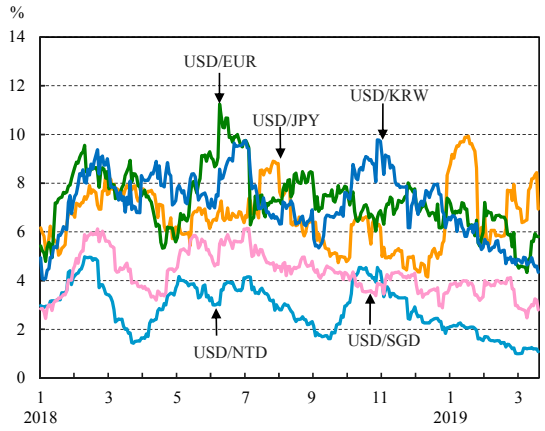
between 0.99% and 2.26% during 2019 Q1. Compared to major currencies such as the Japanese yen, the euro, the Korean won, and the Singapore dollar, the NT dollar exchange rate has been relatively stable against the US dollar (Chart 3.15).

Chart 3.15 Exchange rate volatility of various currencies versus the US dollar



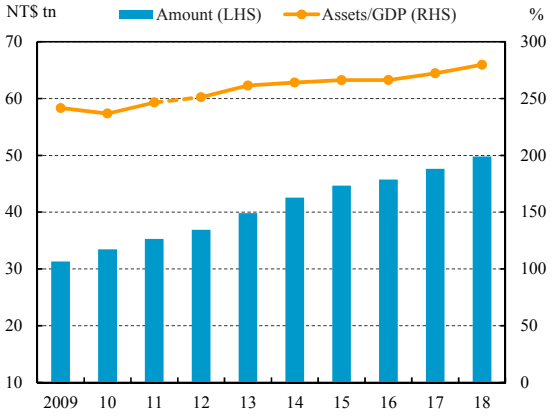
Note: Volatility refers to the annualized standard deviation of 20-day daily returns.
Source: CBC.

3.2 Financial institutions

3.2.1 Domestic banks

The total assets of Taiwan's 38 domestic banks[37] continually expanded in 2018, owing to growth in loans. Asset quality improved, and concentration in corporate loans as well as credit exposures to real estate loans slightly decreased. However, considering the conservative outlook for the real estate market, banks should prudently monitor and control related credit risks. Moreover, the estimated value at risk (VaR) of market risk exposures ascended, but liquidity risk remained moderate thanks to ample funds in the banking system. While domestic banks posted considerably higher profits in 2018 than the previous year, the average capital adequacy ratio remained the same and revealed satisfactory capacity to bear losses.

Chart 3.16 Total assets of domestic banks



Note: Figures from 2012 forward are on the TIFRSs basis, while those of prior years are on the ROC GAAP basis.
Sources: CBC and DGBAS.

Total assets kept growing

The total assets of domestic banks kept growing and reached NT$49.79 trillion at the end of 2018, equivalent to 279.84% of annual GDP (Chart 3.16). The annual growth rate of the total assets also rose to 4.50% due to the substantial increase in loans. Broken down by sector, the asset growth rates of domestic banking units (DBUs), offshore banking units (OBUs), and overseas branches all showed rising trends, with the growth

[37] Includes Agricultural Bank of Taiwan.

rate of OBUs exhibiting a remarkable rebound (Chart 3.17).

Credit risk

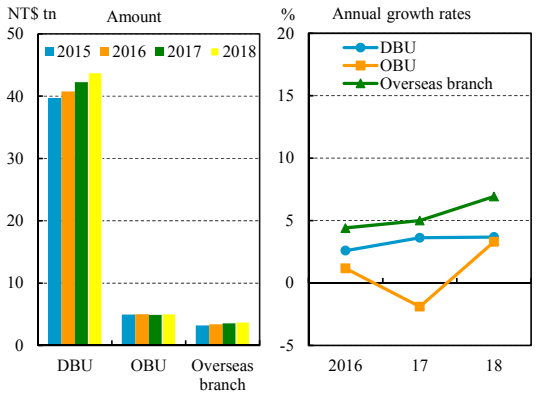
Customer loans kept on rising

Customer loans granted by the DBUs of domestic banks stood at NT$24.40 trillion at the end of 2018, accounting for 49.01% of total assets, with the annual growth rate increasing to 5.10% (Chart 3.18). Among them, the annual growth rate of household borrowing slightly rose to 5.58% owing to steady growth in mortgage loan demand. The growth rate of corporate loans also expanded to 5.51%. However, government loans showed a negative growth rate of -1.86% mainly because of less financing demand from the government as a result of increased tax revenues.

Credit concentration and the share of real estate-secured credit both slightly descended

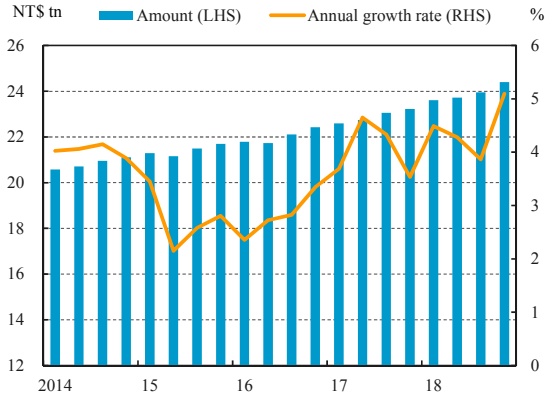
At the end of 2018, real estate loans granted by the DBUs of domestic banks amounted to NT$8.91 trillion and accounted for a share of 36.51% of total loans, which was a little lower than that of the previous year. It reflected marginally decreasing concentration in credit exposure to real estate loans. Moreover, real estate-secured credit granted by domestic banks aggregated NT$16.71 trillion, accounting for 55.46% of total credit,[38] slightly less than that of the previous year (Chart 3.19). Since

Chart 3.17 Total assets of domestic banks by sectors



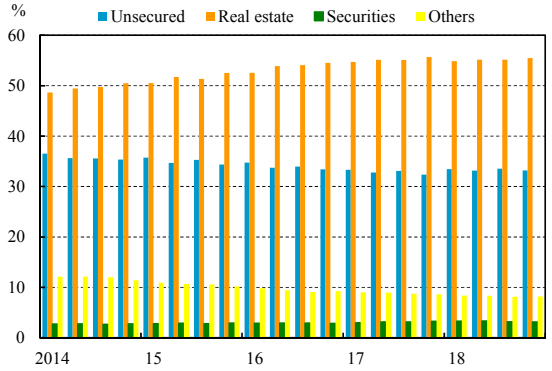
Note: Figures for total assets are inclusive of interbranch transactions.
Source: CBC.

Chart 3.18 Outstanding loans in domestic banks



Note: Loans of OBUs and overseas branches are excluded.
Source: CBC.

Chart 3.19 Credit by type of collateral in domestic banks



Source: CBC.

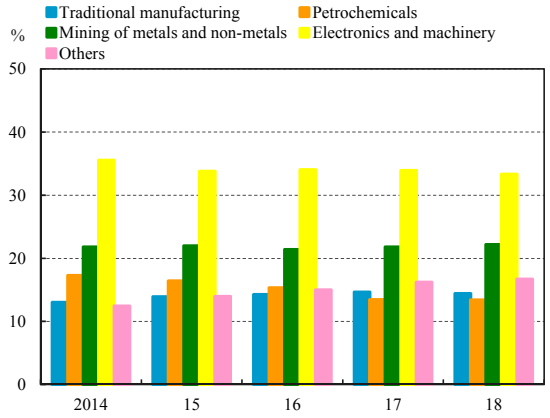
[38] The term "credit" herein includes loans, guarantee payments receivable, and acceptances receivable.

domestic housing prices stayed high and unsold new residential properties might put more pressure on the market, the outlook for the real estate market remained conservative. Banks should continue to pay close attention to real estate related credit risks.

Credit concentration in corporate loans slightly diminished

For the DBUs of domestic banks, corporate loans stood at NT$10.69 trillion at the end of 2018, of which loans to the manufacturing sector registered NT$4.21 trillion and accounted for the largest share of 39.39%. Within the manufacturing sector,[39] loans to the electronics industry contributed 33.31%, the largest, but decreasing, share of the total, reflecting that credit concentration to the electronics sector had mildly diminished (Chart 3.20).

