Banks and capital requirements: Channels of adjustment ☆

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ABSTRACT

Bank capital ratios have increased steadily since the financial crisis. For a sample of 101 large banks from advanced and emerging economies, retained earnings account for the bulk of their higher risk-weighted capital ratios, with reductions in risk weights playing a lesser role. On average, banks continued to expand their lending in real terms, though lending contracted among European banks. Lower dividend payouts and (for advanced economy banks) wider lending spreads have contributed to banks' ability to use retained earnings to build capital. Banks that came out of the crisis with higher capital ratios and stronger profitability were able to expand lending more.

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1. Introduction

In the years since the global financial crisis, both the private and public sectors have exerted pressure on banks to build larger buffers of high-quality capital and reduce the riskiness of their portfolios.

This paper examines the broad patterns in how banks have gone about achieving higher risk-weighted capital ratios since the crisis.

A key finding is that the bulk of the adjustment has taken place through the accumulation of retained earnings, rather than through sharp adjustments in lending or asset growth. The advanced-economy banks in the sample increased their total assets by 2% in real terms from 2009 to 2012, while the emerging-economy banks increased assets by 30%, using weighted averages with end-2009 assets as weights. However, European banks reduced their total assets during this period. Real asset growth tended to be broadly in line with real GDP growth. In the advanced economies, a reduction in risk-weighted assets relative to total assets has also played a role in raising capital ratios, albeit a secondary one. More profitable banks have expanded assets and lending faster than others. There is some evidence for the importance of starting points – banks that came out of the crisis with relatively lower levels of capital have been more likely to pursue adjustment strategies involving slow asset growth.

The evidence in this paper is essentially descriptive. No attempt is made to formally identify the impact of regulatory capital requirements on bank lending and the real economy.[1] Nevertheless, we hope that the trends and patterns presented here shed light on the hypothesis, which was widely held in the immediate post-crisis years, that stronger bank capital requirements are necessarily associated with significant macroeconomic costs.

The next section reviews the different strategies that banks can use to increase their capital ratios and the differing macroeconomic implications of these strategies if banks pursue them on a large scale. We then look at broad evidence on whether, and in what ways, some of these potential macroeconomic impacts have taken place. The following sections look more closely at the adjustment paths taken by a sample of 101 large global banks. Changes in capital ratios are decomposed into factors reflecting changes in capital and changes in assets, and then each of these is studied in more detail. A concluding section recaps the main findings.

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[1] Recent papers that study this question in a more rigorous way include Bridges et al. (2014) and Aiyar et al. (2014).

2. Channels of adjustment

A bank that seeks to increase its risk-adjusted capital ratio has a number of options at its disposal.[2]

One set of strategies targets the bank's *retained earnings*. The bank could seek to reduce the share of its profit it pays out in dividends. Alternatively, it may try to boost profits themselves. The most direct way to do so would be by increasing the spread between the interest rates it charges for loans and those it pays on its funding. Lending spreads would rise across the system if all banks followed a similar strategy and alternative funding channels (such as capital markets) did not offer more attractive rates. Other ways to increase net income include increasing profit margins on other business lines, such as custody or advisory services, reducing overall operating expenses, or engaging in cheaper (but potentially riskier) funding strategies. Higher bank lending spreads or fees need not be evidence of cartel behaviour – rather, they would simply reflect the incorporation of higher industry-wide costs (in this case, the cost of accumulating additional capital) into a higher required return on assets.

A second strategy is to *issue new equity*, such as through a rights issue to existing shareholders, an equity offering on the open market or placing a bloc of shares with an outside investor. This is likely to be the least attractive option for bank shareholders, however, given that a new share issue tends to reduce the market value of the existing shares.[3]

A third set of adjustment strategies involves changes to the *asset* side of the bank's balance sheet. The bank can run down its loan portfolio, or sell assets outright, and use the proceeds of loan repayments or asset sales to pay down debt. Less drastically, it can slow down lending growth, thereby allowing retained earnings and hence capital to catch up. In some cases, an asset sale can boost capital through an accounting gain, as the assets are revalued relative to their purchase cost.

Finally, a bank can seek to reduce its *risk-weighted assets* by replacing riskier (higher-weighted) loans with safer ones, or with government securities.[4]

Banks' choices across this set of strategies will shape the macroeconomic impact of an increase in regulatory capital ratios. It should be emphasised that neither a reduction in outstanding bank loans nor a slowdown in the growth of bank lending would necessarily be bad for the macroeconomy in the longer term. This is especially the case in the aftermath of a crisis that followed an unsustainable debt boom and left debt overhangs in its wake.[5] Some observers nevertheless expressed concern during the debate over the Basel III framework that, if regulators and markets forced banks to build up capital too rapidly, this would impose considerable short-term macroeconomic costs by inducing banks to pull back from lending to finance investment. In response to these concerns, a number of studies attempted to assess the scope of the potential macroeconomic impact of stronger regulation. Most of these studies

Table 1
The impact of a one percentage point increase in capital ratios on lending spreads, lending volumes and growth: Selected estimates.

	Lending spread	Lending volume	GDP growth[a]
MAG (2010a)	+15–17 basis points	−1% to 2%	−4 basis points over 4 years
BCBS (2010a)	+13 basis points	(not estimated)	−9 basis points, permanent
IIF (2011)[b]	+30–80 basis points	−0.8% to 1%	−6 to 12 basis points over 5–10 years
Slovik and Cournède, OECD (2011)	+8–20 basis points	(not estimated)	−4 basis points over 9 years
Elliott et al., IMF (2012)[b]	+5–15 basis points	(not estimated)	(not estimated)
Miles et al. (2013)	+5.5 basis points	(not estimated)	−4.5 basis points permanent
Oxford Economics (2013)[b]	+15 basis points	(not estimated)	−1.6 basis points over 9 years

[a] Impact on annual GDP growth rate, relative to baseline forecast.
[b] Also includes impact of other regulatory measures.

Table 2
The overall impact of stronger banking sector capital requirements on capital ratios and growth: Selected estimates.

	Required increase in capital percentage points	GDP growth[a]
MAG (2010b)	1.3 pp	−5 basis points over 4 years
IIF (2011)[b]	4.8 pp	−30 to 60 basis points over 5 years
Slovik and Cournède, OECD (2011)	3.7 pp	−15 basis points over 9 years
Elliott et al., IMF (2012)[b]	1.2–2.7 pp	(not estimated)
Miles et al. (2013)	3.3 pp	−15 basis points, permanent
Oxford Economics (2013)[b]	4–10 pp	−7 to 16 basis points over 9 years

[a] Impact on annual GDP growth rate, relative to baseline forecast.
[b] Also includes impact of other regulatory measures.

used an approach that translated increases in bank capital into increases in lending spreads, and in some cases into changes in lending volumes (Table 1). Macroeconomic impacts were then derived from these spread and volume effects (Table 2).

3. Bank capital, lending and growth in the aggregate

A series of Quantitative Impact Studies (QIS) conducted by the Basel Committee on Banking Supervision offer evidence for a significant aggregate rise in banks' capital ratios in recent years. The studies estimate average capital adequacy ratios for a global sample of banks according to the definitions that are scheduled to come into force in the Basel III framework.[6] Weighted average capital ratios for large, internationally active banks have risen from 5.7% at the end of 2009 to 9.2% at end-2012. Those for a sample of smaller banks have risen from 7.8% to 9.4% over the same period (Fig. 1).

Leverage ratios (capital under the fully phased-in Basel III definition divided by total unweighted exposures) have also increased, from 2.8% to 3.7% for the first group and from 3.8% to 4.2% for the second. While the 2009 and 2012 figures for risk-weighted capital ratios and leverage ratios are not fully comparable, given differences in the sample, data quality, and some of the relevant definitions, the size and direction of the true increase is likely to have been broadly in line with these results.

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[2] Higher capital requirements were only one element of a range of financial regulatory reforms that have been put in place since the crisis. Some of the other key elements include liquidity requirements for banks, central clearing of standardised OTC derivatives, strengthened disclosure, more robust provisioning, and strengthened resolution regimes for financial entities. While many of these reforms may have potentially significant macroeconomic effects, they are not considered here.

[3] See Myers and Majluf (1984).

[4] Given the wide range of outcomes that can emerge from commonly used risk models, a bank that uses internal models to derive its risk weights may have scope to "optimise" supervisory risk-weighted assets through modelling choices without making significant changes in its portfolio. See Basel Committee on Banking Supervision (2013c,d,f).

[5] Takáts and Upper (2013) find that declining bank credit to the private sector does not necessarily constrain growth in the aftermath of a financial crisis, in cases where such a crisis followed a rapid increase in debt. Bech et al. (2012) find that private sector deleveraging during and after a crisis can even lead to a stronger recovery.

