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Resilience of the Banking Sector

The stress scenario used in this assessment is not a forecast of macroeconomic and financial conditions. It is a hypothetical, coherent, tail-risk setting designed specifically to assess the resilience of the banking sector against hypothesized deterioration in macroeconomic conditions. Under both the baseline and stress scenarios, the solvency level of the banking sector comes under strain but remains well above the domestic regulatory benchmark over the projected three-year horizon. Systemically important large banks carry sufficiently higher capital buffers and are expected to sustain the impact of the assumed shocks over the assessment period. Similarly, the medium and small sized banks are also expected to remain resilient to the shocks. However, credit growth under the baseline scenario is projected to remain low but positive. Under the stress scenario, loans growth is projected to be lower –entering even in negative growth territory. Considering the uncertainty regarding global commodity markets and macro financial conditions, the SBP continues to closely watch the evolving situation and remains ready to take actions necessary to safeguard financial stability.



4.1 Overview and Scenario Design

In order to gauge the resilience of regulated entities, SBP conducts a series of periodic stress tests¹ on a regular basis, including a yearly comprehensive top-down Macro Stress Testing² (MST) exercise for the external stakeholders. The MST exercise involves mapping the impact of credit, market and operational risks, under baseline and stressed scenarios, on banks' solvency position. The projection horizon for the MST exercise is three years.

The MST exercise incorporates two hypothetical scenarios, namely, *baseline* or *business as usual* (S_0) and *stressed* (S_1). The horizon spans Q1CY24 to Q4CY26. A dynamic balance sheet is assumed, where advances and their delinquency rates are estimated based on dynamics of macro-financial risk factors under the assumed scenarios. Whereas for the solvency, the projected paths of lending portfolio and non-performing loans (NPLs) are used to estimate the regulatory capital (RC) and risk weighted assets (RWA). Specifically, the RC and RWAs are impacted by the credit, market and operational risks. Projections are obtained using a suite of vector auto-regressive (VAR) models.

In addition to the system level assessment, the cross-sectional heterogeneity is also captured for the different segments of the banking industry in terms of size, i.e., small, medium, and large banks.

4.2 The Baseline Scenario (S_0)

The confluence of long standing structural weaknesses with shocks to country risk

premium and economic agents' sentiments led to a challenging macroeconomic environment during first half of CY23. Driving factors behind these shocks included heightened level of political uncertainty and disruptions in the IMF stabilization program at a time when foreign exchange (FX) reserves were at a low position. Lagged impact of floods in Q3CY22 and insufficient fiscal consolidation also played their role in pushing inflation up.³ As a result of these challenges, domestic economy faced historically high levels of inflation and currency depreciation, coupled with a sharp reduction in real GDP growth.⁴

However, macroeconomic environment improved in second half of CY23. Positive developments in external sector included resumption of the IMF program, considerable reduction in country risk premium, surplus in current account on annual basis, improvement in FX reserves and stability in exchange rate. On real side, developments included improvement in business confidence, signs of recovery in large-scale manufacturing and reduction in inflation. Against this backdrop, the baseline scenario, S_0 , is built around three main assumptions regarding global and domestic risk factors.

The new government will be able to unlock multilateral financing and implement economic reforms in a stable policy environment...

First, S_0 assumes that the formation of new coalition government will bring about stability to ensure continuity of multilateral financing under a new IMF program, which is in part contingent upon implementation of economic reforms in fiscal, energy and state-owned-

¹ SBP applies various approaches i.e. top-down & bottom-up; methodologies i.e. sensitivity & macro stress tests, and; a suit of models. Currently, SBP follows stress testing regime established under Stress Testing Guidelines of [FSD Circular No. 01 of 2020](#).

² MST is considered an important risk analysis tool as it evaluates the shock absorption capacity of financial institutions towards adverse macroeconomic developments in a forward-looking manner.

³ A brief account of global and domestic developments during CY23 has been covered in Chapter-1.

⁴ Real GDP growth declined from 6.2 percent in FY22 to -0.2 percent in FY23. YoY inflation and depreciation during CY23 were 29.7 and 19.7 percent, respectively.

enterprises sectors. Further, the presence of domestic stability, together with availability of multilateral financing, will boost sentiments, stabilize domestic currency and pave the way for gradual economic recovery. However, owing to fiscal discipline under assumed multilateral funding arrangement and cautious monetary policy stance amid ongoing inflationary environment, GDP growth is not likely to exhibit a sharp rebound.

Public debt is expected to remain under check owing to fiscal consolidation measures and stable exchange rate...

Second, the scenario assumes that owing to implementation of fiscal consolidation measures under the new IMF program, fiscal deficit will be manageable. On the other hand, resumption of multilateral flows is likely to boost confidence, reduce risk premium and stabilize the exchange rate. Based on these two assumptions, the public debt, which increased by 28.4 percent in CY23, is likely to remain in check. However, to control rise in circular debt, revisions in energy tariff and disbursement of power subsidies under the Circular Debt Management Plan FY24, alongside other fiscal measures, are assumed to put upward pressures on prices.

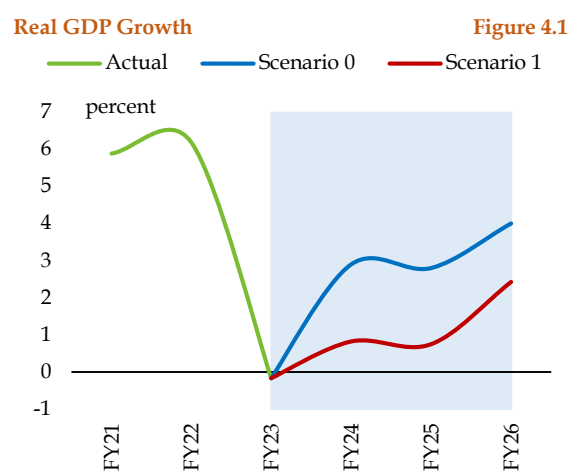
Global commodity prices are expected to remain broadly stable...