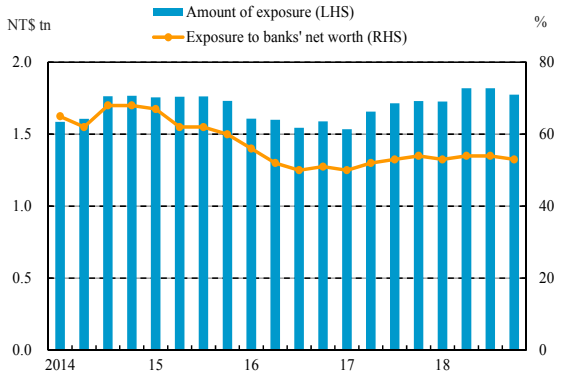
Chart 3.20 Exposure to the manufacturing sector by domestic banks



Notes: 1. Exposure to each sector = loans to each sector/loans to the whole manufacturing sector.
2. Exposures of OBUs and overseas branches were excluded.

Source: CBC.

Chart 3.21 Exposures to Mainland China by domestic banks



Source: FSC.

Exposures to Mainland China increased, but the ratio of the exposures to banks' net worth slightly decreased

At the end of 2018, the exposures of domestic banks to Mainland China increased by 2.55% year on year and stood at NT$1.78 trillion. However, the ratio of the exposures to banks' net worth slightly decreased to 53% (Chart 3.21), much lower than the highest point of 69% in 2014.

Considering that spillover risks stemming from a looming hard landing in Mainland China could possibly pose a greater impact on Taiwan's economic and financial conditions, domestic banks should closely monitor changes in Mainland China's economic and financial

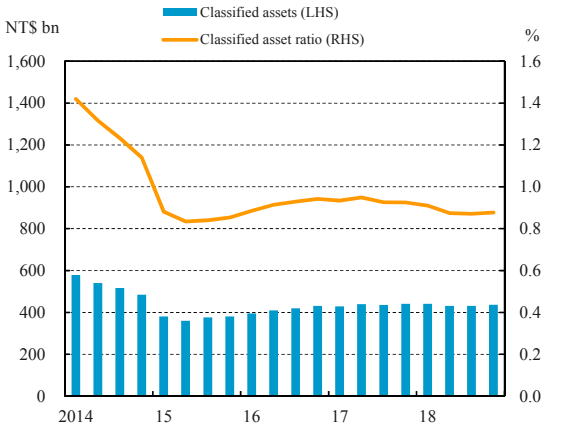
[39] Loans to the manufacturing sector are divided into five categories by industry, including: (1) electronics, (2) mining of metals and non-metals, (3) petrochemicals, (4) traditional manufacturing, and (5) others.

conditions and prudently manage the risk of such exposures.

Asset quality improved

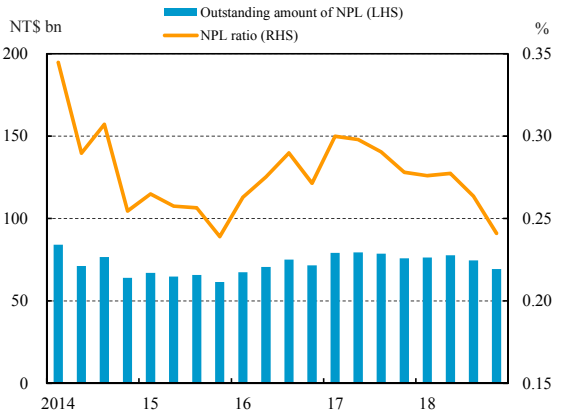
Outstanding classified assets [40] of domestic banks stood at NT$437 billion at the end of 2018, decreasing by 0.91% from a year earlier. The average classified asset ratio also saw a decline to 0.88% (Chart 3.22). Both revealed that the asset quality of domestic banks improved. Although the expected losses of classified assets [41] slightly increased to NT$57.7 billion, it only accounted for 13.11% of loss provisions, indicating that domestic banks had sufficient provisions to cover expected losses.

Chart 3.22 Classified assets of domestic banks



Note: Classified asset ratio = classified assets/total assets.
Source: CBC.

Chart 3.23 NPL of domestic banks



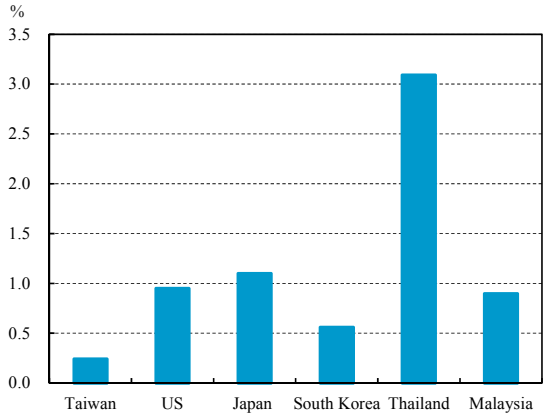
Note: Excludes interbank loans.
Source: CBC.

Furthermore, the outstanding NPLs of domestic banks registered NT$69.4 billion at the end of 2018, decreasing by 8.52% from the previous year. Correspondingly, the average NPL ratio decreased to a recent low of 0.24% (Chart 3.23), and was much lower than those in the US and neighboring Asian countries (Chart 3.24). Among 38 domestic banks, almost all had NPL ratios less than 0.5%, except for one with a slightly higher ratio. In terms of borrowers, the NPL ratio for individual loans marginally decreased to 0.24%, while that for corporate loans continued to decline to 0.26%.

[40] Assets of domestic banks are broken down into five categories: normal, special mention, substandard, doubtful and loss. The term "classified assets" herein includes all assets classified as the latter four categories.
[41] Loss herein refers to the losses from loans, acceptances, guarantees, credit cards, and factoring without recourse.

At the end of 2018, owing to the continual increase in provisions and the decrease in NPLs, the loan coverage ratio and the NPL coverage ratio rose to 1.38% and 573.67%, respectively (Chart 3.25). The capability of domestic banks to cope with potential loan losses improved.

Chart 3.24 NPL ratios of banks in selected countries



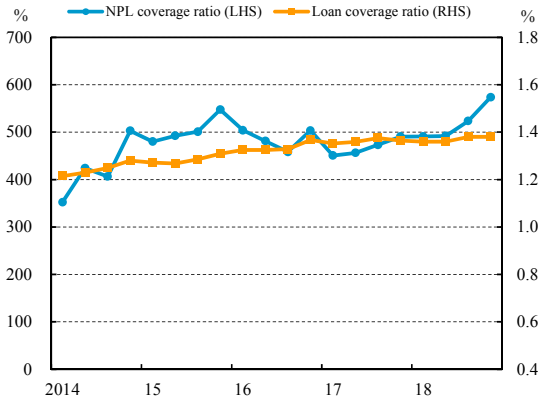
Note: Figure for Japan is end-September 2018 data, while the others are end-December 2018 data.
Sources: CBC, FDIC, FSA, FSS, BOT and BNM.

Market risk

Estimated value-at-risk for market risk exposures increased

At the end of 2018, the net position of debt securities accounted for the largest share of total market risk exposures of domestic banks, followed by the net positions of FX and of equity securities. Based on the Bank's VaR model,[42] the estimated total VaR for market risk exposures of domestic banks stood at NT$119.4 billion at the end of 2018, down by NT$8.8 billion or 7.96% compared to a year earlier (Table 3.1). Among them, the interest rate VaR increased by 10.67%. The main reason was that the US government bond yields oscillated, triggering higher volatility in Taiwan government bond yields. On the other hand, the FX and equities VaR exposures decreased by 14.29% and 3.1%, respectively, owing to reductions in their net positions (Table 3.1).

Chart 3.25 NPL coverage ratio and loan coverage ratio of domestic banks



Notes: 1. NPL coverage ratio = total provisions/non-performing loans.
2. Loan coverage ratio = total provisions/total loans.
3. Excludes interbank loans.
Source: CBC.

However, the US-China trade negotiation uncertainty, an accelerated economic slowdown in Mainland China and the Brexit deadlock may spur global financial market volatility, which could pose higher market risk to domestic banks and thus warrants close attention.

[42] For more details about the Bank's VaR model, please see CBC (2016), *Financial Stability Report*, Box 2, May. In 2018, the Bank calibrated the VaR model for evaluating market risk VaR, and retrospectively adjusted the data at the end of 2017.

Table 3.1 Market risks in domestic banks

Unit: NT$ bn

Types of risk	Items	End-Dec. 2017	End-Dec. 2018	Changes	
				Amount	PP;%
Foreign exchange	Net position	223.5	195.5	-28.0	-12.53
	VaR	4.9	4.2	-0.7	-14.29
	VaR/net position (%)	2.19	2.15		-0.04
Interest rate	Net position	1,799.0	1,796.0	-3.0	-0.17
	VaR	92.8	102.7	9.9	10.67
	VaR/net position (%)	5.16	5.72		0.56
Equities	Net position	59.8	50.5	-9.3	-15.55
	VaR	12.9	12.5	-0.4	-3.10
	VaR/net position (%)	21.57	24.75		3.18
Total VaR		110.6	119.4	8.8	7.96

Note: PP = percentage point.
Source: CBC.