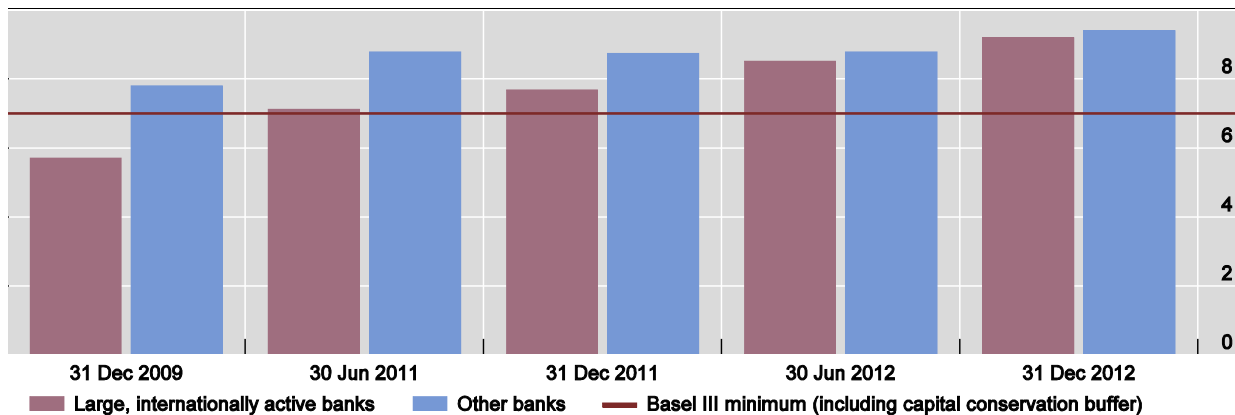[6] See Basel Committee on Banking Supervision (2010b, 2012a,b, 2013a,e).

Fig. 1. Common equity risk-weighted capital ratios under Basel III definitions (in per cent). Source: Basel Committee on Banking Supervision.

Many national authorities have also published figures on bank capital adequacy, though these do not always use common definitions for either the numerator (capital) or denominator (assets). They tend to confirm a picture of broadly rising capital ratios in the global banking system. For example, the ratio of capital to total (not risk-weighted) assets for US commercial banks rose from 11.3% in December 2009 to 11.8% in December 2012.[7] The ratio for euro area monetary financial institutions, measured on a consolidated basis, increased from 7.6% to 9.1% over the same period.[8]

While bank capital has risen more or less steadily worldwide, the performance of credit aggregates and GDP has been mixed (Fig. 2). In most of the advanced economies (red dots), a slow and uneven pace of recovery since the crisis has been accompanied by weak or contracting credit aggregates. This is so regardless of whether one looks at overall credit to the economy (left-hand panel) or at bank-intermediated credit alone (right-hand panel). Many emerging economies, meanwhile, have enjoyed rapid GDP growth, often accompanied by even more rapid expansion of credit (blue dots).

Fig. 2 compares credit growth and GDP since the crisis for a set of advanced and emerging economies. Among the advanced economies, higher GDP growth was not accompanied by higher credit growth, whether one looks at total credit provided to the economy from all sources (left-hand panel), or only at credit provided by banks (right-hand panel). The lack of such a relationship reflects the fact that many firms and households in advanced economies have been reducing their debt, even as new lending supports investment and consumption elsewhere in the economy. Among emerging economies, the relationship appears to be stronger, though Brazil saw strong credit growth without a corresponding boost to GDP. A key question is thus to what extent slow lending growth in certain economies reflects post-crisis macroeconomic challenges that have constrained loan demand, especially sectoral debt overhangs and the euro-area sovereign crisis, and to what extent it reflects tighter loan supply by banks.

As discussed in the previous section, if a drive for higher capital ratios were constraining the willingness of banks to lend, we would see evidence of this in the form of tighter bank lending standards and wider lending spreads.

The post-crisis years of course witnessed a great deal of turbulence in the macroeconomy and the financial system. Nevertheless, it is notable that surveys of bank lending officers in different economies do not point to a sustained tightening of lending standards across all global regions in recent years (Fig. 3). In the US, UK and euro area, the net balance of responses (the percent of respondents reporting tighter conditions minus the percent reporting looser ones), point to considerably easier lending conditions than those that prevailed during the financial crisis. In the US and Japan, these indicators have been consistently negative since early in 2010 (for the US) or 2009 (for Japan). The UK responses have also tended to indicate looser conditions, except for a period in mid-2012. The surveys for the euro area, however, have suggested an ongoing tightness of bank lending conditions, particularly at the height of the sovereign debt concerns in the second half of 2011.[9]

Lending spreads also offer a mixed picture. Fig. 4 compiles a variety of lending spreads from different advanced economies, maturities and sectors. The spread between Baa and Aaa-rated corporate bonds in the US is included as an indicator of spreads in the broader financial system. Most of these spreads, both banking and non-banking, have been stable or narrower since the crisis. As with bank lending standards, the euro area (in this case, the spread between 1 and 5 year business loans and 3-month euribor) again stands as an exception: this spread has widened from around 260 basis points in early 2009 to more than 300 basis points more recently. The timing of the movement of this indicator suggests that the sovereign debt crisis in the euro area has played a substantial role: it widened sharply during the crisis, narrowed somewhat thereafter, then widened again in late 2011 when sovereign credit concerns intensified.[10]

Developments in lending standards and lending spreads do not, by themselves, offer evidence for or against the proposition that tighter regulation restrained bank lending. However, the fact that we did not see a sharp tightening of standards or a sharp increase in spreads suggests that such an effect, if present, would at best have been very weak relative to the other factors influencing bank lending supply.

4. Decomposing changes in the risk-weighted capital ratio

A closer look at bank balance sheet adjustments can shed further light on how banks have responded to tighter capital

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[7] www.federalreserve.gov/releases/h8/current/default.htm.

[8] www.ecb.europa.eu/stats/money/aggregates/bsheets/html/index.en.html. The US and European ratios are not strictly comparable, given differences in accounting conventions (for example, the accounting standards used in Europe have stricter rules about using the net value of matched derivatives positions, resulting in higher measured bank assets) and reporting populations (for example, the European data include money market funds).

[9] Although these surveys typically ask banks whether they are "tightening" their lending conditions, research has found that the survey responses might better be interpreted as an indicator of whether conditions are "tight". For example, De Bondt et al. (2010) find that, for the euro area, the level of this indicator, rather than its quarter-to-quarter change, is significant in forecasting bank credit and real GDP growth for subsequent quarters.

[10] Illes and Lombardi (2013) examine the behaviour of lending spreads in different economies since the crisis, including divergences between core and peripheral euro area economies.
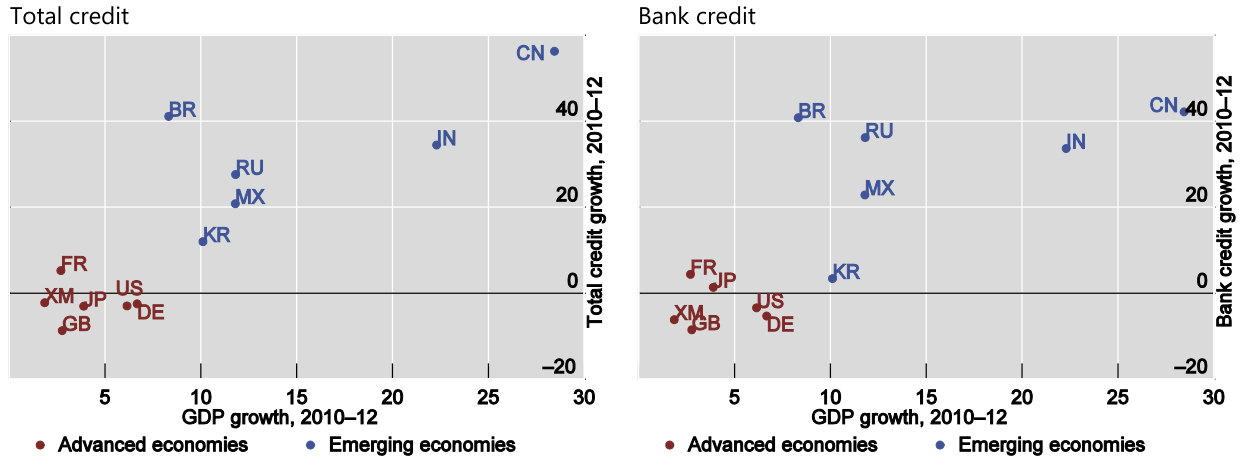
Total credit