Finally, global food and energy prices, which peaked in the aftermath of the Russia-Ukraine conflict amidst post-pandemic recovery, have leveled off after observing a substantial decline in 2023. Following global projections and future oil contracts, the scenarios assumes that oil prices will remain stable in 2024 before observing a slight decline in 2025. In case of food, favorable supply conditions may lead to around 5 percent reduction in global food price index.⁵

Two other factors are also incorporated in the baseline scenario. First, given Pakistan's vulnerability to global warming, climate risk related events of moderate scale may lead to economic losses during the projection horizon.⁶ The scenario assumes that average level floods may impact economic activity to some extent, while causing temporary bouts of food inflation. Second, global geo-economic fragmentation and resulting slowdown in global trade and productivity are likely to negatively affect external inflows for the domestic economy.

Consequently, growth is assumed to exhibit gradual recovery while inflationary pressures are likely to ease in a stable but consolidating policy environment...

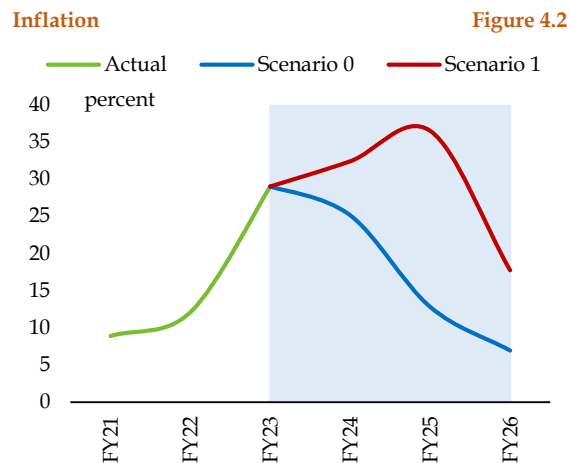
In this perspective, S₀ assumes GDP to grow by around 2.5 percent in FY24 and 2.8 percent in FY25. However, the growth is expected to rise to 4.0 percent in FY26 on account of the assumed ameliorations in global and domestic economic environment (**Figure 4.1**). Further, YoY average CPI inflation may stay at elevated levels of 25.1 percent and 12.8 percent during FY24 and FY25, respectively. Inflation is assumed to reach 7.0 percent during FY26 (**Figure 4.2**).



Source: SBP Staff Calculations

⁵ World Bank Commodity Markets Outlook, April 2024.

⁶ The Germanwatch has included Pakistan in the category of countries that are recurrently affected by the catastrophes and has ranked it at 8th position in long-term climate risk index. [Global Climate Risk Index \(CRI\) 2021, Germanwatch.](#)



Source: SBP Staff Calculations

4.3 The Hypothetical Stressed Scenario (S₁)

The S₁ is built around the following assumptions regarding global and domestic risk factors.

Domestic uncertainty may lead to lagging pace of economic reforms...

Economic reforms are critical to address long-standing structural issues of fiscal sector, particularly pertaining to the energy sector and state-owned enterprises. The S₁ assumes that owing to political cost, an inaction or resistance may lead to a slow pace of reforms agenda. Delays or disruptions in economic reforms may affect productivity of the economy in the long-term and stability in the short-term.

...culminating into delays or disruptions in the multilateral financing

Assumed slowdown on economic reforms may adversely affect prospects of smooth inflows from multilateral sources. Given the low level of FX buffers, this situation may push up risk premium and exert pressure on exchange rate. In the absence of multilateral flows, realization

of official bilateral, as well as private flows, may either become difficult or costlier.

Climate-change related events of high severity pose a major risk to macro economy...

Considering the recurring history of climate risk related events, as discussed in the previous section, S₁ assumes that climate events of extreme severity may lead to economic losses during the projection horizon. A major climate related event is assumed in the first year of the projection horizon – e.g., recurrence of rains and floods similar to CY22.

A rise in geopolitical tensions may result in resurgence in global commodity prices...

S₁ assumes continuation of geopolitical conflicts in the Middle East and Eastern Europe that may push food and oil prices up and precipitate negative supply shocks for global food and energy markets, culminating into a surge in global commodity prices. Resultantly, S₁ assumes that the average oil prices may rise to USD 98 per barrel by the end of FY24, before gradually declining to USD 83 per barrel by the end of projection horizon.⁷

... leading to elevated inflation necessitating continuity of tight global financial conditions

Global headline inflation indicators are showing declining trends and monetary policy rates in advanced economics are likely to ease. However, the assumed surge in commodity prices together with inflation inertia, may lead to elevated levels of inflation globally. This situation may call for delays in anticipated interest rate cuts leading to realization of “higher-for-longer” scenario. S₁, thus, assumes that financial conditions may tighten in the near term, making external financing for emerging markets and developing economies (EMDEs), including Pakistan, more expensive and difficult. This may also build pressure on

⁷ Corresponding baseline assumptions are USD 82.4 per barrel at the end of FY24 and USD 70 per barrel at the end of projection horizon.

EMDEs’ domestic currencies and may result in flight to safety.

To sum up, the domestic economy may continue to face the stagflation during the projection horizon...

Consequently, the real economy is assumed to grow by 0.4 percent and 0.8 percent in FY24 and FY25, before resuming a growth level of 2.4 percent in FY26 (**Figure 4.1**). Under S_1 , the adverse supply shocks are assumed to preclude normalization of ongoing domestic inflationary trend. Accordingly, headline inflation in FY24 and FY25 is assumed to be 32.4 and 36.5 percent, respectively. Inflation is gradually assumed to come down to 17.8 percent in FY26 (**Figure 4.2**).