The impacts of market risk on capital adequacy ratios were slight

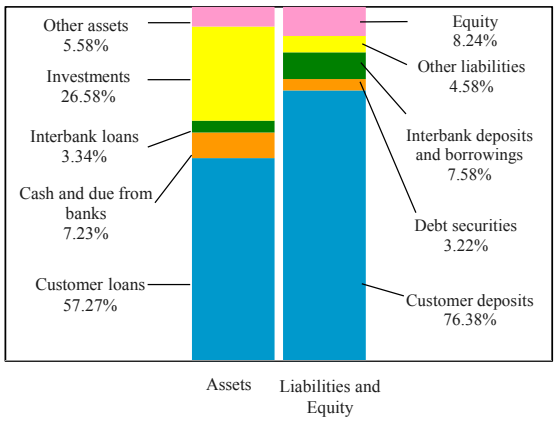
According to the estimation mentioned above, the total VaR would lead to a decrease of 0.22 percentage points in the average capital adequacy ratio of domestic banks and cause the ratio to drop from the current 13.99% to 13.77%. Nevertheless, it would still be higher than the statutory minimum of 9.875% in 2018.

Liquidity risk

Liquidity in the banking system remained ample

The assets and liabilities structure of domestic banks remained roughly unchanged in 2018. For the sources of funds, relatively stable customer deposits still made up the largest share of 76.38% of the total, while for the uses of funds, customer loans accounted for the biggest share of 57.27% (Chart 3.26). The average deposit-to-loan ratio of domestic banks declined to 135.75%, and the funding

Chart 3.26 Asset/liability structure of domestic banks



Notes: 1. Figures are as of end-December 2018.
2. Equity includes loss provisions. Interbank deposits include deposits with the CBC.
Source: CBC.

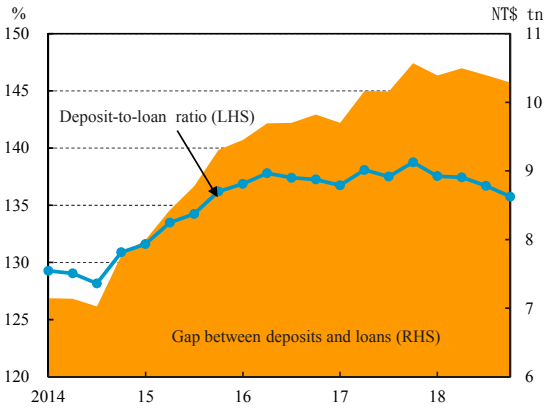
surplus (i.e., deposits exceeding loans) also reduced to NT$10.29 trillion. However, the overall liquidity of domestic banks remained abundant (Chart 3.27).

Overall liquidity risk remained relatively low

The average NT dollar liquid reserve ratio of domestic banks was well above the statutory minimum of 10% in every month of 2018 and stood at 32.63% in December (Chart 3.28). Looking at the components of liquid reserves in December 2018, Tier 1 liquid reserves, mainly consisting of certificates of deposit issued by the Bank, accounted for 83.88% of the total. The quality of liquid assets held by domestic banks remained satisfactory.

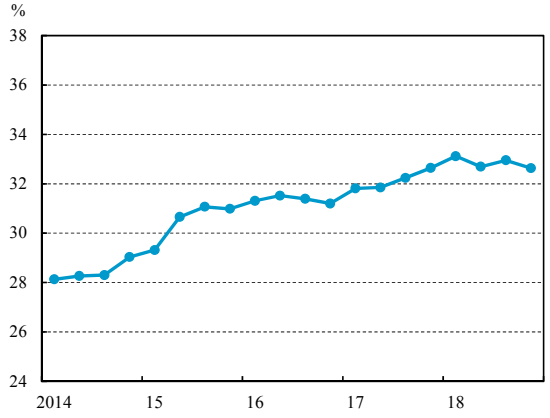
Moreover, the average liquidity coverage ratio (LCR) and net stable funding ratio (NSFR) of domestic banks were 134% and 132%, respectively, at the end of 2018, and all banks met the minimum LCR and NSFR requirements in 2018.[43] Therefore, the overall liquidity risk of domestic banks was relatively low.

Chart 3.27 Deposit-to-loan ratio of domestic banks



Note: Deposit-to-loan ratio = total deposits/total loans.
Source: CBC.

Chart 3.28 Liquid reserve ratio of domestic banks



Note: Figures are the average daily data in the last month of each quarter.
Source: CBC.

[43] The minimum LCR requirement for domestic banks was 90% in 2018, except for O-Bank with a minimum requirement of 60%; the minimum NSFR requirement for domestic banks was 100% in 2018. Banks that receive FSC approval after the FSC has consulted with the Central Bank are not subject to either of the requirements.

Profitability

Profitability increased significantly

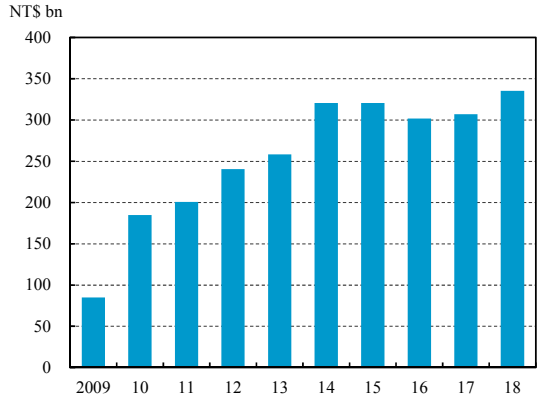
In 2018, the net income before tax of domestic banks rose to NT$335.4 billion, significantly increasing by 9.26% year on year and reaching a 10 year high (Chart 3.29). The rise was mainly caused by growth in net interest revenues. The average ROE and ROA of domestic banks increased to 9.34% and 0.68% (Chart 3.30). Compared to selected Asia-Pacific economies, the average ROE of domestic banks was higher than those of Thailand and South Korea; however, the average ROA still lagged behind those of most other countries (Chart 3.31).

All domestic banks were profitable in 2018. Among them, 12 banks achieved a profitable ROE of 10% or more and four banks had ROAs above the international standard of 1% (Chart 3.32). Most domestic banks performed better than that of the previous year.

Factors that might affect future profitability

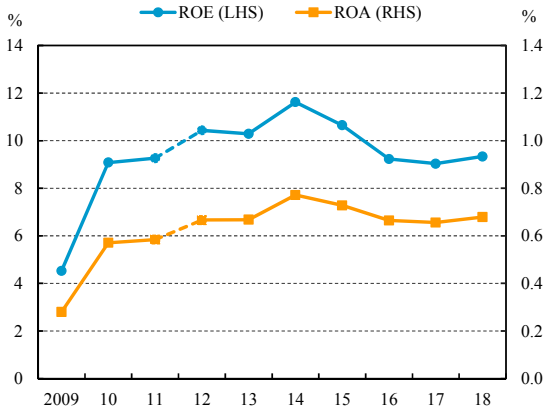
Profitability of domestic banks increased in 2018. In addition, the interest rate spread between deposits and loans of domestic banks rebounded to 1.35 percentage points in 2018 Q4 (Chart 3.33), helping to support future net interest revenues of domestic banks. Nevertheless, the challenges facing future profitability included: (1) decreasing capital expenditures of corporates caused by uncertainties surrounding US-China trade

Chart 3.29 Net income before tax of domestic banks



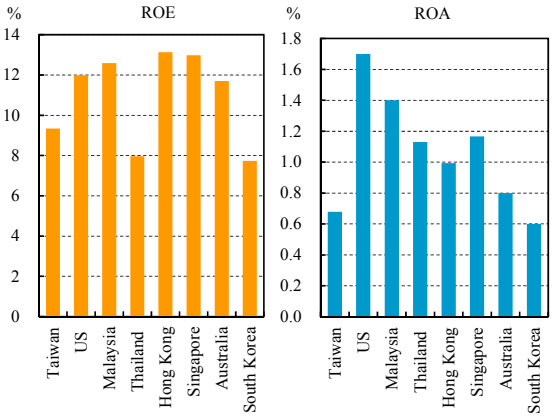
Note: Figures from 2012 forward are on the TIFRSs basis. Figures of prior years are on the ROC GAAP basis (same as all charts in this section).
Source: CBC.

