDS premia[1]

Daily changes, in basis points



The vertical lines represent 30 June 2006 (lower volatility before the recent financial crisis), 14 March 2008 (medium volatility just before the rescue of Bear Stearns) and 10 October 2008 (high volatility around the peak of the crisis).

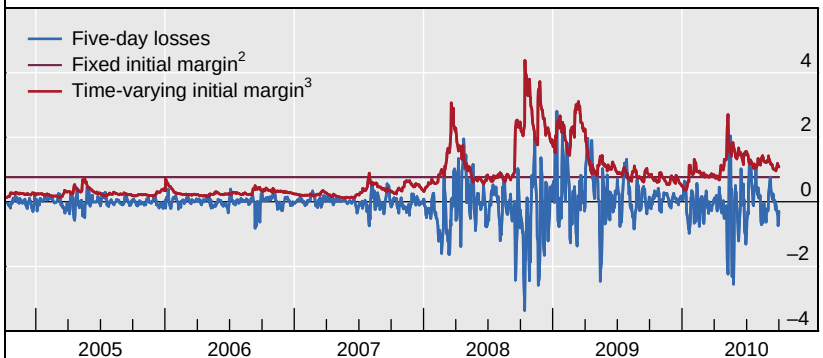
[1] Median of 36 interest rate swap volatilities and 196 CDS premium volatilities.

Sources: Datastream; authors' estimates. Graph 3

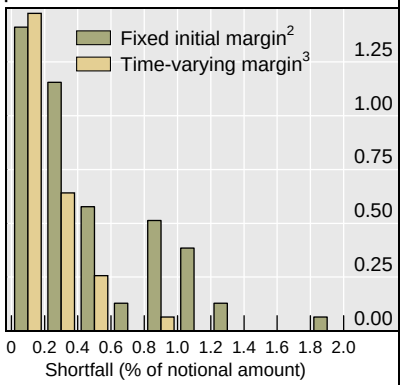
market volatility, while non-margin resources could be put at greater risk by not varying initial margins. This is illustrated in Graph 4, which shows in the left-hand panel how daily changes in the market value of an index of North American CDS (in blue) compare with a fixed initial margin requirement intended to cover 95% of losses over time (in purple) and a variable initial margin requirement intended to cover 95% of possible losses at each moment in time (in red). The variable margin requirement tends to rise ahead of the largest losses. This reduces the size of the largest shortfalls compared with those associated with the fixed margin requirement, as shown in the right-hand panel. Furthermore, it avoids clustering of margin shortfalls. Losses exceed the fixed initial margin on 16% of trading days between mid-2008 and mid-2009, which is significantly higher than the intended 5%.

Historical losses on a CDS index versus fixed and time-varying initial margins[1]

Time profile of margin shortfalls, as a percentage of notional amount



Distribution of margin shortfalls, in per cent



[1] In particular, the CDX.NA.IG index of North American investment grade corporate CDS. [2] Set equal to the 95th percentile of actual losses between October 2004 and September 2010. [3] Set equal to the 95th percentile of possible losses given the contemporary volatility of the CDX.NA.IG premium as estimated by a GARCH model (see Heller and Vause (2011) for more details).

Sources: Datastream; authors' estimates. Graph 4

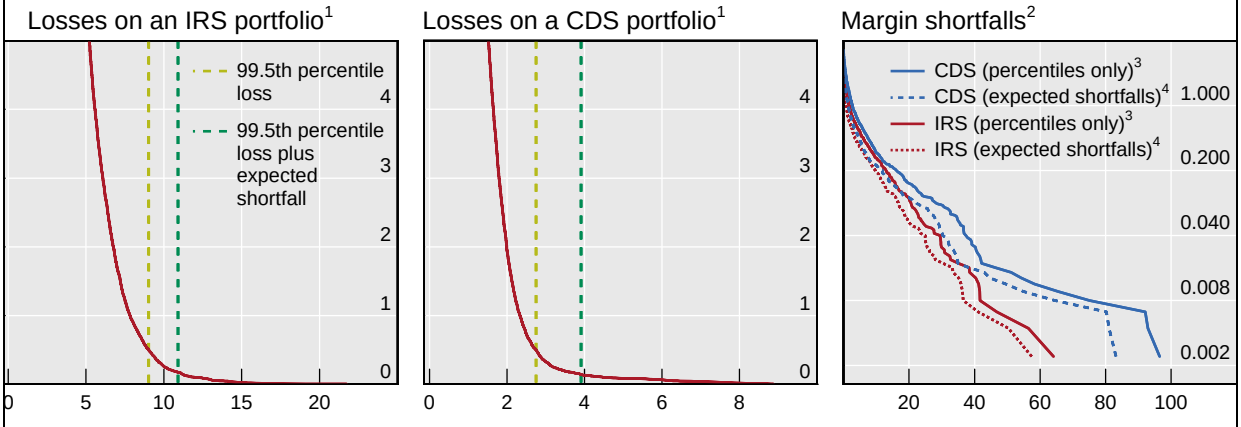
Note that while CCPs can benefit from varying initial margin requirements with changes in market volatility, such a policy could also lead to undesirable procyclical repercussions.[17] It could, for example, boost the cost of borrowing assets that CCPs would accept as collateral and encumber more of dealers' other assets in the process whenever market volatility increased. This could lead dealers to unwind other positions, potentially exacerbating the increase in volatility and, hence, margin requirements. Such feedbacks could be avoided, while protecting CCPs to at least the same degree, by fixing initial margins at levels commensurate with high volatility. For much of the time, however, this would of course encumber more collateral at the CCP than under a time-varying regime.