4.4 Stress Testing Results: System Level

a) Impact on Credit Riskiness

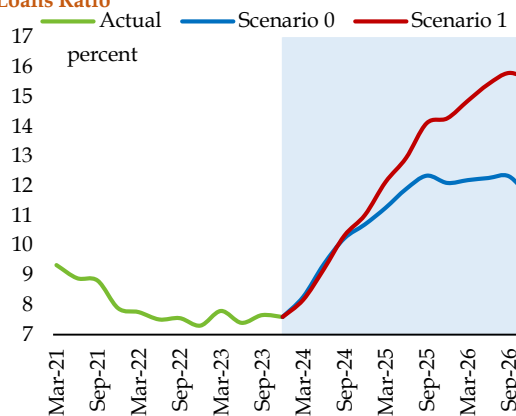
The results of the MST exercise indicate that the gross non-performing loans ratio (GNPLR)⁸, under S_0 , is likely to remain on the higher side over three-year projection horizon (**Figure 4.3**). The rise in loan delinquency ratio, despite assumption of gradual recovery, may be explained by two factors. First, advances are projected to decline initially in response to a sharp deceleration of GDP in recent past. This denominator effect explains the rise in GNPLR. However, the advances’ growth becomes positive in the second half of projection horizon; leading to slight reduction in baseline GNPLR towards the end of projection horizon. On average, advances are projected to grow by 3.0 percent over FY24 –FY26 under S_0 .

Second, the lagged effects of economic challenges of recent past e.g. slowdown in economic activity, high inflation and high interest rate may lead to surge in NPLs. As a

result, the GNPLR peaks at 12.3 percent from current level of 7.6 percent before settling at 11.6 percent by the end of projection period CY26.

The asset quality indicator, under hypothetical stressed scenario, S_1 , on the other hand, follows an upward trajectory because of the assumed sharp slowdown amid elevated global commodity prices and domestic supply shocks. The advances growth may also significantly be affected. Under S_1 , the lending portfolio is projected to contract, on average, by 2.3 percent over the projection period. The delinquency rate peaks at 15.8 percent and remains elevated until the end of projection horizon (**Figure 4.3**).

System-Level Gross Non-Performing Loans Ratio Figure 4.3



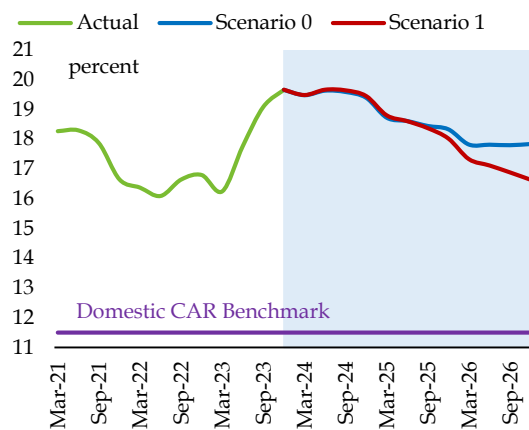
Source: SBP Staff Calculations

b) Impact on Solvency

The impact on solvency is measured via the Capital Adequacy Ratio (CAR) of the banking system.⁹ The CAR of the system declines in both the scenarios. Under the baseline, the CAR shrinks by 183 bps by the end of CY26 from the prevailing level of 19.7 percent. However, in stress scenario, it falls by 303 bps from the current level (**Figure 4.4**).

⁸ GNPLR = Gross Non-Performing Loans ÷ Gross Advances

⁹ CAR = Eligible Capital ÷ Risk Weighted Assets

System-Level Capital Adequacy Ratio Figure 4.4

Source: SBP Staff Calculations

Positively though, under both the scenarios, the banking industry maintains its CAR above the local minimum regulatory requirement of 11.5 percent and global benchmark of 10.5 percent during the entire period of projection horizon.

The resilience of the banking sector, despite the substantial level of assumed slowdown in real economy, can be justified based on following facts. First, the banking sector is already maintaining higher capital buffers i.e. 817 bps above the regulatory benchmark of 11.5 percent. Second, the release of 100 bps capital conservation buffer during COVID-19 has not been reversed yet, which gives banks additional liquidity. Third, favorable overall repricing gaps amidst assumed policy rate movements provide further cushion during times of stress. Finally, the sector's historical behavior has been to re-balance asset portfolio from riskier private sector loans to risk-free treasury investments.¹⁰ Moreover, the banks in general follow a conservative lending strategy and prefer to lend to borrowers with better credit worthiness, as well as capacity to withstand macroeconomic shocks.

¹⁰ The share of credit to public sector relative to total assets of banks increased from 55.81 percent at the end of CY22 to 60.56 percent at the end of CY23.

¹¹ The categorization has been done based on balance sheet footing. The banks with assets above 70th percentile of the entire banking sector are termed as 'Large' while below 30th percentile are categorized as 'Small'. The banks falling in between these two thresholds are categorized as 'Medium' sized banks.

4.5 Results: Cross Sectional Dynamics of Banking Segments

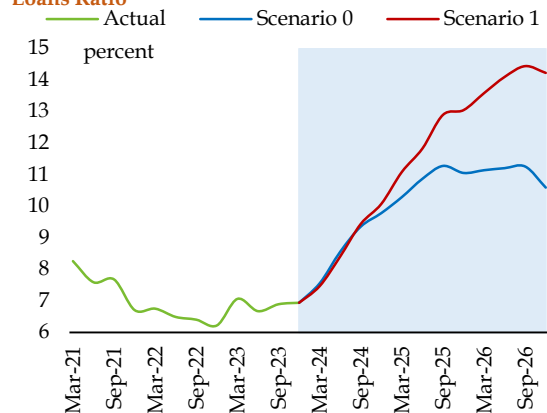
In line with the system-level credit risk analysis, infection ratios of banking segments (small, medium and large sized banks)¹¹ have also been projected separately. This aspect of the banking industry is included to assess how cross-sectional heterogeneity affects the resilience of banks against various macroeconomic risks.