Chart 3.30 ROE & ROA of domestic banks



Notes: 1. ROE = net income before tax/average equity.
2. ROA = net income before tax/average total assets.
Source: CBC.

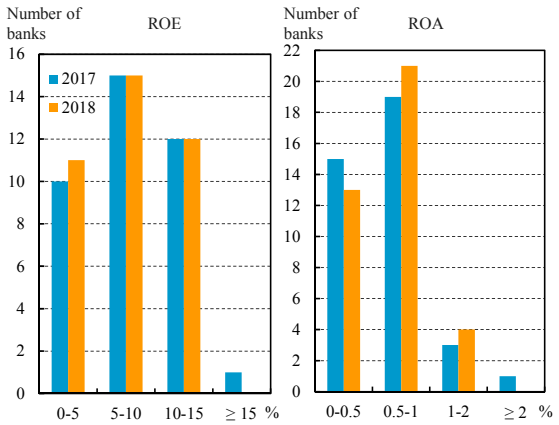
Chart 3.31 ROEs and ROAs of banks in selected economies



Note: Figures are 2018 data.
Sources: CBC, FDIC, BNM, BOT, APRA, FSS and IMF.

tensions leading to lower funding demand; (2) rising economic and financial risks of Mainland China affecting exposures of domestic banks, boosting loan loss provisions; (3) compliance costs of domestic banks remaining high as a result of banks reinforcing their AML/CFT regulatory compliance programs. Though the implementaion of RegTech might help to contain compliance costs, related risks still need to be appropriately managed (Box 2).

Chart 3.32 Domestic banks classified by ROE and ROA



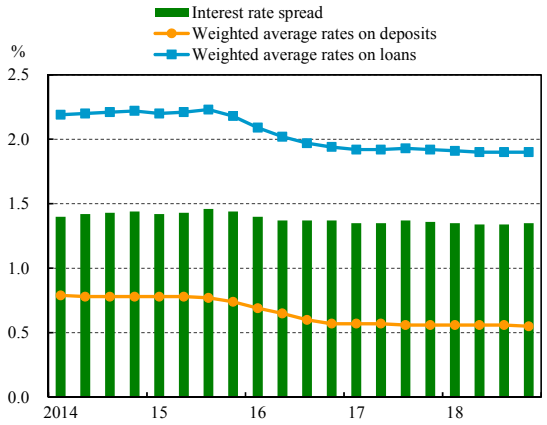
Source: CBC.

Capital adequacy

Capital ratios leveled off

The average capital ratios of domestic banks declined slightly in 2018 Q2 owing to seasonal factors such as cash dividends declared and paid. Afterwards, with capital injection, accumulated earnings, and issuance of eligible capital instruments, all capital ratios rebounded. The average common equity ratio, Tier 1 capital ratio, and capital adequacy ratio of domestic banks registered 11.19%, 11.86%, and 13.99%, respectively, at the end of 2018 (Chart 3.34), almost equivalent to those ratios a year before. However, compared to some Asia-Pacific economies, Taiwan's banking industry had relatively lower capital levels (Chart 3.35).

Chart 3.33 Interest rate spread of domestic banks



Notes: 1. Interest rate spread = weighted average interest rates on loans - weighted average interest rates on deposits.
2. The weighted average interest rates on deposits and loans exclude preferred deposits of retired government employees and central government loans.

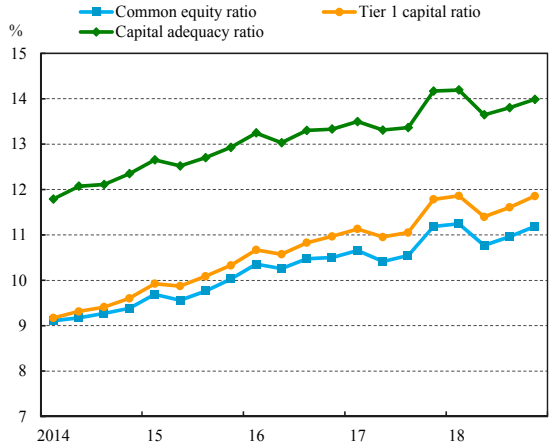
Source: CBC.

Further broken down by components of regulatory capital, common equity Tier 1 capital, which features the best loss-bearing capacity, accounted for 79.98% of eligible capital. This showed that the capital quality of domestic banks was satisfactory.

All domestic banks had capital ratios higher than the statutory minimum and leverage ratios higher than the international standard

At the end of 2018, the common equity ratios, Tier 1 capital ratios, and capital adequacy ratios for all domestic banks remained above the statutory minimum requirements [44] for 2018 (Chart 3.36). The average leverage ratio of domestic banks at the end of 2018 stood at 6.56%, higher than a year before and well above the international standard of 3%. It indicated domestic banks maintained sound financial leverage.

Chart 3.34 Capital ratios of domestic banks



Notes: 1. Common equity ratio = common equity Tier 1 capital/risk-weighted assets.
2. Tier 1 capital ratio = Tier 1 capital/risk-weighted assets.
3. Capital adequacy ratio = eligible capital/risk-weighted assets.

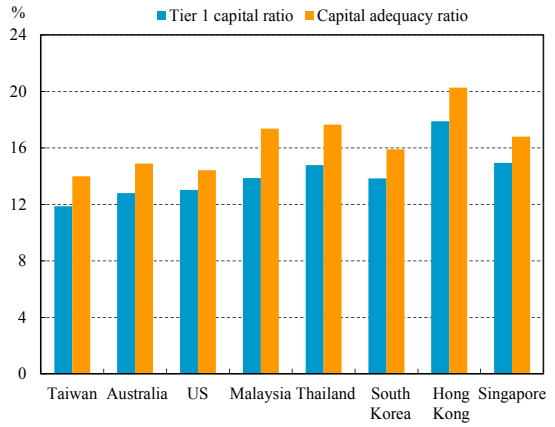
Source: CBC.

Credit ratings

BICRA remained steady but BSI/MPI slightly decreased

Standard & Poor's kept Taiwan's Banking Industry Country Risk Assessment (BICRA)[45] unchanged at Group 4 with moderate risk. Compared to other Asian economies, the risk level of Taiwan's banking system was the same as that of Malaysia, but much lower than those of Mainland China, Thailand, the Philippines and Indonesia. Moreover, the assessment of Taiwan's banking system by Fitch Ratings' Banking System Indicator/Macro-Prudential Indicator (BSI/MPI)[46] was downgraded from bbb/1 to bbb/2

Chart 3.35 Capital ratios of banking industry in selected economies



Note: Figures are as of the end of 2018.

Sources: CBC, APRA, FDIC, BNM, BOT, FSS, HKMA and IMF.

[44] The statutory minimum capital requirements of domestic banks for 2018 and 2019 onwards are as follows:

Ratios	2018	2019 onwards
Common equity ratio (%)	6.375	7.0
Tier 1 capital ratio (%)	7.875	8.5
Capital adequacy ratio (%)	9.875	10.5

[45] BICRA is scored on a scale from 1 to 10, ranging from the lowest-risk (group 1) to the highest-risk (group 10), which indicates the assessment results by Standard & Poor's of economic and industry risks of a country's banking system.

[46] Fitch Ratings assesses banking system vulnerability with two complementary measures, the BSI and the MPI. These two indicators are brought together in a Systemic Risk Matrix. The BSI represents banking system strength on a scale from aa, a, bbb, bb/b to ccc/cc/c. The MPI indicates the vulnerability of the macro environment on a scale from 1 to 3.

because the credit to GDP ratio increased by more than 5 percentage points for two consecutive years[47] (Table 3.2).

All domestic banks received ratings by credit rating agencies at the end of 2018. The weighted average credit rating index[48] went up slightly compared to the previous year owing to the upgrading of two banks (Chart 3.37).

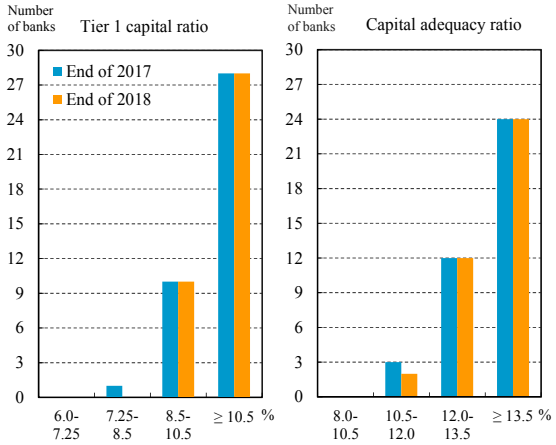
Rating outlooks for almost all domestic banks remained stable or positive

Almost all domestic banks maintained credit ratings of twAA/twA (Taiwan Ratings) or AA(twn)/A(twn) (Fitch Ratings) and none had credit ratings lower than twBB/BB(twn) at the end of 2018 (Chart 3.38). Only two banks received negative rating outlooks, while rating outlooks for the other 36 banks remained stable or positive.