Bank credit

Fig. 2. Credit and GDP growth (in per cent). Sources: BIS; national data
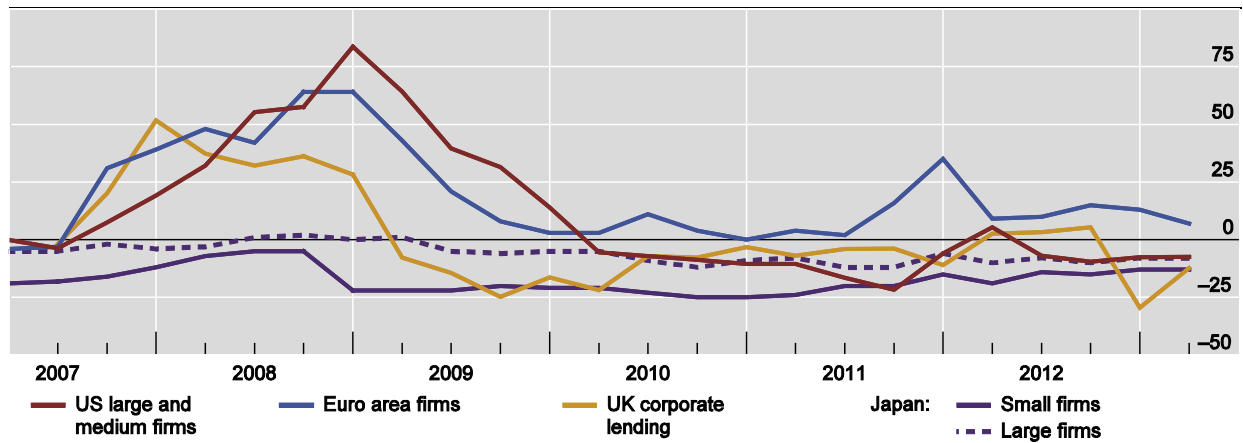
Fig. 3. Survey responses on banking standards (net tightening, in percentage points). Difference between banks reporting tighter lending conditions during the previous quarter and those reporting looser conditions. Sources: Bank of England; Bank of Japan; European Central Bank; Federal Reserve Board.
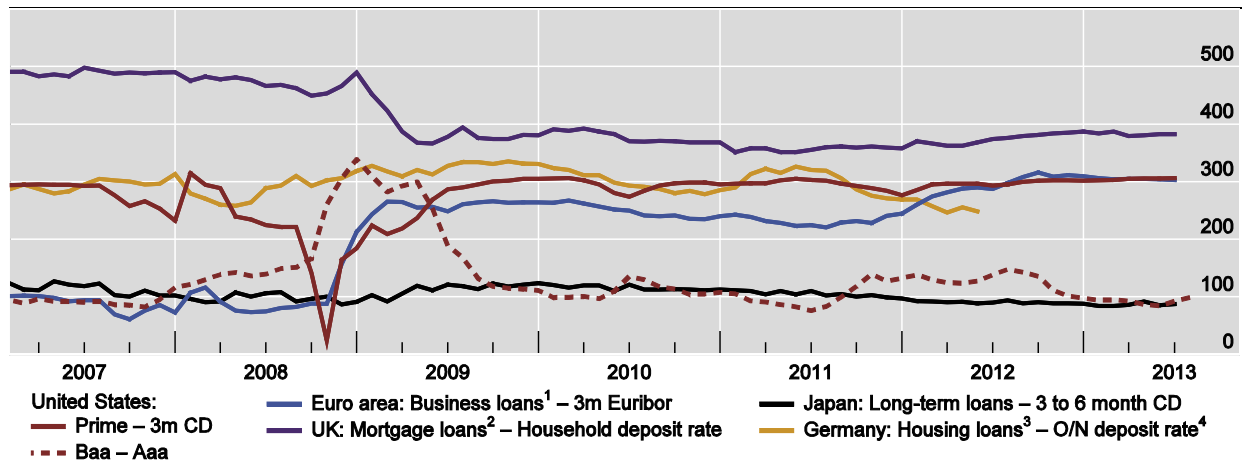
Fig. 4. Lending spreads in selected economies (in basis points). [1] One to five year business loans. [2] Variable rate mortgages. [3] One to five years housing loans. [4] Deposits of non-financial corporates. Source: National data.

requirements. To understand these adjustments, we can decompose the change in risk-weighted capital requirements as follows:

$$\frac{K_1/RWA_1}{K_0/RWA_0} = \frac{\left(1 + \frac{Inc_1}{K_0} - \frac{Div_1}{K_0} + \frac{Oth_1}{K_0}\right)}{\left(\frac{RWA_1/TA_1}{RWA_0/TA_0}\right)\left(\frac{TA_1}{TA_0}\right)} \qquad (1)$$

where K_i is capital, RWA_i is risk-weighted assets, and TA_i is total assets, at time i; while Inc_1 is net income, Div_1, is dividends, and Oth_1 is other changes to capital (calculated as a residual) between time 0 and time 1. This decomposition allows us to isolate the three factors that influence a risk-weighted capital ratio: changes to capital, changes to the ratio of risk weighted assets to total assets, and changes to total assets.

To analyse these factors, we have drawn data from the Bankscope database for a set of 101 banks (Table 3). The sample was chosen so as to include as many significant institutions from the main global financial centres as possible, as well as banks from smaller centres and emerging economies. In some cases, these data were supplemented with data from the Bloomberg and SNL databases. Banks were included if they reported several years of reliable data in the relevant categories.[11]

The sample thus covers banks from a wide range of advanced and emerging economies.[12] It includes all of the 29 institutions identified by the Financial Stability Board in November 2013 as globally systemically important banks (G-SIBs) based on the methodology developed by the Basel Committee on Banking Supervision.[13] It covers 67% of the end-2012 assets of the top 1000 global banks as listed by *The Banker*.[14]

Our measure of "capital" will be common equity, as reported by Bankscope. This definition does not include preferred shares or hybrid securities. Risk-weighted assets are as reported in the Bankscope database, which are measured using Basel II definitions.

The banks in the sample increased their common equity capital by a total of US$998 billion from end-2009 to end-2012 (Table 4). Their assets rose by $9.6 trillion during this time, while risk-weighted assets rose by $2.6 trillion. Capital rose for all of the subsamples considered in Table 4: advanced-economy banks, emerging-economy banks, G-SIBs, advanced-economy non-G-SIBs, US banks, European banks, and banks from other advanced economies. Total assets rose for all of these groups, except for the European banks. Risk-weighted assets fell for the advanced-economy banks, though they rose for the full sample and for banks from emerging economies.

In terms of weighted averages, using end-2009 total assets as weights,[15] the banks in our sample increased their risk-weighted common equity capital ratio from 11.4% at end-2009 to 14.0% at end-2012 (Table 5).

The 2.6 percentage-point increase in capital ratios from end-2009 to end-2012 in our sample is somewhat below the QIS finding of an increase of 3.5 percentage points over the same period for capital ratios using the fully phased in Basel III definitions.[16] Our ratios are also quite a bit higher (between five and six percentage points) than those calculated by the Basel Committee in the QIS. These discrepancies arise from a number of factors. For one thing, risk-weights for many asset classes are higher under Basel III than Basel II. This will reduce the calculated ratio. A second factor is that regulatory capital, which is in the numerator of the ratios reported by the Basel Committee, is likely to be less than capital as reported on a bank's balance sheet, because of deductions to the regulatory figure for goodwill, securitisation positions, deferred tax assets and other items. This, too, will reduce the overall level of the ratio. Since banks are likely to have taken the regulatory capital ratio as their target rather than the balance sheet ratio that is discussed in this paper, it is not surprising that the regulatory ratio has increased more. Unfortunately, few banks publicly reported their fully phased-in Basel III ratios during 2009–2012. We therefore study ratios calculated from balance-sheet data as an imperfect substitute.

The increase in reported risk-weighted capital ratios in the Bankscope data largely resulted from higher capital rather than lower risk weights or smaller assets. Common equity capital (the numerator of the right-hand side of Eq. (1)) increased 35%, while risk-weighted assets (the denominator) rose 6% (Table 5, third and fourth columns).[17] The overall increase in risk-weighted assets in turn results from an 8% reduction in the ratio of risk-weighted to total assets, and a 15% increase in the level of total assets (Table 5, fifth and sixth columns). Total assets increased for every sub-group considered in Table 5. For every group except emerging economy banks, risk-weighted assets fell as a share of total assets.

Figures for risk-weighted assets are reported by the banks themselves, using Basel II approaches. As noted above, a number of recent studies have found significant variation in risk weights as calculated by firms' internal models. These findings raise questions as to whether a decline in the ratio of (reported) risk-weighted to total assets for a given bank can be taken as a precise measure of a decline in the actual riskiness of the bank's portfolio. Nevertheless, the scope for reducing risk-weights without any changes in underlying riskiness is not unlimited, so we can assume that at least some reduction in the riskiness of lending was probably involved.

In order to better understand the impact of different factors, it is helpful to transform Eq. (1) so that the different quantities can be expressed as additive components of the percentage-point change in the risk-weighted capital ratio. To do this we can take logarithms of both sides of Eq. (1) and then multiply both sides by a common factor. The resulting decomposition is as follows:

$$\frac{K_1}{RWA_1} - \frac{K_0}{RWA_0} = F \ln\left(1 + \frac{Inc_1}{K_0} - \frac{Div_1}{K_0} + \frac{Oth_1}{K_0}\right)$$
$$- F\left(\ln\left(\frac{RWA_1}{TA_1}\right) - \ln\left(\frac{RWA_0}{TA_0}\right)\right)$$
$$- F\ln\left(\frac{TA_1}{TA_0}\right) \qquad (2)$$

where F, the normalisation factor, equals $(K_1/RWA_1 - K_0/RWA_0)/(\ln(K_1/RWA_1) - \ln(K_0/RWA_0))$.

Calculating the elements of Eq. (2) confirms that increases in capital drove increases in the overall ratio, both for the full sample and for most subsamples (Table 6, Fig. 5). For the advanced

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[11] There were no significant mergers among the banks in our sample during the sample period (end-2009 to end-2012). Smaller mergers and acquisitions by specific banks were treated as increases or reductions in assets. There was one case of a failed bank: In 2011 the Belgian operations of Dexia Group were taken over by the Belgian government while its French operations were sold to two French banks. Since it remained in the Bankscope database and did not cease operations (though with a steady decline in assets), we kept it in the sample. Dropping it from the sample does not change the results in a significant way.

[12] The dataset includes banks from 23 jurisdictions. The home economies classified as advanced are Australia, Austria, Belgium, Canada, France, Germany, Ireland, Italy, Japan, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States, The home economies classified as emerging are Russia, Brazil, China, India, Korea, Malaysia, Taiwan (Chinese Taipei) and Thailand.