For the GNPLR, system-level projections of NPLs and gross advances are distributed proportionately based on the contribution of each segment to the aggregate loan portfolio of the banking system as of December 2023. Similarly, capital is also distributed proportionately to compute segment level CARs.

(a) Large Banks

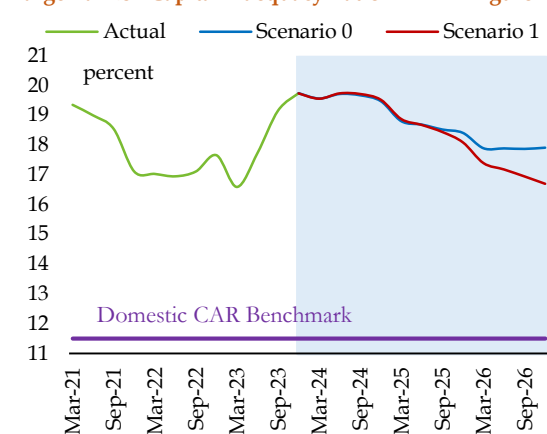
The large banks segment - comprising 76.7 percent of the banking sector's assets - under S_0 witnesses an increase of 365 bps in GNPLR by end-CY26 from its current level of 6.9 percent. Under S_1 , however, the rise in infection ratio is a bit sharper: 729 bps by the end of projection horizon (**Figure 4.5**). The CAR decreases by 183 bps in the baseline scenario and falls by 304 bps in the stressed scenario from prevailing level of 19.7 percent over the projection horizon (**Figure 4.6**). Remarkably though, the CAR remains, respectively, 641 bps and 520 bps higher than the local benchmark under S_0 and S_1 .

Large Banks - Gross Non-Performing Loans Ratio Figure 4.5



Source: SBP Calculations

Large Banks - Capital Adequacy Ratio Figure 4.6



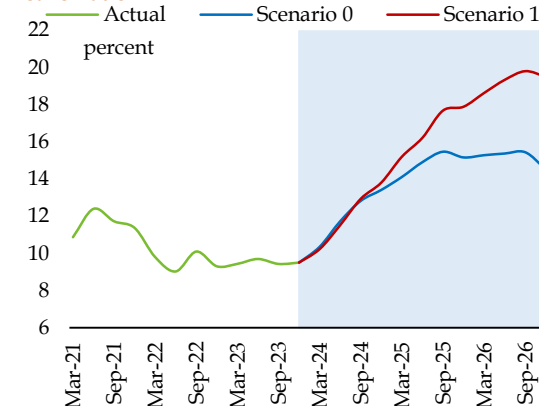
Source: SBP Calculations

The large banks are generally well-placed to withstand stress over the simulation horizon. Higher capital buffers available with larger banks are the likely factor behind this resilience. Incidentally, these banks generally have relatively lower costs of funds due to their wider outreach, giving them a competitive advantage to maintain a loan portfolio of relatively better rated obligors. More importantly, the systemically important banks are also likely to remain well-capitalized and resilient to the shocks assumed in stressed scenario.

(b) **Medium-sized Banks**

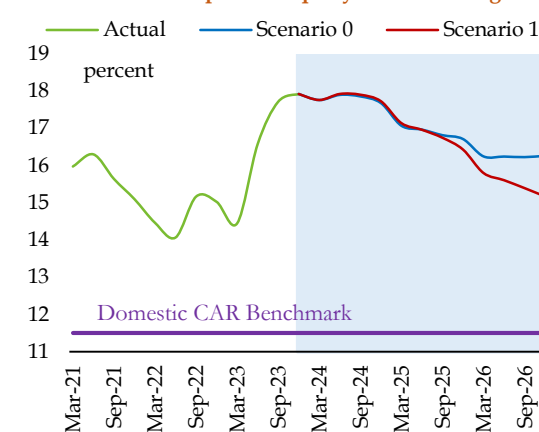
By the end of the projection period, the infection ratio of medium-sized banks (having market share 17.5 percent) increases by 501 bps and 999 bps in S_0 and S_1 , respectively, from existing 9.5 percent (Figure 4.7). The CAR, correspondingly, attains 166 bps and 276 bps lower level compared with the prevailing reading of 17.9 percent, under S_0 and S_1 . The medium-sized banks are, therefore, also expected to remain compliant with the regulatory CAR standards, even under the stressed scenario (Figure 4.8).

Medium Banks - Gross Non-Performing Loans Ratio Figure 4.7



Source: SBP Calculations

Medium Banks - Capital Adequacy Ratio Figure 4.8



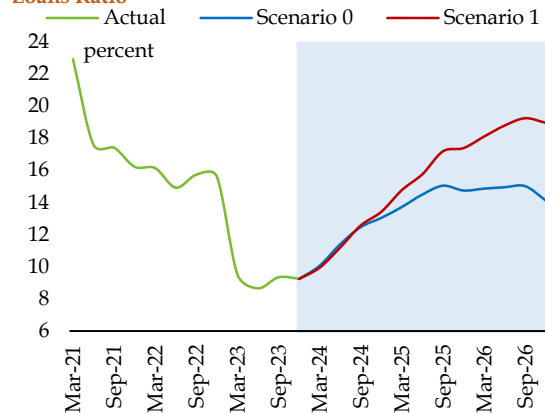
Source: SBP Calculations

Their level of CAR remains 476 bps and 367 bps percentage points above the minimum regulatory requirement (11.5 percent) in S_0 and S_1 , respectively. Although their delinquency ratios are higher and pre-shock capital buffers are lower than the large and small banks segments, however, medium-sized banks also carry sufficient capital buffers and can withstand assumed shocks under stressed scenario.