3.2.2 Life insurance companies

In 2018, total assets of life insurance companies continued their rapid growth, and overall credit ratings held stable. However, their average RBC ratio descended, pretax income declined year on year due to an increase in hedging costs, and the industry still faced higher equity risk.

Chart 3.36 Domestic banks classified by capital ratios



Note: At the end of 2018, the number of domestic banks decreased from 39 a year before to 38.

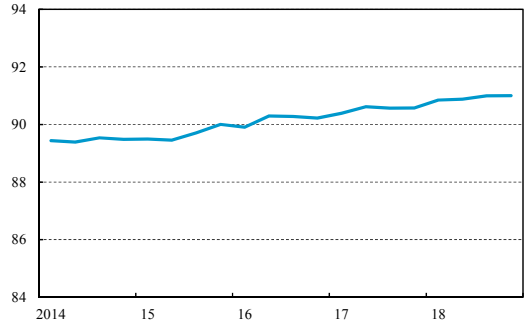
Source: CBC.

Table 3.2 Systemic risk indicators for the banking system

Banking System	Standard & Poor's		Fitch	
	BICRA		BSI/MPI	
	2018/2	2019/2	2018/3	2019/4
Hong Kong	2	2	a/3	a/3
Singapore	2	2	aa/2	aa/2
Japan	2	2	a/1	a/2
South Korea	3	3	a/1	a/1
Taiwan	**4**	**4**	**bbb/1**	**bbb/2**
Malaysia	4	4	bbb/1	bbb/1
Mainland China	6	6	bb/1	bb/1
Thailand	6	6	bbb/1	bbb/1
Philippines	7	6	bb/1	bb/1
Indonesia	7	7	bb/1	bb/1

Sources: Standard & Poor's and Fitch Ratings.

Chart 3.37 Credit rating index of domestic banks



Sources: Taiwan Ratings Corporation, Fitch Ratings and CBC.

[47] Banks' credit to GDP ratio increased by 7.8 and 5.6 percentage points relative to prior year in 2017 and 2018, respectively, while the growth rate has slowed down in 2018.

[48] The credit rating index is an asset-weighted average rating score of rated domestic banks, measuring the overall creditworthiness of those banks on a scale from 1 (weakest) to 100 (strongest). The rating score for banks is determined according to their long-term issuer ratings from Taiwan Ratings or national long-term ratings from Fitch Ratings. The higher the index is, the better the bank's overall solvency.

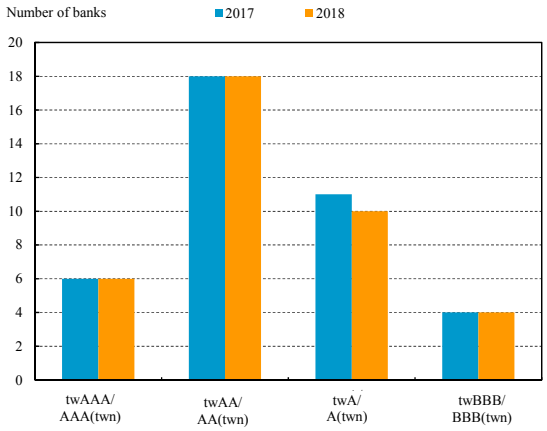
Assets maintained fast growth

The total assets of life insurance companies continued growing and reached NT$26.32 trillion at the end of 2018, equivalent to 147.92% of annual GDP (Chart 3.39). The annual growth rate of total assets decreased to 7.58%, which was still at a high level. The top three companies in terms of assets made up a combined market share of 55.49%. The market structure of the life insurance industry remained roughly unchanged in 2018.

Foreign portfolio investments remained the primary usage of funds

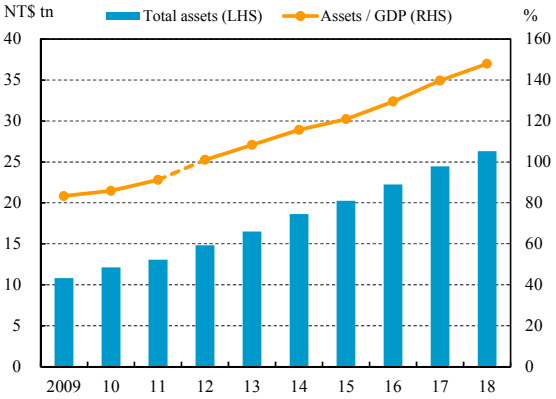
In terms of the usage of funds of life insurance companies, foreign portfolios accounted for 62.31% at the end of 2018, the largest share of total assets, whereas the share of domestic securities investments continued to drop to 16.81%. As for their sources of funds, insurance liabilities accounted for 86.22%, the primary share of total liabilities and equity, while the share of equity decreased markedly to 4.14% owing to strongly expanding unrealized investment losses (Chart 3.40). Overall, financial leverage of life insurance companies rose significantly.

Chart 3.38 Number of domestic banks classified by credit ratings



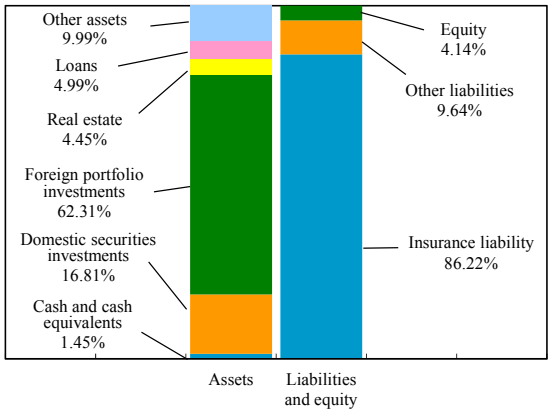
Notes: 1. End-of-period figures.
2. The number of domestic banks decreased from 39 in 2017 to 38 in 2018.
Sources: Taiwan Ratings Corporation and Fitch Ratings.

Chart 3.39 Total assets of life insurance companies



Note: Figures from 2012 forward are on the TIFRSs basis. Figures of prior years are on the ROC GAAP basis.
Sources: FSC and DGBAS.

Chart 3.40 Asset/liability structure of life insurance companies



Note: Figures are as of the end of 2018.
Source: FSC.

Pretax income declined sharply

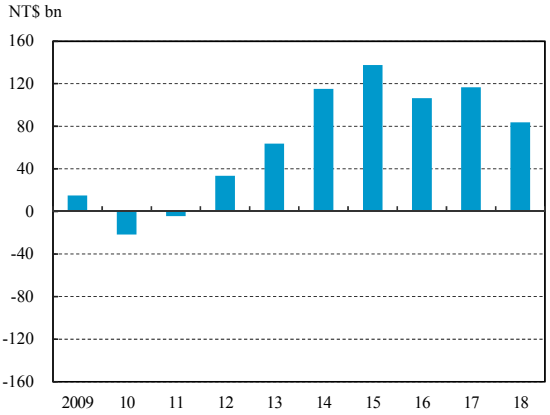
Life insurance companies reported net income before tax of NT$83.7 billion in 2018, decreasing dramatically by 28.22% year on year (Chart 3.41). This was chiefly driven by growth in hedging costs and an increase in non-operating losses on disposal of assets. Therefore, the average ROE and ROA dropped to 6.82% and 0.33%, respectively (Chart 3.42), indicating weakened profitability.

In 2018, the comprehensive income of life insurance companies was NT$-500.7 billion, mainly owing to the substantial increase in unrealized losses on financial assets. However, it has greatly improved on the back of improving global financial markets in 2019 Q1. In addition, the International Financial Reporting Standard 17 (IFRS 17) *Insurance Contracts* is expected to be introduced into Taiwan for implementation in 2025 at the earliest. Life insurance companies could, therefore, face severe financial impairments and capital raising pressures. In response, the FSC has required life insurance companies to strengthen their financial health in order to relieve the impact of the introduction of the IFRS 17.