[13] See Financial Stability Board (2013, 2014) and Basel Committee on Banking Supervision (2013b). The list of G-SIBs, which was first published in November 2011, is modified annually to reflect changes in bank characterstics and supervisory discretion. Three banks were removed and two added in 2012. Industrial and Commercial Bank of China was added to the list in 2013. Agricultural Bank of China was added in 2014. We use the 2013 list, which is based on end-2012 data. As discussed below the results are substantially similar for the lists from other years.

[14] The coverage of our sample relative to the list in "The Banker" varies across countries and regions. For example, we cover 85% of assets of US banks on the "The Banker" list, almost 100% of UK banks, about two thirds of euro-area and Chinese banks, and about half of Japanese banks.

[15] Unless otherwise stated, the figures in the text, graphs and tables in the remainder of the paper are weighted averages with end-2009 assets as weights. For banks with fiscal years that do not end on December 31, data are assigned to the nearest year-end (that is, fiscal years ending from January through June are assigned to the previous year, while fiscal years ending from July through November are assigned to the current year).

[16] All of the Basel Committee's QIS studies discussed here apply the full package of Basel III standards and definitions to the sampled banks, even though in practice these standards are being phased in over time.

[17] To eliminate exchange-rate valuation effects, these changes are calculated using the local currency of the bank's headquarters. The original data are in US dollars. To convert these to local currency, end-period exchange rates are used for balance sheet items (assets, capital, etc) while the average daily exchange rates are used for flow items (income, dividends etc). For example, for banks with calendar year financial reporting, the change in capital from end-2009 to end-2012 is calculated as the percentage increase in capital expressed in local currency from end-2009 (using the end-2009 exchange rate) to end-2012 (using the end-2012 exchange rate). To compute income earned during 2010–12, we use reported (US dollar) income for the years 2010, 2011, and 2012, converted to local currency using the average daily exchange rates for each of those years.

Table 3
Banks included in analysis.

Country	Bank	Assets at end 2012 US$ billion	GSIB
Europe			
Austria	Erste Group Bank AG	282	
	Raiffeisen Zentralbank Oesterreich AG	180	
Belgium	Dexia	471	
	KBC Group	339	
France	Banque Populaire CdE	1023	X
	BNP Paribas	2516	X
	Crédit Agricole SA	2134	X
	Credit Mutuel	851	
	Société Générale	1650	X
Germany	Commerzbank AG	839	
	Deutsche Bank AG	2655	X
	Deutsche Postbank AG	256	
	Landesbank Hessen-Thueringen	263	
Ireland	Bank of Ireland	195	
Italy	Gruppo Monte dei Paschi di Siena	289	
	Intesa Sanpaolo	889	
	UniCredit SpA	1223	X
Netherlands	ING Groep NV	1539	X
Poland	PKO Bank Polski	62	
Portugal	Banco Comercial Português, SA	118	
	Banco Espirito Santo SA	110	
Russia	Sberbank of Russia	497	
Spain	Banco Bilbao Vizcaya Argentaria SA	842	X
	Banco Popular Espanol SA	208	
	Banco Santander SA	1675	X
Sweden	Nordea Bank AB	882	X
	Skandinaviska Enskilda Banken AB	377	
	Svenska Handelsbanken	367	
	Swedbank AB	284	
Switzerland	Banque Cantonale Vaudoise	43	
	Credit Suisse AG	991	X
	UBS AG	1374	X
Turkey	Turkiye Garanti Bankasi A.S.	101	
	Turkiye is Bankasi A.S. – ISBANK	113	
	T.C. Ziraat Bankasi A.S.	93	
United Kingdom	Barclays Bank Plc	2349	X
	HSBC Holdings Plc	2693	X
	Lloyds Banking Group Plc	1474	
	Nationwide Building Society	311	
	Royal Bank of Scotland Group Plc (The)	2071	X
	Standard Chartered Plc	631	X
North America			
Canada	Bank of Montreal	526	
	Bank of Nova Scotia (The)	668	
	Canadian Imperial Bank of Commerce CIBC	394	
	National Bank of Canada	178	
	Royal Bank of Canada RBC	825	
	Toronto Dominion Bank	811	
Mexico	Banorte	55	
United States	Bank of America Corporation	2210	X
	Bank of New York Mellon Corporation	359	X
	BB&T Corporation	184	
	Capital One Financial Corporation	313	
	Citigroup Inc	1865	X
	Comerica Incorporated	65	
	Fifth Third Bancorp	122	
	Goldman Sachs Group, Inc	939	X
	JP Morgan Chase & Co.	2359	X
	KeyCorp	89	
	Morgan Stanley	781	X
	Northern Trust Corporation	97	
	PNC Financial Services Group Inc	305	
	State Street Corporation	223	X
	SunTrust Banks, Inc.	173	
	US Bancorp	354	
	Wells Fargo & Company	1423	X
Asia-Pacific			
Australia	Australia and New Zealand Banking Group	672	
	Commonwealth Bank of Australia	733	
	National Australia Bank Ltd	798	
	Westpac Banking Corporation	706	

Table 3 (continued)

Country	Bank	Assets at end 2012 US$ billion	GSIB
China	Agricultural Bank of China Limited	2106	
	Bank of China Limited	2016	X
	Bank of Communications Co. Ltd	838	
	China CITIC Bank Corporation Limited	471	
	China Construction Bank Corporation	2222	
	China Merchants Bank Co Ltd	542	
	Industrial & Commercial Bank of China	2789	X
India	ICICI Bank Limited	121	
	State Bank of India	358	
Japan	Aozora Bank Ltd	62	
	Bank of Tokyo – Mitsubishi UFJ Ltd	2005	X
	Mizuho Financial Group	1964	X
	Nomura Holdings Inc	435	
	Sumitomo Mitsui Financial Group, Inc	1727	X
Korea	Hana Bank	146	
	Kookmin Bank	244	
	Shinhan Bank	222	
	Woori Bank	232	
Malaysia	CIMB Bank Berhad	87	
	Malayan Banking Berhad – Maybank	162	
	Public Bank Berhad	90	
Taiwan (Chinese Taipei)	Chinatrust Commercial Bank Ltd	67	
	Mega International Commercial Bank Co Ltd	84	
Thailand	Bangkok Bank Public Company Limited	79	
South America			
Brazil	Banco Bradesco SA	390	
	Banco do Brasil SA	561	
	Banco Itau Unibanco SA	448	
Chile	Banco Chile	49	
Africa and Middle East			
Saudi Arabia	National Commercial Bank	92	
South Africa	Absa Bank Ltd	90	
	FirstRand Bank Ltd	84	
	Standard Bank of South Africa Ltd	115	

economy banks, roughly 2.2 of the overall increase of 2.8 percentage points reflected higher capital, while the rest resulted from a decline in risk-weighted assets. Total assets rose for these banks, subtracting the equivalent of 0.7 percentage point from the ratio, but this was counteracted by a significant fall in the ratio of risk-weighted to total assets, which added 1.3 percentage points.

Emerging economy banks, by contrast, increased both capital and total assets substantially. Their overall risk-weighted capital ratio increase of 1.1 percentage points reflects the fact that higher capital, which added 5.5 percentage points to the risk-weighted capital-ratio, outpaced the increase in risk-weighted assets, which subtracted 4.4 percentage points. Unlike the advanced-economy banks, the increase in the risk-weighted assets of emerging-economy banks actually outpaced their increase in total (unweighted) assets – in other words, their average level of risk-weights increased.

The G-SIBs[18] increased their risk-weighted capital ratios by 2.55 percentage points. For these banks, higher capital by itself accounted for capital-ratio increase of 2.63 percentage points, while higher risk-weighted assets, reduced the ratio by 0.08 percentage points. Higher assets were almost exactly counteracted by lower risk weights for this group: the reduction in the ratio of risk-weighted assets to total assets accounted for a 0.98 percentage point increase in the G-SIBs' capital ratio, while the increase in total assets reduced the capital ratio by 1.06 percentage point.[19] Advanced economy

banks that are not G-SIBs, by contrast, increased their capital ratios by somewhat more, namely 3.0 percentage points. Unlike the G-SIBs, a significant role in achieving this was played by a reduction in risk-weighted assets; with higher capital contributing 1.8 percentage points and lower risk-weighted assets 1.2 percentage points. Total assets increased for this group (accounting for about a half percentage point capital-ratio increase), but a lower ratio of risk-weighted to total assets (accounting for 1.8 percentage points) overwhelmed this effect. Even for the European banks, higher capital accounted for a greater share of the increase in the capital ratio than did lower risk-weighted assets. However, for European banks lower risk weights drove almost all of the decline in risk-weighted assets, while total assets increased by a relatively small amount (accounting for only 0.1 percentage point of the higher capital ratio).[20]

5. Decomposing changes to capital

For the full sample, and for most subsamples, retained earnings (net income minus dividends) accounted for most of the increase in capital from 2009 to 2012. Table 7 breaks down the increase in capital for the firms in the sample according to the three components in the numerator of the expression on the right-hand side of Eq. (1): net income, dividends[21] and other changes to capital. This last term is calculated as a residual, based on reported data on common equity, net income and dividends. It comprises share issues and items that are not included in net income, such as gains and losses on fixed assets and available-for-sale securities. For the sample of

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[18] All of the G-SIBs but two (Bank of China and Industrial and Commercial Bank of China) are based in advanced economies (Table 3).