(c) Small Banks

Small banks – contributing 5.7 percent of the banking sector assets – are also found to be resilient against both baseline and stressed scenarios. From its existing level of 9.3 percent, the loan delinquency rate increases by 487 bps in S_0 , whereas it rises by 971 bps under S_1 , by the end of horizon (**Figure 4.9**).

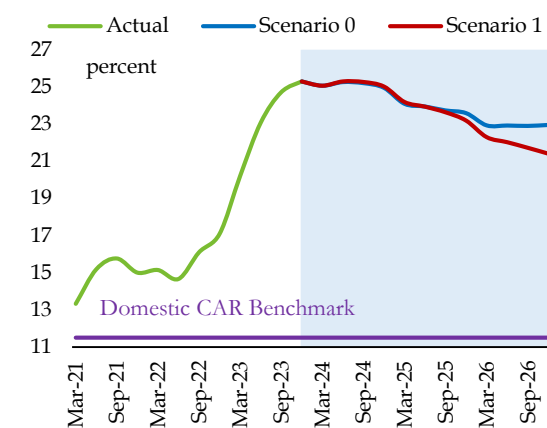
Small Banks - Gross Non-Performing Loans Ratio **Figure 4.9**



Source: SBP Calculations

In terms of solvency, the CAR of small banks falls by 235 bps and 389 bps under S_0 and S_1 from the prevailing level of 25.3 percent (**Figure 4.10**). The CAR, however, remains 1,146 bps higher than the local benchmark in S_0 while staying 992 bps above the minimum requirement under S_1 . Over time, this segment has strengthened its resilience by substantially building the capital adequacy levels.

Small Banks - Capital Adequacy Ratio **Figure 4.10**



Source: SBP Calculations

Overall, under the baseline scenario, although the delinquency ratio rises, the solvency of the banking sector portrays an encouraging picture with capital adequacy staying well above the domestic regulatory benchmark. Under the hypothetical stress scenario as well, the banking sector is expected to withstand a severe slowdown induced by adverse global and domestic macroeconomic conditions, including the global commodity market pressures. In terms of size, all the segments of the sector (small, medium, and large) can withstand the stressful conditions as well. Reassuringly, the large size banks, whose stability has particular significance for economy and financial system, carry higher capital buffers and are thus able to sustain the impact of hypothesized shocks for the projection period of three years.

Also, the other two segments of banks meet the solvency criteria during the projection horizon. Furthermore, if history is any guide, the domestic banking sector has generally performed quite reasonably during severe downturns, such as the external sector crises in 2008, COVID-19 pandemic and flash floods of 2022. This is clearly visible in the results of the stressed scenario (S_1), as the sector remains well capitalized and resilient.

That said, the exact severity, duration, and paths of assumed global commodity markets and macro financial conditions due to ongoing geopolitical tensions in Middle East and Eastern Europe remain highly uncertain. As a result, the

stress-test results are also subject to significant uncertainty. SBP continues to closely watch the evolving situation and remains ready to take necessary actions to safeguard the financial stability.

Box 4.1: Climate Risk Scenario Analysis

Introduction

Climate change is one of the many structural changes that affect the financial system. The issue has got significant attention of the financial sector regulators, international organizations and market participants towards understanding the implications of climate change for the financial sector and its stability. SBP, recognizing its importance and criticality, has also included climate change as one of the strategic themes in its Vision 2028.¹²

According to the Global climate risk index, Pakistan is the 8th most vulnerable country to climate change.¹³ Over the years, physical hazards due to climate - related changes have adversely impacted the economy of Pakistan.¹⁴ Climate change may impact the banking sector by affecting the credit worthiness of counterparties or through holding of financial assets that are vulnerable to climate change. Besides its direct impact on financial sector, climate change can impact the wider economy, which may in turn affect the banking system.

On a broader level, risks to financial stability from climate change are classified into Physical and Transition risks. **Physical risks** include possible economic costs and financial losses resulting from the increased severity and frequency of climate-change related weather events. Whereas, **Transition risks** relate to the process of adjustment towards a low carbon economy including shifts in policies designed to mitigate and adapt to climate change.

Given Pakistan's economic vulnerability to climate change, an assessment of climate related risks to the banking sector is crucial. SBP has been incorporating the impacts of climate - related physical risks through demand side variables in its annual stress testing exercises published in the FSR. Building on the climate risk assessment work presented previously, this box is dedicated to the scenario analysis of physical and transition risks for the stability of banking sector of Pakistan.

Physical risk

Physical risks include economic losses from extreme weather events related to climate change as well as long terms progressive shifts of climate. Physical risk drivers are further classified into acute and chronic. Acute risk drivers include floods, wildfires, excessive precipitation, lethal heatwaves, storms and cyclones. Chronic risk drivers encompass gradual degradation caused by climate change e.g. rising sea levels, increase in average temperatures, ocean acidification and desertification as a result of extended periods of high temperature.

According to United Nations Office for Disaster Risk Reduction (UNISDR) (2014), 75 percent of the natural losses arising due to natural hazards in Pakistan are attributable to the flooding.¹⁵ The floods of 2010 and 2022 have accentuated country's vulnerability to these events. On the back of this context, physical risk scenario analysis

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¹² SBP Vision 2028 available at <https://www.sbp.org.pk/SBPVision/Index.html>.