Average RBC ratio decreased

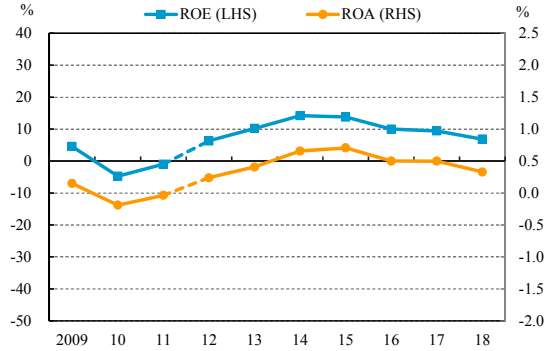
In 2018, capital levels of life insurance companies declined because of a greater decrease in equity. As a result, the average RBC ratio dropped to 268.43% at the end of the year (Chart 3.43). By individual company,

Chart 3.41 Net income before tax of life insurance companies



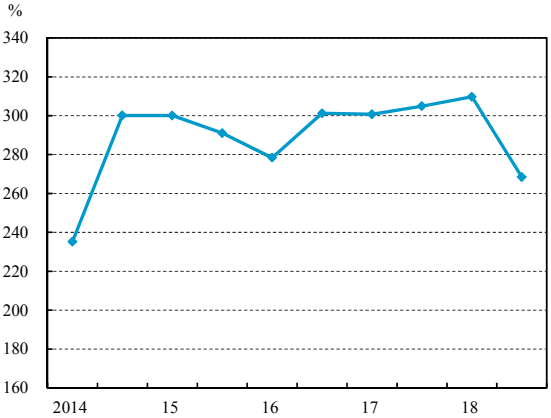
Note: Figures from 2012 forward are on the TIFRSs basis. Figures of prior years are on the ROC GAAP basis.
Source: FSC.

Chart 3.42 ROE & ROA of life insurance companies



Notes: 1. Figures from 2012 forward are on the TIFRSs basis. Figures of prior years are on the ROC GAAP basis.
2. ROE = net income before tax/average equity.
3. ROA = net income before tax/average assets.
Source:FSC.

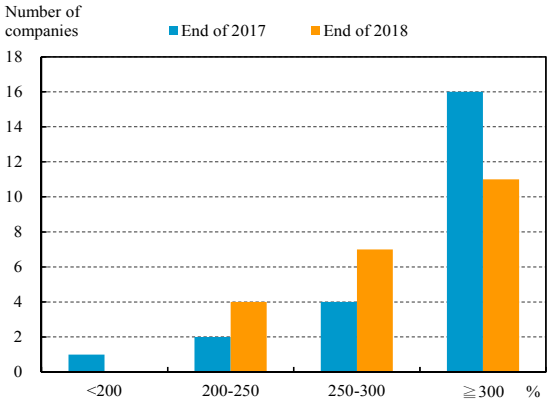
Chart 3.43 RBC ratio of life insurance companies



Notes: 1. RBC ratio = regulatory capital/risk-based capital.
2. Figures are exclusive of life insurance companies in receivership.
Source: FSC.

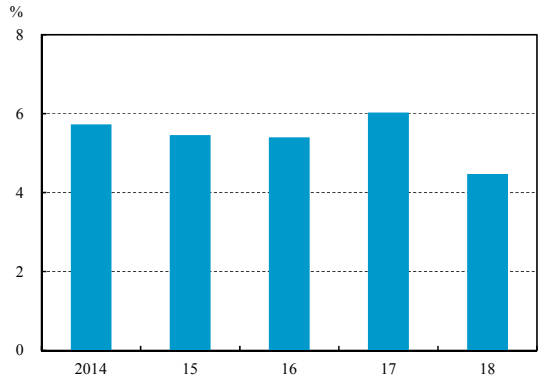
there were 11 companies with RBC ratios over 300%. No company had an RBC ratio below the statutory minimum of 200% (Chart 3.44). Furthermore, the equity to asset ratio decreased markedly to 4.46% at the end of 2018 (Chart 3.45) but rebounded significantly in 2019 Q1.

Chart 3.44 Life insurance companies classified by RBC ratios



Note: The number of life insurance companies decreased to 22 as of the end of 2018 from 23 registered at the end of the previous year.
Source: FSC.

Chart 3.45 Equity/Asset ratios of life insurance companies



Note: Assets are exclusive of separated account products assets.
Source: FSC.

Overall credit ratings remained stable[49]

In 2018, credit ratings among the 11 life insurance companies remained stable. As of the end of the year, all rated life insurance companies maintained credit ratings above twA or its equivalent, while the rating of the top three companies in terms of assets held at twAA+. Moreover, most companies received positive or stable credit outlooks.

Foreign portfolio positions expanded with increasing FX hedging cost and higher equity risk

Foreign portfolio positions of life insurance companies grew continually and reached NT$16.40 trillion in 2018. Life insurance companies also actively used derivative financial instruments to mitigate the impact of FX rate fluctuations. However, FX hedging costs substantially increased owing to consecutive interest rate hikes by the Fed. In January 2019, the FSC amended the applicable regulations and raised the required ratio of FX valuation reserves,[50] which could help life insurance companies manage FX risk flexibly and lower hedging costs. Nonetheless, life insurance companies should monitor the changes in global as well as domestic financial conditions and review their FX hedging strategies in a timely manner so as to alleviate the impacts of rising hedging costs on their profits.

[49] The majority of rated life insurance companies received issuer ratings from Taiwan Ratings; therefore, this section is based primarily on the Taiwan Ratings' rating (tw~), and secondarily on other ratings.
[50] See Section 4.2 "Measures undertaken by the FSC to maintain financial stability."

Furthermore, because the FSC imposed a limit[51] on the amount of international bond investments by insurance companies, such investments slowed down. On the other hand, NTD-denominated bond ETF investments of life insurance companies, excluded from the amounts subject to the overseas investment ceiling, grew rapidly and exceeded NT$500 billion at the end of March 2019. Nevertheless, considering that the net asset value of ETFs is affected by the FX volatility of underlying overseas investment targets, FX risk is still embedded within NTD-denominated bond ETF investments[52] and warrants close attention.

Regarding interest rate risk, US government bond yields moved downward significantly in 2019 Q1, which would help increase the value of bond investments. However, considering that recent volatility in global stock markets exacerbated and the US-China trade dispute heated up, equity risk remained high. Therefore, life insurance companies should prudently control related risks.

3.2.3 Bills finance companies

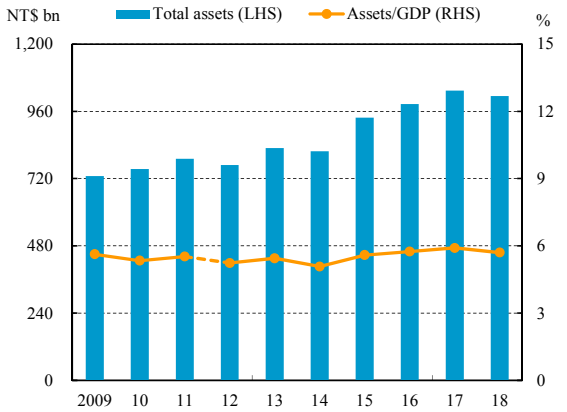
The total assets of bills finance companies contracted marginally in 2018, while the guarantee business expanded and credit asset quality remained sound. However, their profitability weakened and the average capital adequacy ratio declined slightly, while liquidity risk rose.

Total assets contracted marginally

In 2018, mainly owing to the decrease in negotiable certificates of deposit investments, the total assets of bills finance companies decreased by 1.92% and stood at NT$1,014 billion at the end of the year, equivalent to 5.70% of annual GDP (Chart 3.46).

With respect to the asset and liability structure of bills finance companies, bill and bond investments constituted the largest share of 94.45% of total assets as of the end of 2018, the same as the figure recorded a year earlier.

Chart 3.46 Total assets of bills finance companies

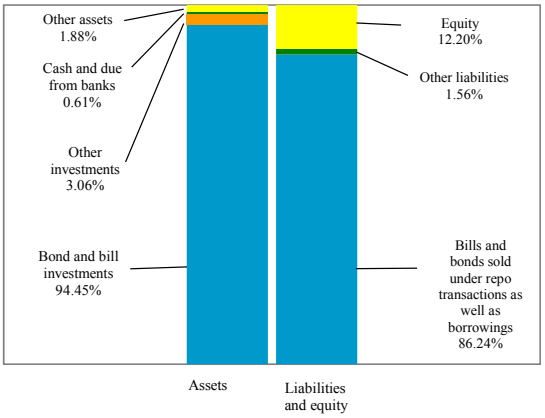


Note: Figures from 2012 forward are on the TIFRSs basis.
Figures of prior years are on the ROC GAAP basis.
Sources: CBC and DGBAS.