[19] The results are broadly similar for the 2011, 2012 and 2014 G-SIB lists. However, reflecting the addition of two Chinese banks, the later lists display stronger growth in total assets and risk-weighted assets. Thus, for the 2011 list the risk-weighted capital ratio grew 2.92 percentage points, of which 2.21 percentage points resulted from higher capital and 0.71 percentage points lower risk-weighted assets (total assets grew while risk weights fell). For the 2014 list, the increase in the capital ratio was 2.56 percentage points, of which 2.80 points resulted from higher capital, offset by 0.24 percentage points of higher risk-weighted assets.

[20] "Europe" in the results reported here comprises banks from the euro area, the UK and Switzerland. Results are substantially similar for euro area banks considered alone.

[21] Net income is defined as earnings after taxes and before other changes, such as revaluation of available-for-sale securities that do not flow through the income statement. Dividends are the sum of common and preferred dividends.

Table 4
Bank capital and assets, 2009–12 (aggregate figures, in US$ billion).

	End-2009			End-2012			2009–12			Number of banks
	Capital	RWA	Total assets	Capital	RWA	Total assets	Net income	Dividends	Other increases in capital	
All	3293	29,126	65,212	4291	31,775	74,861	1093	412	271	101
Advanced	2667	23,262	54,726	3197	22,464	58,767	607	251	154	68
Emerging	626	5864	10,486	1094	9311	16,094	486	161	118	33
G-SIB	2062	17,657	42,500	2563	18,137	46,922	585	192	109	29
Advanced economy non-G-SIB	781	7228	15,233	950	6992	16,651	179	115	83	41
US	935	6891	10,755	1128	6767	11,861	232	48	9	17
Europe	1385	12,317	35,005	1501	10,936	34,401	174	99	28	36
Other advanced	347	4053	8966	568	4762	12,505	201	104	116	15

The table shows the calculation of the elements of Eq. (1) in the text, aggregated across the set of banks indicated in each row.
Sources: Bankscope, Bloomberg SNL; BIS calculations.

Table 5
Sources of changes in bank capital ratios, end-2009–end 2012 (in percent).

	K/RWA 2009	K/RWA 2012	Increase in capital	Increase in RWA	Increase in RWA/TA	Increase in total assets	Number of banks
All	11.4	14.0	34.8	6.0	−7.7	14.4	101
Advanced	11.7	14.4	27.7	−3.0	−10.0	8.3	68
Emerging	10.3	11.5	72.5	54.2	4.7	47.1	33
G-SIB	11.9	14.5	31.6	2.3	−7.3	11.1	29
Advanced economy non-G-SIB	10.8	13.8	23.8	−7.1	−14.8	8.0	41
US	13.9	17.4	22.4	−2.2	−11.3	10.3	17
Europe	11.7	14.2	16.3	−6.1	−8.1	2.5	36
Other advanced	8.6	11.8	78.9	8.3	−15.8	28.5	15

The table shows the calculation of the elements of Eq. (1) in the text for the set of banks indicated. Changes are calculated in local currency terms. Weighted averages (using end-2009 assets as weights) are shown.
Sources: Bankscope, Bloomberg SNL; BIS calculations.

Table 6
Sources of changes in bank capital ratios, end-2009–end 2012 (normalised to percentage points of end-2009 risk-weighted assets).

	Increase in K/RWA a	Increase in capital b	Increase in RWA c	Increase in RWA/TA d	Increase in total assets e	Number of banks
All	2.52	2.78	0.26	−1.00	1.27	101
Advanced	2.78	2.21	−0.57	−1.29	0.72	68
Emerging	1.11	5.51	4.40	0.44	3.96	33
G-SIB	2.55	2.63	0.08	−0.98	1.06	29
Advanced economy non-G-SIB	3.04	1.78	−1.26	−1.77	0.51	41
US	3.49	2.96	−0.53	−1.92	1.39	17
Europe	2.47	1.40	−1.06	−1.17	0.11	36
Other advanced	3.14	3.66	0.52	−1.22	1.74	15

The table shows the calculation of the elements of Eq. (2) in the text for the set of banks indicated. Changes are calculated in local currency terms. Weighted averages (using end-2009 assets as weights) are shown. The columns are related as follows: $a = b − c = b − (d + e)$.
Sources: Bankscope, Bloomberg SNL; BIS calculations.

91 banks for which information was available, retained earnings (net income minus dividends) accounted for about 22 percentage points out of the overall 35.5% increase in capital from end-2009 to end-2012.

As in the previous section, it is useful to look at these figures in terms of percentage-point increases in the risk-weighted capital ratio. To create an additive relationship, we need a further transformation, as follows:

$$F \ln\left(\frac{K_1}{K_0}\right) = G\left(\frac{Inc_1}{K_0}\right) − G\left(\frac{Div_1}{K_0}\right) + G\left(\frac{Oth_1}{K_0}\right) \qquad (3)$$

where the normalisation factor G is defined as $F \ln(K_1/K_0)/(K_1/K_0 − 1)$.

Table 8 and Fig. 6 report the components of increases in capital, after the transformation set out in Eq. (3). When expressed in terms of percentage points of the risk-weighted capital ratio, retained earnings account for 1.7 out of the 2.8 percentage-point increase in capital, while capital from other sources accounts for the remaining 1.1 percentage points.

For the G-SIBs, as well as for the advanced economy banks as a group, retained earnings were more than half of the overall increase in capital. Retained earnings by the G-SIBs accounted for 1.7 percentage points of the overall capital increase of 2.6 percentage points. Capital generated from other sources provided the rest.

For banks in emerging economies, retained earnings were somewhat more significant, contributing three fourths of the overall increase in capital – 4.2 out of the total 5.6 percentage points. In contrast to the advanced economy banks, dividend payouts were substantially greater than other increases in capital for banks in emerging economies. A very rapid accumulation of net income (corresponding to 6.4 percentage points in capital-ratio terms) allowed these banks to increase their common equity quite substantially despite their relatively high dividend payouts.
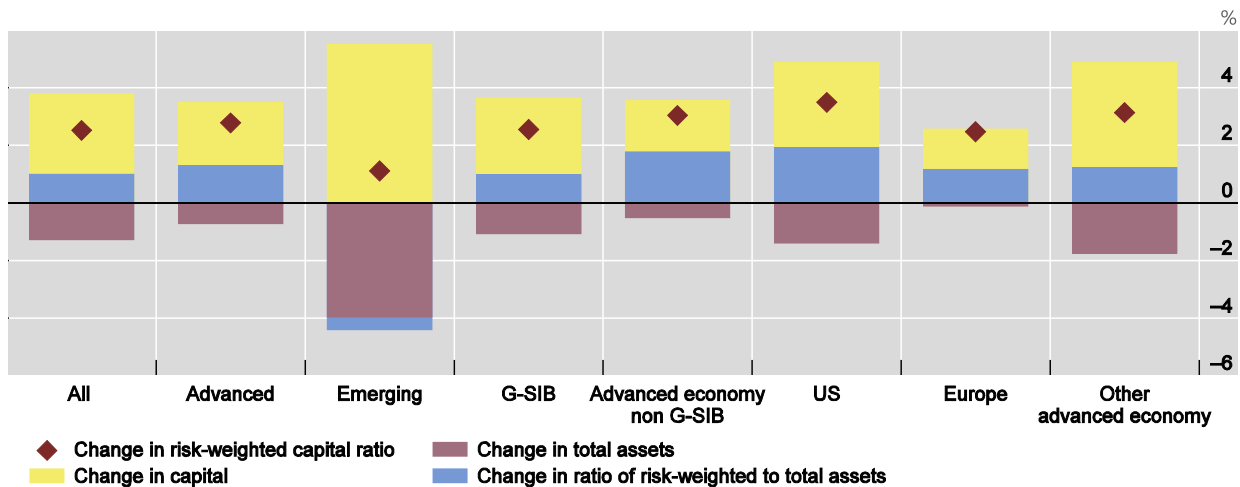
Fig. 5. Sources of changes in bank capital ratios, end-2009 to end-2012 (normalised to percentage points of end-2009 risk-weighted assets). The graph shows the change in the ratios of common equity to risk-weighted assets at the (fiscal-year) end of 2009 and 2012, respectively, in percentage points. The overall change is shown by the red diamonds. The components of this change are the terms on the right-hand side of Eq. (2) in the text, normalised by the ratio $(b - a)/(\ln(b) - \ln(a))$. All figures are weighted averages, using end-2012 assets as weights. Sources: Bankscope; Bloomberg; BIS calculations. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

The ability of banks to increase their capital by accumulating retained earnings was not associated with especially strong improvements in profitability. Net income as a share of assets fell from 0.76% in the three years before the crisis to 0.46% in the 2010–12 period across the banks in the sample (Table 9). This ratio fell even more sharply for advanced-economy banks – from 0.73% to 0.32% – though it rose slightly for emerging economy banks, from 1.05% to 1.21%. The fall in the return on assets primarily reflected a decline in "other income", which is calculated as a residual based on net income, net interest income and operating expenses, on the part of the advanced-economy banks.