¹³ See the [Global Climate risk index published by German Watch](#)

¹⁴ [German Watch \(2017\)](#), estimates Pakistan annual average losses from climate change at USD 3.8 billion.

¹⁵ See UNISDR (2014), [Prevention Web: Basic country statistics and indicators](#)

Lending Portfolio of Banks & MFBs in Flood Vulnerable Sectors/Districts at December 2023

Table 4.1.1

Sr.no	Sector	million Rupees	
		Banks	MFBs
1	Agriculture, forestry and fishing	270,585	193,591
2	Mining and quarrying	532	0
3	Manufacture of food products	215,704	906
4	Manufacture of textiles	229,083	2,056
5	Manufacture of wearing apparel	3,725	206
6	Manufacture of leather and related products	5,868	36
7	Manufacture of wood and of products of wood	239	33
8	Manufacture of paper and paper products	747	2
9	Construction	18,718	1,841
10	Land transport and transport via pipelines	3,245	297
11	Accommodation	491	106
12	Real estate activities	1,709	1
13	Consumer Financing	139,578	37,566
Total vulnerable portfolio		890,226	236,641
Gross Loans as of end December 2023		13,100,595	407,790
Flood vulnerable portfolio (percent)		6.8	58.0

Source: State Bank of Pakistan

presented in this exercise attempts to estimate the incremental credit losses to the banking sector in case of recurrence of flooding equal in intensity to the floods of 2022. The scope of this exercise extends to the lending portfolio of banks and MFBs.

For the purpose of this exercise, geographical (district-wise) loan data of banks and MFBs, as of December 31, 2023 is utilized. For identification of vulnerable sectors¹⁶, climate stress tests carried out by various jurisdiction were reviewed.¹⁷ Only the sectoral lending portfolio in the districts affected by floods in 2022 is stressed for this exercise (Table 4.1.1).

The district wise sectoral lending exposures reveals a stark contrast: only 6.8 percent of banks' gross loan portfolio, amounting to Rs 890.2 billion, is disbursed in the affected districts and vulnerable sectors. For MFBs, 58 percent of their gross loan portfolio, amounting to Rs 236.6 billion, is concentrated in these districts and sectors. On sectoral basis, agriculture, forestry and fishing are the most vulnerable sector with major share of disbursements followed by manufacturing of textiles and consumer lending.

Two hypothetical scenarios have been developed to test the resilience of banks and MFBs to another episode of devastating floods, identical in the intensity to the 2022 episode. The first scenario maps the actual, post-floods sectoral growth of NPLs over four quarters i.e. Q3CY22 to Q2CY23. This intuitively incorporates the impact of regulatory relief offered by the central bank and government. A second scenario assesses the credit losses of the banks in the absence of any such relief. Deterioration in the credit portfolio of institutions during the one - year window assists in capturing the deterioration in the repayment capacity of the borrowers due to flood related economic losses.

Scenario 1 - Presence of regulatory reliefs: In this scenario, vulnerable portfolio in flood affected districts is stressed equivalent to the actual growth in credit delinquencies observed during the one-year period following the floods of 2022. The stress in this scenario is relatively subdued, as banks, in line with SBP guidance, rescheduled or restructured a significant amount of loans to dampen the impact of floods. Due to the higher concentration of their portfolio in the flood affected districts and relatively low net worth of their borrowers, MFBs are more vulnerable to

¹⁶ These sector are based on ISIC-4 classification of advances.

¹⁷ For reference, see climate stress tests conducted by the [ECB](#) and [Bank of Canada](#).

floods as their non-performing loans ratio (NPLR) surges to 8.3 percent post-shock. Despite, the larger volume of loans extended by the commercial banks in the flood affected districts, their losses are relatively contained as their borrowers mainly consist of high net worth individuals and corporates (Figure 4.1.1).

Scenario 2 - Absence of regulatory relief: This scenario is built on the assumptions similar to the previous scenario; however, the impact of restructured /rescheduled loans and any write-offs made by the institutions during the Q3CY22 - Q2CY23 have been added back.¹⁸ Under this scenario, the asset quality of MFBs deteriorates significantly as their non-performing loan ratio (NPLR) doubles to 13.4 percent. For scheduled banks, the infection ratio surges by only 50 basis points to 8.1 percent, which, nonetheless, translates into a substantial amount given large volume of banks' lending portfolio (Figure 4.1.2).

Overall, the MFB sector with relatively higher concentration of advances in the flood affected areas, is more vulnerable to climate-related physical risks compared to the scheduled banks. However, due to the relatively smaller size of their portfolio, chances of systemic risk for financial sector are muted.

Transition risk

Transition risks include potential disruptions and economic shocks arising out of transition towards a low carbon economy. Transition risk drivers include climate policies, technology and consumer/investor sentiments. Changes in these drivers may disrupt different sectors of the economy, especially the financial sector if these changes are abrupt and not planned in advance.

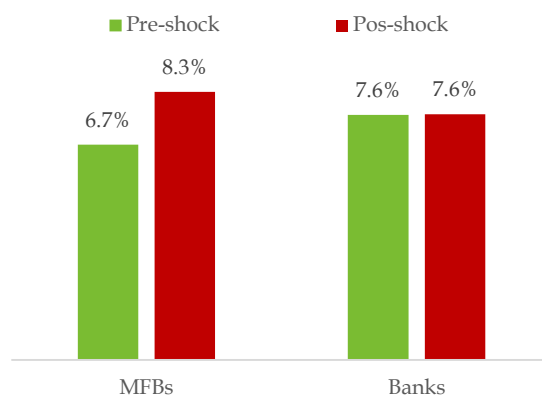
Imposition of carbon tax is a major climate risk mitigation policy that may affect the credit risk of banks through their counterparty exposures. Numerous central banks, regulatory authorities and the IMF have employed the use of carbon taxation scenarios to study the impact of climate related transition risks on the financial sector.¹⁹

For transition risk scenario, the impact of a carbon tax on the Pakistan Stock Exchange (PSX) listed firms' probabilities of default (PDs) and Interest Coverage ratios (ICR) is explored. Beginning with a carbon tax floor of USD 5 per ton of CO₂ emission (tCO₂e), changes in PDs and ICRs of corporates up to USD50/tCO₂e²⁰ are presented.