[51] See Section 4.2 "Measures undertaken by the FSC to maintain financial stability."
[52] Life insurance companies invested in NTD-denominated bond ETFs, which could face FX risk, interest rate risk and insufficient liquidity when such investments were made by a single or minority of life insurance companies. The FSC already planned to revise RBC calculations about FX risk of bond ETFs so as to reasonably reflect the capital charge. In addition, the FSC required securities investment trust companies to develop investor diversification mechanisms when issuing bond ETFs in order to ensure sound market development.

On the liability side, bills and bonds sold under repo transactions as well as borrowings accounted for the primary share of 86.24% of total assets, less than the figure recorded in the previous year. Meanwhile, equity only accounted for 12.2% (Chart 3.47). The asset and liability structure remained roughly unchanged.

Chart 3.47 Asset/liability structure of bills finance companies



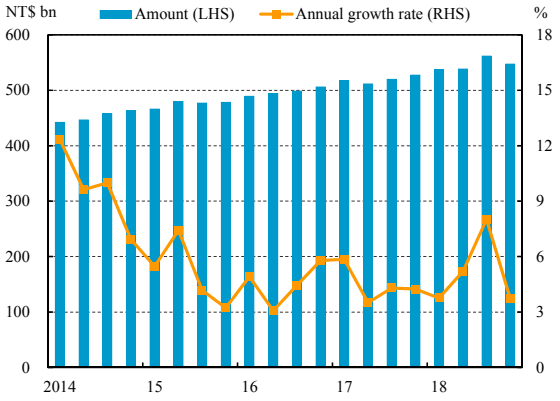
Note: Figures are as of the end of 2018.
Sources: CBC and FSC.

Credit risk increased moderately

Guarantee liabilities expanded and the share of credit secured by real estate trended up

Owing to rising funding demand of corporates in money markets spurred by low short-term market rates, CP guaranteed by bills finance companies registered NT$547.5 billion at the end of 2018, increasing by 3.73% year on year (Chart 3.48). Meanwhile, the average multiple of guarantee liabilities to equity slightly decreased to 4.78 times because of a greater increase in equity. In addition, such multiple of each company was still below the regulatory ceiling of 5 or 5.5 times.

Chart 3.48 Outstanding CP guaranteed by bills finance companies



Source: CBC.

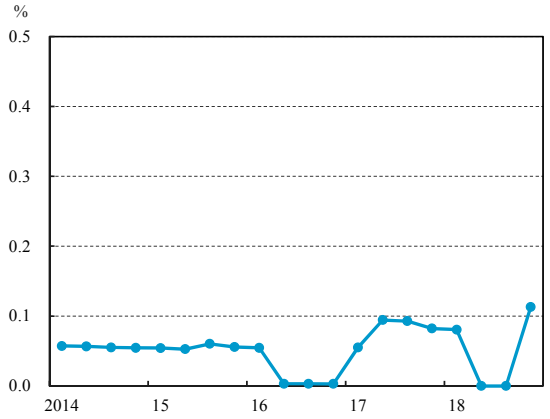
At the end of 2018, guarantees granted to the real estate and construction industries and credit secured by real estate increased to 30.32% and 38.71%, respectively, of total credit of bills finance companies. Both ratios remained at high levels. As the outlook for the domestic housing market remains conservative, bills finance companies should closely monitor the impacts of housing market trends on the quality of related credit and reinforce their capacity to cope with the changes in the real estate cycle.[53]

[53] To strengthen credit risk bearing capacity, the FSC raised the minimum credit loss reserve ratio of guarantees granted to the real estate industry by bills finance companies to 1.5% in March 2019. The bills finance companies should meet this minimum requirement from the end of 2021 onwards.

Credit quality remained sound

The credit quality of bills finance companies remained sound in 2018, as the non-performing credit ratio rose marginally to a still-low level of 0.11% at the end of the year (Chart 3.49). Moreover, the credit loss reserves to non-performing credit ratio stood at 12.08 times, reflecting sufficient reserves to cover potential credit losses.

Chart 3.49 Non-performing credit ratio of bills finance companies

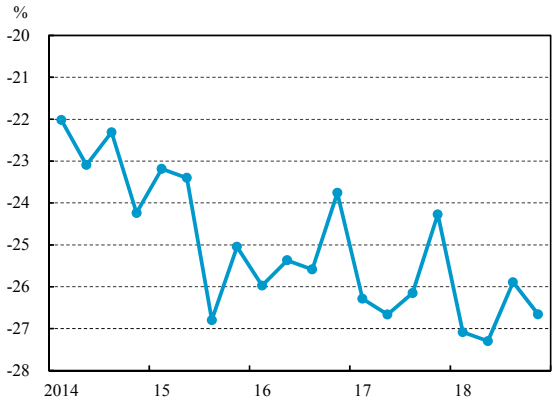


Note: Non-performing credit ratio = non-performing credit/(overdue guarantee advances + guarantees).
Source: CBC.

Liquidity risk rose

Bills finance companies still faced a significant maturity mismatch between assets and liabilities, as more than 90% of their assets were invested in bills and bonds, 43.77% of which were long-term bonds. In addition, more than 80% of their liabilities were from short-term interbank call loans and repo transactions. In addition, the 0-30 day maturity gap to total assets denominated in NTD worsened to -26.66%, reflecting a higher liquidity risk in bills finance companies[54] (Chart 3.50).

Chart 3.50 0-30 day maturity gap ratio of bills finance companies



Note: 0-30 day maturity gap ratio = net NTD cash flow within 0-30 days/total assets denominated in NTD.
Source: CBC.

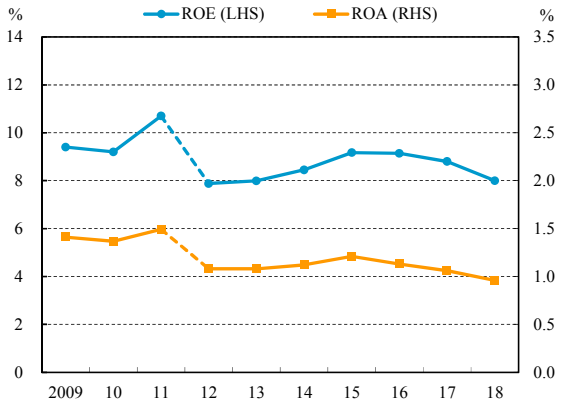
The major liabilities [55] to equity ratio decreased to 7.64 times at the end of 2018, and the multiple of each company remained below the regulatory ceilings of ten or twelve times, indicating an improvement in financial leverage.

[54] To strengthen liquidity risk management of bills finance company, the Bills Finance Association introduced a self-disciplinary rule in February 2019, prescribing that bills finance companies should establish a mechanism to control the 0-30 day maturity gap of NTD cash flow and develop an emergency plan.
[55] Major liabilities include call loans, repo transactions as well as issuance of corporate bonds and CP.

Profitability weakened

Bills finance companies posted a net income before tax of NT$9.7 billion in 2018, a decrease of 7% year on year. The decline was mainly driven by an increase in the yielding costs of bond investments and a higher base period resulting from a substantial amount of lawsuit settlement income in the previous year. The average ROE and ROA fell to 8% and 0.96%, respectively, reflecting weakening profitability (Chart 3.51).

Chart 3.51 ROE & ROA of bills finance companies



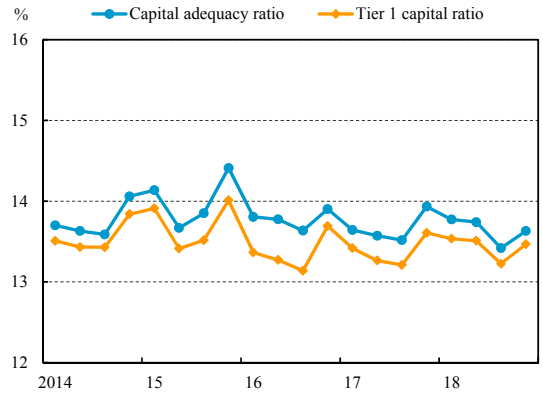
Notes: 1. Figures from 2012 forward are on the TIFRSs basis. Figures of prior years are on the ROC GAAP basis.
2. ROE = net income before tax/average equity.
3. ROA = net income before tax/average assets.

Source: CBC.

Average capital adequacy ratio slightly declined

Owing to a greater increase in risk assets, the average Tier 1 capital ratio and the capital adequacy ratio of bills finance companies slightly descended to 13.47% and 13.63%, respectively, at the end of 2018 (Chart 3.52). However, the capital adequacy ratio for each company remained well above the statutory minimum of 8%.

Chart 3.52 Average capital adequacy ratios of bills finance companies



Source: CBC.