One of the predicted effects of the transition to higher bank capital ratios – wider lending spreads – appears to have taken place, though the widening was rather mild. Net interest income rose from 1.41% of assets to 1.57% for the full sample. This 16-basis point increase in the spread between banks' gross interest earnings and their funding costs works out to 6 basis points per percentage point of increase in the capital ratio – which is towards the bottom of the range of published estimates for the likely increase in lending spreads (Tables 1 and 2).

Two other predicted effects – that banks would increase their income from non-interest-paying sources and that they would reduce their operating expenses – did not take place for the banks in this sample. Operating expenses were roughly unchanged across the sample, though they do appear to have declined somewhat for the emerging-economy banks. Income from sources besides net interest income fell for the sample as a whole and for the advanced economy banks, though it rose for banks in the emerging economies.

While overall profitability fell, increased earnings retention enabled banks to devote a greater share of income to accumulating capital (Table 10, first and third columns). Dividends fell from more than 24% of income before the crisis for banks in the sample to 19%. This decline entirely reflected a reduction in dividend payouts on the part of advanced-economy banks, while the payout ratio rose slightly for emerging economy banks. The G-SIBs reduced dividend payouts especially sharply: from 23% to 13%. In part the reduction in dividends reflected formal and informal pressure by regulators on banks to reduce dividends so as to build up their capital ratios.

Falling profitability and rising capital have led to a decline in returns on equity. The ratio of net income to book equity fell sharply for the full sample, from 19% to 7%, again reflecting a decline by the advanced economy banks (Table 10, second and fourth columns).

6. Assets and lending

As already noted, the banks in our sample tended to see their assets grow during the period under consideration. They achieved increases in capital ratios by effecting greater increases in equity capital and, at least in the advanced economies, reducing their ratio of risk-weighted to total assets.

This section examines developments in different categories of bank assets from end-2009 to end-2012 in two ways: first by taking the weighted average of bank-level asset growth over 2009–2012 for the full sample of banks and different subsamples (Table 11), and second by looking at the aggregate change in different categories of bank assets, in effect pooling the balance sheets across the sample and the various subsamples (Table 12).[22]

From end-2009 to end-2012, banks across the full sample saw their assets grow by 6.5% in real terms, based on a weighted average[23] (Table 11, first column). Assets of emerging-economy banks grew an average of 30%, while advanced economy bank assets grew 2%. G-SIBs increased their assets at a faster pace (4%) than did advanced economy banks that are not G-SIBs (1%).[24] This very slow growth rate appears to reflect the experience of the European banks, which reduced their assets by 4% in real terms; real assets increased for banks from the US (by 4%) and other advanced economies (by 25%).

Similar patterns are also apparent when one looks at aggregate asset growth in a pooled balance sheet[25] (Table 12, first column). Assets grew by 8% for all banks, by 1% for the set of advanced economy banks, and by 44% for the set of emerging economy banks. Asset growth was 4% for the G-SIBs, and 3% for the advanced economy non-G-SIBs.

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[22] The first measure uses asset growth figures denominated in local currencies (using the currency of the bank's head office in the case of banks that are active in multiple jurisdictions). The second uses assets denominated in US dollars. This will result in relatively higher asset growth figures using the first measure for banks in countries which experienced depreciation against the US dollar over 2009–12, and lower figures where there was appreciation.

[23] To correct for inflation we use the consumer price index in the country where the bank is headquartered. As before, end-2009 assets are used as weights in constructing the weighted average.

[24] The G-SIB figure is nevertheless higher than that for advanced economy banks as a whole because of very rapid asset growth by the one G-SIB (Bank of China) that is not based in an advanced economy.

[25] In this case, because all figures are in US dollars, we use the US consumer price index.

Table 7
Sources of changes in bank capital, end-2009–end 2012 (in percent).

As a percent of end-2009 capital								
	K/RWA 2009	K/RWA 2012	Increase in capital, end-2009–end-2012 *a*	Net income, 2010–12 *b*	Dividends, 2010–12 *c*	Retained earnings, 2010–12 *d*	Other sources of capital, 2010–12 *e*	Number of banks
All	11.4	13.9	35.5	34.8	13.2	21.6	13.9	91
Advanced	11.6	14.3	28.6	25.8	10.4	15.4	13.1	62
Emerging	10.3	11.5	73.4	83.5	28.5	55.0	17.7	29
G-SIB	11.9	14.5	31.6	29.9	10.0	19.9	11.7	29
Advanced economy non-G-SIB	10.5	13.2	26.5	25.7	16.4	9.3	17.2	35
US	13.9	17.4	22.4	26.0	5.5	20.6	1.8	17
Europe	11.7	14.0	16.9	16.4	7.6	8.8	8.1	31
Other advanced	8.5	11.7	79.7	60.5	26.8	33.8	45.9	14

The table shows the sources of increases in bank capital for the set of banks indicated. Changes are calculated in local currency terms. Weighted averages (using end-2009 assets as weights) are shown. The variables are related as follows: $a = b - c + e = d + e$.
Sources: Bankscope, Bloomberg, SNL; BIS calculations.

Table 8
Sources of changes in bank capital, end-2009–end 2012 (normalised to percentage points of end-2009 risk-weighted assets).

As a percent of end-2009 capital								
	K/RWA 2009	K/RWA 2012	Increase in capital, end-2009–end-2012 *a*	Net income, 2010–12 *b*	Dividends, 2010–12 *c*	Retained earnings, 2010–12 *d*	Other sources of capital, 2010–12 *e*	Number of banks
All	11.4	13.9	2.8	2.8	1.0	1.7	1.1	91
Advanced	11.6	14.3	2.3	2.1	0.8	1.2	1.0	62
Emerging	10.3	11.5	5.6	6.4	2.2	4.2	1.4	29
G-SIB	11.9	14.5	2.6	2.5	0.8	1.7	1.0	29
Advanced economy non-G-SIB	10.5	13.2	1.9	1.9	1.2	0.7	1.3	35
US	13.9	17.4	3.0	3.4	0.7	2.7	0.2	17
Europe	11.7	14.0	1.5	1.4	0.7	0.8	0.7	31
Other advanced	8.5	11.7	3.7	2.8	1.2	1.5	2.1	14

The table shows the sources of increases in bank capital for the set of banks indicated, using the normalisation discussed in the text. Changes are calculated in local currency terms. Weighted averages (using end-2009 assets as weights) are shown. The variables are related as follows: $a = b - c + e = d + e$.
Sources: Bankscope, Bloomberg, SNL; BIS calculations.

Lending growth, whether calculated before (gross loans) or after (net loans) reserves for impaired and non-performing loans, largely tracked asset growth for most subsamples.[26] For the non-GSIB advanced economy banks, real gross loans fell 1% on average, compared with the 1% increase in assets. For the US banks in the sample, both assets and gross lending grew by an average of 4% in real terms. However, for European banks, lending growth lagged behind asset growth. The average European bank reduced assets by 4% in real terms and gross lending by 7%. Instead, these banks appear to have accumulated cash and interbank assets at a faster pace than did other advanced-economy banks. While US banks increased their holdings of cash and interbank claims by 24% and those in other advanced economies by 69%, European banks increased their holdings in this category by 104% (Table 11, fifth column).

For comparison, real GDP growth in the corresponding regions over the three years 2010–2012 are recorded in the last column of Table 11. In advanced economies, real bank assets and lending tended to lag real GDP, which grew 13%. Bank asset and lending growth in emerging economies were slightly faster than that of real GDP, which grew 25%.

It should be emphasised that the figures in Tables 11 and 12 break down asset growth by the nationality of the bank, not that of the borrower. The pullback in lending by European banks thus does not necessarily correspond to a reduction in credit provided to the banks' domestic economies. As documented by BIS (2012), European banks have moved to reduce their cross-border assets more readily than domestic assets in recent years.[27]

Some analysts have predicted that regulatory reforms and the experience of the crisis would induce a pullback of banks from trading activities. Banks will need to hold more capital against securities inventories and derivatives positions, and some will be subject to structural regulatory initiatives such as the "Volcker Rule" in the US that place restrictions on trading activities.

The evidence suggests that while many banks did reduce their stock of trading assets, especially in Europe, others maintained or increased them, particularly in the US and emerging economies.[28] This pattern is reflected in the divergence between the bank-level growth rates in the fourth column of Table 11, and the aggregate growth rates in the fourth column of Table 12. These figures should be interpreted with caution; some of the changes reflect changes in the valuation of the assets used, and the classification of assets as "trading securities" is likely to have differed somewhat across banks and jurisdictions, reflecting differences in accounting standards. Nevertheless, certain patterns emerge.

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[26] The gross and net lending figures exclude banks for which gross loans were less than 20% of assets in 2009, namely Goldman Sachs, Morgan Stanley, Nomura, State Street, Bank of New York Mellon, and Deutsche Bank. In these cases a small absolute change in gross loans translates into a very large percentage change, skewing the asset-weighted averages reported in Table 11. These banks are included in the pooled sample for Table 12.