Probabilities of Default

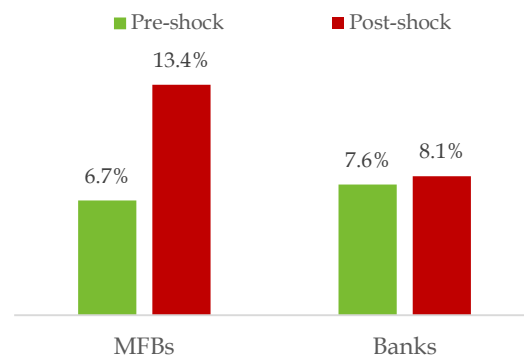
Corporate sector is a major user of bank credit in Pakistan.²¹ Impact of imposition of carbon tax on the financial

Pre and Post Shock Infection Ratios (Presence of Regulatory Relief) Figure 4.1.1



Source: SBP Staff Estimates

Pre and Post Shock Infection Ratios (Absence of Regulatory Relief) Chart 4.1.2



Source: SBP Staff Estimates

¹⁸ Write-off amounts of only Q1 and Q2 of CY23 have been included, whereas restructured/rescheduled amount of all four quarters is included in the shock.

¹⁹ See [ECB](#) and [Bank of Canada](#) climate stress tests, IMF FSAP for [Norway & Chile](#) and transition risk stress tests for [Columbia](#) and [Japan](#).

²⁰ (i) PKR-USD parity rate is the average rate for the month of December, 2023.

²¹ As of December, 2023, 74.5 percent of the total private sector advances were extended to the corporate sector.

health of PSX listed firms is estimated in this scenario. To capture the transition risk to the banking sector, evolution of probabilities of default (PDs) of the firms post carbon tax is assessed.

The workhorse model to estimate PDs is based on Altman Z-score, augmented with the macroeconomic factors. However, the coefficients have been re-estimated for Pakistani firms by employing a Logit model.

$$\Pr(y_i = 1) = \Lambda(X_i\beta)$$

$$X = \left[\frac{WC}{TA}; \frac{Sales}{TA}; \frac{RetEarn}{TA}; \frac{Eqty}{TA}; \frac{EBIT}{TA}; GDP_Growth; Int.Rate \right]$$

Using data on 275 non - financial firms spanning over 2013 to 2022, the model estimates *pre*-shock PDs. We proxy the default ($y_i = 1$) by using firm specific data from SBP's Credit Registry, where a firm is taken to have defaulted if its credit obligations remain overdue by 90 days and above ($OD \geq 90$).

For *post*-shock analysis, relevant variables are adjusted for the amount of carbon tax. The tax is calculated based on the level of sales of firms and their carbon intensity. Specifically,

Evolution of Sectoral PDs in Response to Carbon Tax

Table 4.1.2

Sector	Carbon Intensity (per million US\$ Sales)	No tax	Tax Rate (US\$)					
			5	10	20	25	30	50
			Probabilities of Default (percent)					
Fuel & Energy	2,036	14.6	14.8	15.0	15.5	15.8	16.1	17.6
Cement	888	1.9	1.9	2.0	2.0	2.1	2.1	2.2
Chemical	888	2.5	2.6	2.7	2.9	2.9	3.0	3.4
Textile	501	19.7	19.7	19.8	19.9	20.0	20.1	20.3
All		13.8	13.8	13.9	14.0	14.1	14.2	14.5
ECL* (billion Rupees)		136	139	142	149	153	157	175
GNPLR (percent)		7.6	7.6	7.6	7.7	7.7	7.8	7.9

*Expected Credit Loss = LGD x PD x EAD

Source: S&P Global (Intensities) and SBP Staff Calculations

$$\text{Emission} = [\text{Sales} \div \text{Threshold}] \times \text{Intensity},$$

Where, 'Threshold' is the PKR equivalent of one million US dollars (\approx PKR 282 million), assuming exchange rate of PKR 282 against USD. The Carbon 'Intensities' for the sectors are proxied using Standard & Poor's data on greenhouse gas emission of global industries.²² Intensities for sectors under study are given in **Table 4.1.2**.

Finally, the Carbon Tax is given by

$$\text{Carbon Tax} = \text{Emission} \times \text{Tax Rate}$$

The tax rates ranges from USD 5/tCO₂e to USD 50/tCO₂e (in equivalent PKR). Incidentally, IMF (2021) suggests a floor of USD 25/tCO₂e for lower income emerging countries.²³ Also, as per World Bank's Carbon Pricing Dashboard, 30 jurisdictions have imposed carbon taxes in the range of 1 USD/tCO₂e (Ukraine) to 156 USD/tCO₂e (Uruguay), with an average tax of USD36/tCO₂e.²⁴ Therefore, the tax range used in the study is well within the plausible range.

²² See S&P (2021), "[Transition Risk: Historical Greenhouse Gas Emissions Trends for Global Industries](#)" for sectoral emission intensities.

²³ Parry, I., Black, S., & Roaf, J. (2021). [Proposal for an international carbon price floor among large emitters](#). Staff Climate Note No. 01 of 2021, International Monetary Fund.