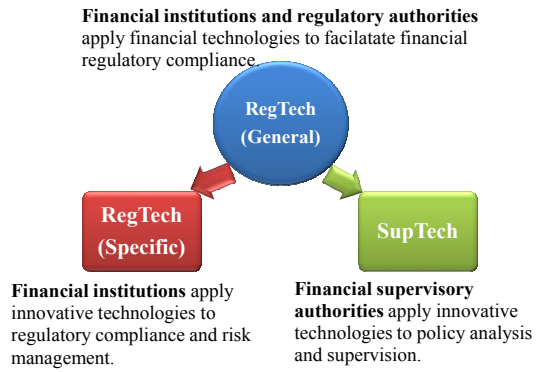
Box 2
RegTech development and applications by domestic banks

After the 2008 global financial crisis, increasingly stringent and radically changing financial regulations in most countries have led to increases in the number of financial institutions having enormous fines imposed on them for breaking regulations. Moreover, the surging cost of regulatory compliance and risk management have imposed a heavy burden on financial institutions' operations.[1] Recently, with the rise of RegTech, a growing number of financial institutions have applied new technologies to enhance compliance efficiency. This box first explores current development and application of RegTech by domestic banks and then analyzes the potential risks arising from the application of RegTech and caveats that warrant attention.

1. Definition of RegTech

"RegTech" is the combination of "regulatory" and "technology". Generally, the Institute of International Finance (IIF) defines RegTech as "the use of new technologies to solve regulatory and compliance requirements more effectively and efficiently."[2] Specifically, RegTech and SupTech refer to the application of innovative technologies by financial institutions and supervisory authorities for regulatory compliance and risk management as well as policy analysis and supervision, respectively (Chart B2.1).[3]

Chart B2.1 Differences between RegTech and SupTech



Source: CBC.

In Taiwan, the Financial Supervisory Commission defines RegTech as follows: Financial institutions use information technologies to broadly collect information regarding various countries' financial regulatory systems and regulatory requirements and to provide analysis and management tools, so as to help the automated compliance processes to lower operational risk.[4]

2. RegTech development and applications by domestic banks

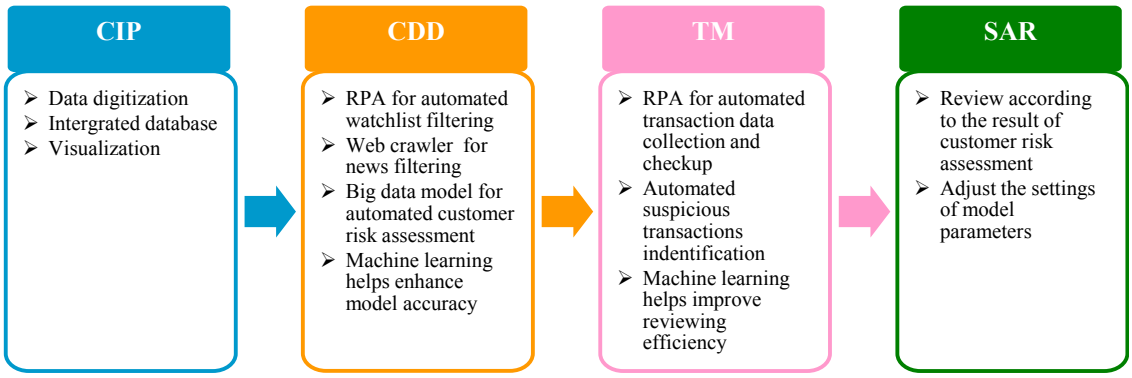
Many financial institutions around the world have broadly applied information technologies, such as artificial intelligence, big data, blockchain and machine learning, to regulatory compliance, risk management, transaction monitoring and customer

identification programs (CIPs). Regarding technological development for RegTech, domestic banks focus primarily on database applications, such as the construction of process automation and big data models. The application of RegTech mainly includes AML/CFT, regulatory compliance, internal audit/control and risk management. Among them, AML/CFT are more well-developed by domestic banks. RegTech development and applications by domestic banks are summarized as follows.

2.1 AML/CFT

In view of increasingly stricter AML/CFT requirements by regulatory authorities and the fact that the manual examination process in know your customer (KYC) and transaction monitoring is costly and prone to omission, the application of robotic process automation (RPA) and big data models could help enhance AML/CFT efficiency. Accordingly, domestic banks actively apply RegTech to AML/CFT processes (Chart B2.2).

Chart B2.2 RegTech applications on AML/CFT processes



Source: CBC.

(1) CIP: Customer information digitization can enhance CIP efficiency and effectiveness by building up a complete KYC database and visualizing manually unrecognizable data, such as customer relationships and cash flow networks.

(2) Customer due diligence (CDD): RPA system can import sanction lists into the database for automated comparison. Also, a web crawler can automatically collect and analyze public information to enhance the efficiency of the CDD process. By combining the internal and external KYC information mentioned above, banks can assess customer risk level through models, and then apply corresponding customer reviewing and monitoring processes accordingly.

(3) Transactions monitoring (TM): An RPA system gathers historical transaction data of customers and their counterparties to identify suspicious transactions by means of data comparison so as to support the transaction review.

(4) Suspicious activity reporting (SAR): The parameters for the types of risks will be determined according to the assessment of the degree of customers' risks. With these parameters, automated transaction monitoring processes can help achieve consistency of reviewing procedures and increase the accuracy of SAR.

2.2 Other applications

(1) Compliance management platform: The platform provides a database that integrates the internal rules and external regulations to instantly update information for consultation. In addition, the platform can automatically track the follow-up work of the relevant business units in response to regulation changes and enhance the efficiency of compliance management.

(2) Automated examinations for regulatory reports: The system can automatically perform cross-table and intertemporal examinations and identify related items within regulatory reports through formula exploration.

(3) Computer-aided audit tools: Auditors can screen high-risk or abnormal behavior cases through the system prior to conducting on-site audits so as to enhance audit efficiency; meanwhile, the complete audit trails will be kept in the system.

(4) Credit risk models: The models would integrate different aspects of customer information, such as personal profile, payment behavior, and debt burden, and then use statistical analytical methods to measure customers' default risk as a reference benchmark for credit evaluation and loan approval.

3. Risks and caveats of RegTech applications

The potential risks arising from the application of RegTech and caveats that warrant attention are shown as follows:

(1) Software bugs in the system: Before the system goes online, system design and parameter settings should be carefully tested. Continuous monitoring and problem analysis for instant debugging are essential to prevent wrong trading trend or behavior type.

(2) Over-reliance on the system may result in misjudgment: Professional judgment and high awareness are needed to avoid over-reliance on the system, which may result in misjudgment.

(3) Incomplete database and poor data quality: Embedded self-examination mechanism is required to lower the possibilities of error or meaningless data input, which may lead

to a failure or "garbage in, garbage out" result.

(4) Cyber security and personal information leakage: Popularity of cloud technology and change of data access type may increase the risks of cyber security and personal information leakage. Therefore, cyber security management and personal information protection should be reinforced with software and hardware tools.

4. Conclusions

An international trend is visible in developing the application of RegTech, and a growing number of domestic banks have been promoting its development. To evaluate the costs and benefits of RegTech, banks should properly respond to the risks arising from the application of RegTech to avoid missteps or violation of regulations.

Moreover, the application of RegTech can reduce certain manpower needs, which could change the content and type of work for existing staff. To effectively utilize human resources, banks should strengthen capacity building programs to train their staff, shift the streamlined human resources towards improving the interaction between banks and customers, and conduct activities and services which could create higher value.

Notes: 1. According to IIF (2015), JPMorgan Chase added 13,000 employees from 2012-14 to support regulatory compliance and control, at a cost of US$2 billion. In 2014, JPMorgan Chase spent a combined US$600 million on regulatory and control technology. In the same year, Deutsche Bank and UBS spent an additional €1.3 billion and US$900 million on new regulatory requirements, respectively (Institute of International Finance (2015), "REGTECH: Exploring Solutions for Regulatory Challenges," October).

2. Institute of International Finance (2016), "RegTech in Financial Services: Technology Solutions for Compliance and Reporting," March.

3. UK Government Office for Science (2015), "FinTech Futures: the UK as a World Leader in Financial Technologies," March; Toronto Centre (2017), "FinTech, RegTech and SupTech: What They Mean for Financial Supervision," August; BIS (2018), "Innovative Technology in Financial Supervision (SupTech) – the Experience of Early Users," *FSI Insights on Policy Implementation* No 9, July.

4. Financial Supervisory Commission (2016), "FinTech Development Strategy White Paper," May.