[27] Avdjiev et al. (2012) document how euro area banks reduced cross-border lending to emerging economies more than did banks based in other regions after the crisis.
[28] Roengpitya et al. (2014) look at the evolution of bank business models in advanced and emerging economies since the crisis, finding that retail banking has gained at the expense of models based on wholesale funding.
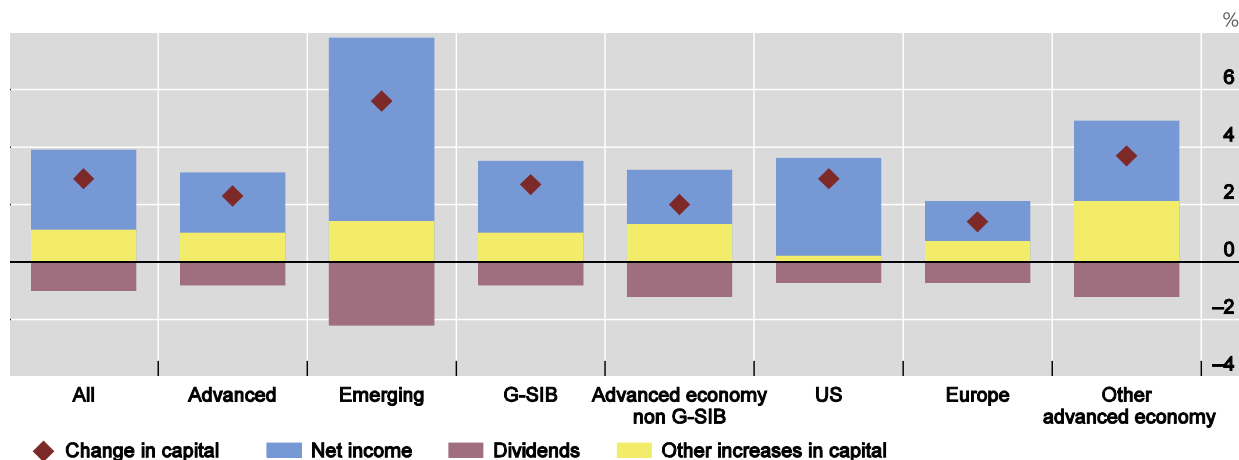
Fig. 6. Sources of increases in bank capital, end-2009 to end-2012. Normalised to percentage points of end-2009 risk-weighted assets. Sources: Bankscope; Bloomberg; BIS calculations.

Table 9
Changes in components of bank income (in percent of total assets).

	2005–07				2010–12			
	Net income *a*	Net interest income *b*	Operating expenses *c*	Other income *d*	Net income *a*	Net interest income *b*	Operating expenses *c*	Other income *d*
All	0.76	1.41	1.67	1.26	0.46	1.57	1.64	0.92
Advanced	0.73	1.25	1.68	1.37	0.32	1.38	1.68	1.02
Emerging	1.05	2.79	1.61	0.29	1.21	2.61	1.43	0.32
G-SIB	0.70	1.24	1.60	1.29	0.39	1.38	1.67	1.06
Advanced non-G-SIB	0.84	1.50	1.85	1.35	0.30	1.54	1.56	0.76
US	1.06	1.91	2.75	2.24	0.66	2.18	3.14	2.22
Europe	0.65	1.05	1.38	1.14	0.15	1.15	1.33	0.74
Other advanced	0.57	1.10	1.36	1.04	0.59	1.32	1.28	0.70

The figures in the table are weighted averages (using end-period assets as weights) for the ratios of different components of income to total assets, for the banks in the sample. They are related to one another as follows: $a = b - c + d$.
Sources: Bankscope, Bloomberg, SNL; BIS calculations.

Table 10
Dividend payouts and returns on equity (in percent).

	2005–07		2010–12	
	Div payout ratio	Return on equity	Div payout ratio	Return on equity
All	24.4	19.1	19.1	7.4
Advanced	25.5	19.4	18.9	5.4
Emerging	15.9	16.1	20.0	18.3
G-SIB	22.9	19.1	12.9	7.1
Advanced non-G-SIB	31.8	19.3	40.1	3.3
US	23.9	15.8	9.8	7.3
Europe	27.7	19.3	19.5	2.8
Other advanced	22.4	24.5	27.6	13.2

Dividend payout ratio is dividends divided by net income. Return on equity is net income divided by common equity. Both are weighted averages across the corresponding group of banks, using assets at the start of the period as weights.
Sources: Bankscope, Bloomberg, SNL; BIS calculations.

While banks on average increased their holdings of trading securities by 23% (Table 11, fourth column), the stock of trading securities held by the banks in the sample fell by 15% (Table 12, fourth column). Advanced economy banks on average reduced their stock of trading securities, with a weighted average reduction of 8.5% from 2009 to 2012 and an aggregate reduction of 17% during this time. The aggregate trading securities held by G-SIBs fell

20%. Banks headquartered in Europe were especially aggressive in reducing trading portfolios, with their holdings of such securities declining on average by 25% over this period. The aggregate holding of trading securities by European banks fell 29%. US banks, on average, increased trading portfolios by 36%, but this appears to be due largely to a rapid build-up from a low base by a subset of the US banks in the sample. Using aggregate figures, US banks' holdings of trading securities rose 5%. Emerging economy banks also increased trading securities sharply, with the (weighted) average bank almost doubling its holdings over this time, while the aggregate trading portfolio of the emerging-economy banks rose 44%. However, this rapid growth starts from a relatively low base. At end-2012 trading securities still accounted for only 4% of emerging economy bank assets, compared with 8% for advanced economy banks.

7. A closer look at adjustment strategies

A crucial question is the degree to which differences in growth rates of bank assets, and other adjustment measures undertaken by banks, reflect transitions to higher capital ratios as opposed to other factors such as macroeconomic conditions in the bank's home economy. Table 13 presents the outcomes of regressions of different bank asset aggregates on increases in capital and other factors. The models are of the form:

Table 11
Growth in categories of bank assets, 2009–12 (in percent).

	Assets	Gross loans[a]	Net loans[a]	Trading securities	Cash and interbank	Other assets	Memo: GDP Growth[b]
All	6.5	2.8	2.7	22.8	24.3	19.7	13.0
Advanced	2.1	−3.5	−3.5	−8.5	19.9	20.4	1.6
Emerging	29.8	33.2	33.0	191.3	51.8	14.9	24.6
G-SIB	4.4	−1.8	−1.7	28.4	27.2	22.8	
Advanced non-G-SIB	1.1	−1.0	−1.3	−10.2	2.7	12.7	
US	3.7	3.3	5.1	35.9	30.2	−0.6	3.6
Europe	−4.3	−10.9	−11.4	−24.7	13.2	20.2	−1.0
Other advanced	24.9	17.3	17.4	3.4	35.2	45.6	3.3

The figures in the table are weighted average of the percentage growth from end-2009 to end-2012 across banks in the categories shown, using end-2009 assets as weights and corrected for US inflation. "Net loans" equal "gross loans" minus reserves against possible losses on impaired or non-performing loans. "Cash and interbank" includes cash, balances with central banks (interest- and non-interest-earning), loans and advances to banks, and loans pledged to banks as collateral. "Other assets" equal assets minus gross loans, trading securities, cash and interbank assets.
Sources: Bankscope; Bloomberg, SNL, IMF; BIS calculations.
[a] Excludes banks for which gross loans were less than 20% of assets in 2009.
[b] Total real GDP growth at market exchange rates, 2010–2012.

Table 12
Aggregate growth in categories of bank assets, 2009–12 (in percent).

	Assets	Gross loans	Net loans	Trading securities	Cash and interbank	Other assets	Memo: GDP Growth[a]
All	8.0	6.2	6.1	−14.8	17.1	12.8	13.0
Advanced	1.0	−3.3	−3.3	−16.6	0.1	12.0	1.6
Emerging	44.4	47.3	47.3	44.4	72.4	20.1	24.6
G-SIB	3.8	−0.4	−0.4	−19.9	5.5	14.1	
Advanced non-G-SIB	2.8	0.6	0.5	2.7	−0.3	4.8	
US	3.7	3.7	5.3	5.3	24.6	−1.4	3.6
Europe	−7.6	−13.9	−14.5	−28.9	−9.3	9.0	−1.0
Other advanced	31.2	23.5	23.6	12.0	38.6	48.4	3.3

The figures in the table are the percentage growth from end-2009 to end-2012 in the aggregate amounts of assets in the categories shown across the relevant subsample, in US dollars, corrected for US inflation. "Net loans" equal "gross loans" minus reserves against possible losses on impaired or non-performing loans. "Cash and interbank" includes cash, balances with central banks (interest- and non-interest-earning), loans and advances to banks, and loans pledged to banks as collateral. "Other assets" equal assets minus gross loans, trading securities and cash/interbank.
Sources: Bankscope; Bloomberg, SNL, IMF; BIS calculations.
[a] Total real GDP growth at market exchange rates, 2010–2012.

$$Adj_i = \overrightarrow{Geog_i} \cdot \beta_{0\ldots3} + (\beta_4 + \beta_5 Europe_i + \beta_6 Emerging_i)$$
$$* \left(\frac{K_{i,0}}{RWA_{i,0}}\right) + (\beta_7 + \beta_8 Europe_i + \beta_9 Emerging_i)$$
$$* \Delta\left(\frac{K_i}{RWA_i}\right) + (\beta_{10} + \beta_{11} Europe_i + \beta_{12} Emerging_i)$$
$$* \left(\frac{NetInc_i}{Assets_i}\right) + \varepsilon_i \tag{4}$$

where i indexes banks, Adj_i is a variable measuring some aspect of banks' adjustment strategies, $Europe_i$ is a dummy variable set equal to one if a bank is based in an advanced European economy, $Emerging_i$ equals one if a bank is based in an emerging economy, and $Geog_i$ is a vector of dummy variables where the bank's home country or region is equal to 1. Geographical dummies are included for the United States, advanced European economies, other advanced economies (Australia, Canada and Japan), and emerging economies. These span the geographies included in the data set so a constant term is not needed. Changes in capital and in the dependent variables are measured from end-2009 to end-2012, while the net income-to-assets ratio is an average for the years 2010, 2011 and 2012.