... and the potential for extreme losses, which vary by asset class

Second, CCPs could benefit from basing initial margins not only on high percentiles of possible losses but also on the size of the losses in excess of these percentiles. One way to do this could be to set initial margins equal to a particular high percentile of possible losses plus the "expected shortfall" associated with these high-percentile losses. Expected shortfalls measure the expected loss given that losses are of at least a particular size. The left-hand and centre panels of Graph 5 show possible losses on hypothetical IRS and CDS portfolios for one of the G14 dealers, with the 99.5th percentiles of these losses and the corresponding expected shortfalls marked by vertical lines. The graphs are typical in that they show larger expected shortfalls relative to 99.5th percentile losses for CDS than for IRS, reflecting the greater tail risk of CDS.

The right-hand panel of Graph 5 shows the total margin shortfalls that our hypothetical CCP could expect to face depending on how it set initial margins. The solid red and blue lines show the total margin shortfalls when initial margins are set equal to the 99.5th percentiles of IRS and CDS portfolio losses

Incorporating expected shortfalls into initial margins



[1] Five-day losses on the hypothetical IRS and CDS portfolio of one particular G14 dealer. On the x-axis: billions of US dollars; on the y-axis: probability of portfolio loss of the indicated amount or greater, in per cent. [2] Total losses in excess of initial margins across all dealers; as a percentage of total initial margins (on x-axis); logarithmic y-scale. [3] Initial margins set on the basis of percentiles only. [4] Initial margins set on the basis of percentiles and expected shortfalls.

Source: Authors' estimates. Graph 5

[17] The issues of procyclicality and feedback loops are, for instance, discussed in more detail in CGFS (2010) and CPSS-IOSCO (2011).

for each dealer. These are the same as the red lines in Graph 2. The dotted red and blue lines then show total margin shortfalls when initial margins are set equal to the 99th percentile loss plus the associated expected shortfall of each dealer's IRS or CDS portfolio. Incorporating expected shortfalls into initial margin requirements helps to ensure that tail risks are taken into account and, hence, are less likely to deplete non-margin resources. It also facilitates the adoption of consistent CCP risk management practices across different segments of the derivatives market. This could help CCPs operating in different market segments to allocate margin and non-margin resources between them in the event that they chose to interoperate.[18] Even after incorporating expected shortfalls into initial margin requirements, however, a sizeable gap remains between the total margin shortfalls (relative to total initial margins) that could be expected with very low probabilities for CDS and equivalent shortfalls for IRS. CCPs clearing CDS may wish to make an adjustment to default fund contributions to ensure that this is taken into account.

Expansion of central clearing can economise on collateral

Expanding central clearing can economise on collateral ...

We next consider the scope for economies in margin and non-margin resource requirements as central clearing is expanded, both within and across market segments.

To illustrate the scope for economies within a market segment, we consider a CCP clearing only multi-name CDS, a CCP clearing only single-name CDS and a CCP clearing all types of CDS. The first clears all the multi-name positions in our hypothetical CDS portfolios of G14 dealers. Similarly, the second CCP clears all the single-name positions in our hypothetical CDS portfolios. The CCP clearing all types of CDS operates as previously. Each of these hypothetical CCPs sets initial margin requirements equal to the 99.5th percentiles of portfolio losses.