The interaction terms allow us to test the factors affecting the adjustment strategies of two sets of banks that stood out in the previous discussion, namely banks based in Europe and banks based in emerging economies. For the dependent variable, the four columns of Table 13 look at real growth in assets, gross loans (that

is, loans before provisions for impairment and non-performing loans),[29] risk-weighted assets, and the bank's stock of trading securities.

The results suggest that banks from non-European advanced economies which had high risk-weighted capital ratios at end-2009 tended to increase their assets more than their peers (Table 13, column 1). Specifically, according to the estimated model, a non-European, advanced economy bank which had a one percentage-point higher risk-weighted capital ratio at the end of 2009 was likely to have a 2.83 percentage-point higher rate of real asset growth (column 1) and a 5.33 percentage point higher rate of real gross loan growth (column 2) over the subsequent three years. A one standard deviation increase in the capital ratio, or about 5 percentage points, would have increased asset growth by 14% and loan growth by 27%.

More profitable banks from these countries also grew more rapidly. A bank which had a 0.3 percentage point higher ratio of income to assets in 2010–12, which is about one standard deviation for this sample of banks, tended to have a 3.3 percentage-point higher rate of real asset growth during this time (column 1) and an 8.9 percentage point higher growth rate of real gross loans (column 2).

However, these effects varied in important ways for European and emerging-economy banks.

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[29] Banks with gross loans less than 20% of total assets are excluded from the regression in column 2.

Table 13
Capital ratios, profitability, and adjustment strategies.

Dependent variable	Growth in assets 1	Growth in gross loans[a] 2	Growth in risk-weighted assets 3	Growth in trading securities 4
US	−0.40**	−0.86*	−0.13	−6.92**
	(−2.30)	(−1.76)	(−0.62)	(−3.33)
Europe	0.07	0.04	−0.16	−0.53**
	(0.54)	(0.25)	(−1.38)	(−2.21)
Other advanced economies[b]	−0.15	−0.61	−0.02	−6.28**
	(−0.87)	(−1.25)	(−0.09)	(−3.27)
Emerging	0.24**	−0.05	0.03	0.59
	(2.95)	(−0.30)	(0.19)	(0.21)
Capital ratio end-09	2.83**	5.33*	0.48	41.53**
	(5.41)	(1.88)	(0.65)	(3.47)
Capital ratio* Europe	−3.49**	−6.03**	0.10	−39.25**
	(−3.15)	(−2.00)	(0.08)	(−3.24)
Capital ratio* Emerging	−5.89**	−5.51*	−1.96	−31.98
	(−5.82)	(−1.78)	(−1.07)	(−1.39)
Change in capital ratio 2009–12	0.10	0.26	−0.25	4.66**
	(0.55)	(0.74)	(−1.23)	(3.21)
Ch in capital ratio* Europe	−0.33	−0.53	−0.03	−4.55**
	(−1.57)	(−1.33)	(−0.12)	(−3.11)
Ch in capital ratio* Emerging	−0.07	−0.19	0.06	0.48
	(−0.28)	(−0.44)	(0.18)	(0.07)
Net income/Assets 2010–12	11.09	29.68*	15.05	113.44*
	(0.78)	(1.94)	(0.96)	(1.97)
Net income/Assets* Europe	14.48	−1.49	14.35	−82.52
	(0.93)	(−0.09)	(0.88)	(−1.41)
Net income/Assets* Emerging	16.75	−1.75	19.91	−154.90
	(0.99)	(−0.10)	(1.09)	(−1.38)
Adjusted R[b]	0.52	0.52	0.62	0.12
# of obs	100	93	100	93

The table shows the coefficients from OLS regressions of the stated dependent variable on the independent variables and dummies for the United States, Europe, other advanced economies, and emerging economies. Coefficients on the geographical dummies are not shown. T-statistics are in parentheses, based on White (heteroskedasticity-robust) standard errors. Assets, risk-weighted assets, gross loans, and trading securities are measured from end-2009 to end-2012. "Europe" refers to European advanced economies. Risk-weighted assets use Basel-II risk weights. Gross loans are loans before provisions for impairments and non-performing loans. ** Significantly different from 0 at a 95% confidence level. * Significantly different from 0 at a 90% confidence level.
Sources: Bankscope, Bloomberg; BIS calculations.
  [a] Excludes banks for which gross loans were less than 20% of assets in 2009.
  [b] Australia, Canada, and Japan.

Table 14
Selected Wald Test results: Interaction terms.

	Combined coefficient	t-statistic
Growth in assets (column 1)		
Capital ratio + Capital ratio* Europe	−0.66	−0.67
Capital ratio + Capital ratio* Emerging	−3.06**	−3.53
Net income/assets + net income/assets* Europe	25.57**	4.22
Net income/assets + net income/assets* Emerging	27.84**	3.10
Growth in gross loans (column 2)		
Capital ratio + Capital ratio* Europe	−0.70	−0.68
Capital ratio + Capital ratio* Emerging	−0.18	−0.14
Net income/assets + net income/assets* Europe	28.20**	4.07
Net income/assets + net income/assets* Emerging	27.94**	3.31
Growth in trading securities (column 4)		
Capital ratio + Capital ratio* Europe	2.28	1.19
Capital ratio + Capital ratio* Emerging	9.55	0.49
Net income/assets + net income/assets* Europe	30.91**	2.79
Net income/assets + net income/assets* Emerging	−41.46	−0.43

** Significantly different from zero at a 95% confidence level.

From the coefficients on the interaction terms, one can see that the starting capital ratio by itself did not have an impact on how quickly European banks expanded assets and lending. In the asset growth regression, the sum of the coefficients on the end-2009 capital ratio and on the interaction of this ratio with the European dummy is −0.66 and, according to a Wald test, not significantly different from zero (Table 14). Similar results hold for loan growth. However, the tendency for profitable banks to increase lending was the same for European as for other banks. One can see this from the absence of a significant coefficient on the interaction term between the return on assets and the European dummy for asset or lending growth.

Emerging economy banks that had high risk-weighted capital ratios in 2009 grew relatively more slowly than those with lower ratios. Adding the coefficients on the end-2009 capital ratio and on the interaction of that ratio with the dummy variable for emerging-economy banks totals -3.06 and is significant according to a Wald test (Table 14). However, more profitable banks in the emerging regions grew more quickly than did profitable banks in advanced economies.

When these effects are accounted for, the *increase* in the capital ratio does not have a statistically significant impact on asset growth for any of these groups. Put another way, the effects of the 2009 capital ratio and subsequent profitability on bank asset growth hold *regardless* of how quickly the bank moved to increase its capital ratio.[30]

While banks that raised their risk-weighted capital ratio more sharply between 2009 and 2012 did not reduce their total assets or overall lending, they did tend to cut back on risk-weighted assets, though the effect is not significant (Table 13, column 3). Among banks from advanced non-European economies, for every percentage point by which a bank increased its capital ratio during this period, its risk-weighted assets fell by about one quarter of a percentage point.

As noted earlier, an important method for achieving higher capital ratios, especially for European banks, has been to reduce trading portfolios. Some banks made greater use of this strategy than others. Banks that had high risk-weighted capital ratios in 2009, those that increased their capital ratios subsequently, and those that enjoyed high profitability were more likely to increase their trading portfolios during 2009–12 (Table 13, column 4). For non-European, advanced economy banks, a one percentage point higher capital ratio at the end of 2009 was associated with an increase in the bank's trading portfolio by 41.5% over the following three years. More profitable banks and those who increased capital ratios during 2009–12 also tended to expand their trading portfolios. Among European banks, profitability was associated with faster growth in trading securities but the 2009 capital ratio did not have an effect. Neither profitability nor the 2009 capital ratio played a role in the accumulation of trading assets by banks in emerging economies.

8. Conclusions

The evidence presented here suggests that most banks have achieved higher capital ratios since the crisis through the accumulation of retained earnings. Banks in advanced economies have reduced dividend payouts as part of this process. Banks in emerging economies have enjoyed high earnings and asset growth, and have had little trouble using some of their strong earnings to increase their capital ratios. An additional, though secondary, role has been played by the shift to assets with lower risk weights on the part of advanced economy banks. Banks in advanced economies have benefited from modestly wider net interest margins. Reductions in operating expenses do not appear to have played much of a role.

Banks in aggregate do not appear to have cut back sharply on asset or lending growth during the time that they implemented stronger capital standards. However, banks that had high capital ratios at the start of the process or strong profitability in the post-crisis years did tend to grow more than other banks. This points to the importance of solid bank balance sheets in supporting lending. There has been a pronounced shortfall in lending growth on the part of European banks, though European banks have accumulated other assets in the form of cash and securities. Some banks, especially in Europe, have cut back their trading portfolios.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jbankfin.2015.09.022.

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[30] Kapan and Minoiu (2013) find that banks with higher, better-quality capital did not reduce lending during the financial crisis as much as did other banks.

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