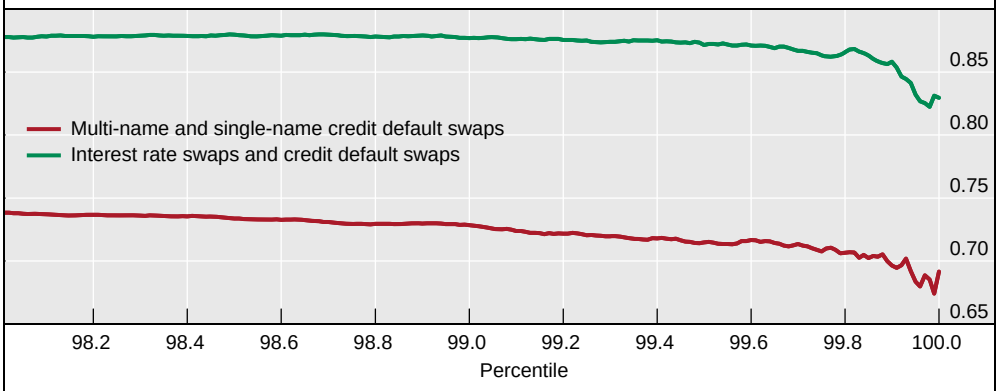
... both within ...

As the red line in Graph 6 shows, the total initial margin requirements of the integrated clearer are about 70% of those of the sum of requirements of the multi-name and single-name clearers. Variation margin calls are reduced by a similar scale factor. This reflects the hedging of certain single-name positions by particular multi-name positions in integrated CDS portfolios as well as some more general diversification benefits, as is typically found in broader portfolios.[19] Furthermore, these loss-reducing factors remain in evidence even for more extreme losses, as shown to the right of the vertical line marking the 99.5th percentile in the graph. This suggests little risk, for example, of hedges

[18] If a CCP that cleared IRS were to interoperate with a CCP that cleared CDS, the two CCPs would establish a single set of margin requirements of dealers based on their integrated IRS and CDS portfolios. They would then have to decide how to allocate these resources between them.

[19] In fact, dealers typically operate a larger number of hedging strategies, each of which involves fewer more-closely matched contracts than we were able to incorporate in our hypothetical portfolios. A single central clearer of all types of CDS may therefore require even fewer margin and non-margin resources relative to separate multi-name and single-name CDS clearers than suggested here.

Comparison of potential losses for separate versus integrated central clearing of different types of derivatives[1]



[1] Ratios of total high-percentile losses for all G14 dealers on integrated portfolios of derivatives to the sum of losses on segregated portfolios at the same percentiles.

Source: Authors' estimates. Graph 6

breaking down for extreme changes in market values. An integrated central clearer of CDS could therefore also economise on non-margin resources by a factor of around 70% compared with separate clearing of multi-name and single-name CDS.

... and across derivatives markets

To illustrate the scope for economies in clearing resources across market segments, we consider separate and integrated central clearing of our hypothetical IRS and CDS portfolios. The potential economies are smaller in this case, as IRS and CDS are not natural hedges for one another. Nevertheless, there are still some economies, reflecting the greater diversification of the integrated portfolios compared with the IRS-only and CDS-only portfolios. As the green line in Graph 6 shows, losses on integrated portfolios are commensurate with around 85% of the sum of losses on IRS-only and CDS-only portfolios. This applies at, below and above the initial margin threshold, suggesting that margin and non-margin resource requirements could be reduced by around 15% if a single CCP cleared both market segments or if CCPs representing the two market segments interoperated.

It should be noted that our assumption of individual CCPs clearing different segments of the derivatives market might not be the final market structure that will emerge. At present, a number of central clearers operate in the CDS market, for example, with different operators focusing on clearing CDS within particular geographic regions. A fragmented market structure would generate opposite results to those of integration illustrated above. That is, total initial margins and default funds would increase because the benefits of multilateral netting would decline. One way to reintroduce the benefits of multilateral netting, however, would be to make the segmented CCPs interoperable. This would involve multiple CCPs setting single margin requirements and default fund contributions for each clearing member on the basis of the aggregate portfolios that they collectively clear, and subsequently dividing the resources between them. But this is not straightforward to implement. For example, competing CCPs may find it difficult to agree on the risk controls that are to be applied to inter-CCP positions. Also, linked CCPs

are required by regulators to hold more non-margin collateral than a fully integrated CCP.[20]

Conclusions

We find that major derivatives dealers already have sufficient unencumbered assets to meet initial margin requirements if central clearing were expanded to cover the full volume of their interest rate swap and credit default swap holdings. Some of them, however, may need to increase their cash holdings to meet variation margin calls with ease. Similarly, CCPs may need immediate access to plentiful funding to ensure that they could make variation margin payments in the event that they inherited such obligations as a result of the default of a clearing member. We also find that the potential costs of two simultaneous dealer defaults should be affordable to CCPs and their non-defaulting members. The precise volume of non-margin resources that CCPs should collect in anticipation of such costs depends on the prospects for multiple dealer defaults. To help ensure that non-margin resources are adequate to absorb all feasible losses, CCPs should factor into initial margin requirements the extent of tail risk and time variation in risk of different types of derivatives. Finally, we find that expansion of central clearing within or across segments of the derivatives markets could economise both on margin and non-margin resources.

[20] See CPSS-IOSCO (2011).

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