²⁴ World Bank (2023). [State and Trends of Carbon Pricing Dashboard](#).

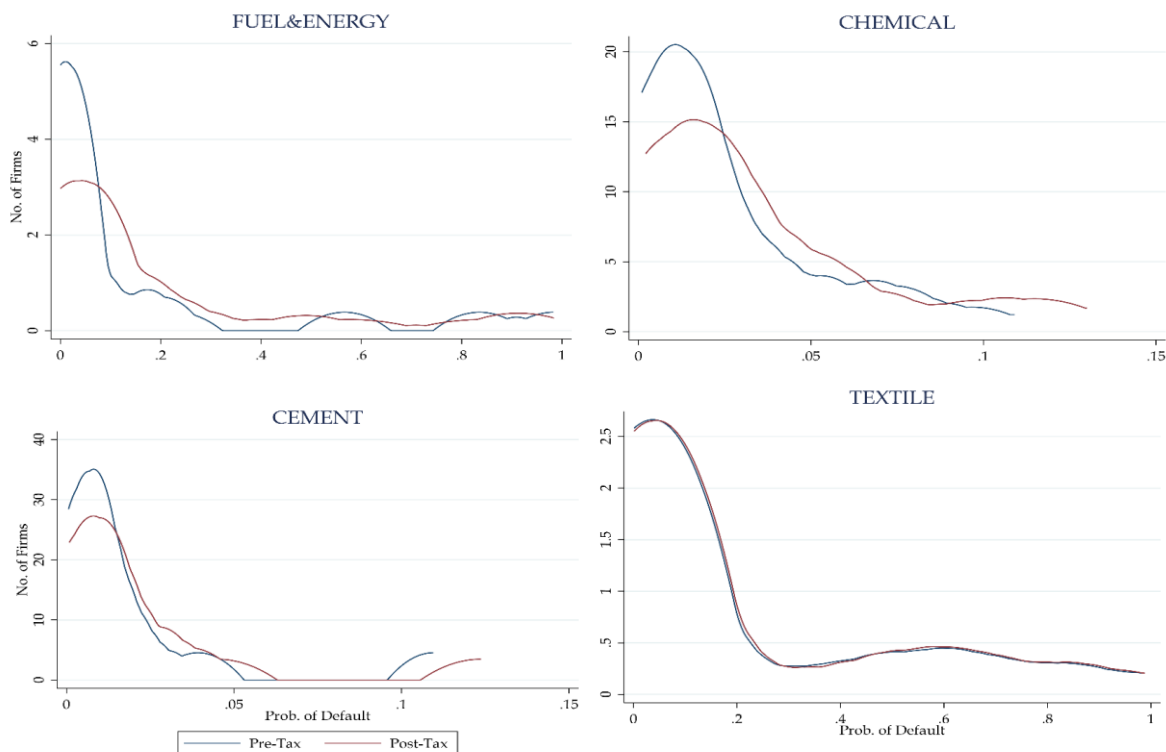
The Logit estimates put *pre*-shock average PD²⁵ of the corporates at 13.8 percent, which surges by 78 basis points (bps) to 14.5 percent in case of imposition of a 50 USD/tCO₂e carbon tax (Table 4.1.2).

A marginal increase in the PD at this higher level of tax implies the financial resilience of Pakistani corporate sector. Among major sectors, Fuel & Energy and Chemicals sectors exhibit the highest vulnerability to carbon tax, given their higher emission intensities, as their PDs rise by 300 bps and 90 bps, respectively from pre-shock levels of 14.6 percent and 2.5 percent. Textile sector, with the largest share of corporate lending and relatively higher *pre*-shock PD (due to a few firms in tail of PD distribution) remains resilient in response to the imposition of carbon tax which signifies two facts: first, robust financial health of firms (as the mass of PDs is concentrated below 30 percent), and second, low assumed carbon intensity.

The sectoral PD distributions suggest minimal migration of firms from safe (< 0.5) to the default zone of (> 0.5). Post tax, distribution for Fuel & Energy, Chemical and Cement sectors reflect some rightwards movement i.e. rise in PDs, however, no migration to the default zone is observed for any of the firm in these sector (Figure 4.1.3).

Sectoral PD distribution

Figure 4.1.3



Source: SBP Staff Calculations

Density distributions correspond to a US\$ 50 tax

Results of the exercise provide some evidence that carbon tax could impact the PDs of firms in the sectors with higher emission intensities; however, the magnitude of increase in PDs is relatively contained and likely to have commensurate impact on the solvency of the banking system. This can be gauged from the fact that the credit risk

²⁵ These are staff model based estimates and shall not interpreted as official SBP view.

due to carbon tax (US\$ 50) results in an incremental *expected credit loss*²⁶ of only Rs 39 billion. As a result, the infection ratio may increase from current level of 7.6 percent to 7.9 percent at maximum tax levels.

The PD model, however, relies on a multitude of factors, some of which are strong enough to dampen the aggregated impact of a carbon tax on the PDs of corporates. Resultantly, no sizeable migration of firms to the default zone is observed.

Interest Coverage Ratio:

To isolate the impact of transition risk on the debt repayment capacity of non-financial corporates, a potential source of increase in credit risk of the banking sector, changes in interest coverage ratio (ICR) of the non-financial firms in response to the imposition of a carbon tax are analyzed.

The ICR is defined as the extent of (or times/multiples) a firm's earnings before interest and taxes (EBIT) to cover the interest payments. Balance sheet and firm level emission data is utilized to estimate changes in the PSX listed firms' coverage ratios for carbon tax levels up to USD 50/tCO_{2e}.

Estimates of this analysis assume that firms fully absorb the carbon tax levied on their emissions. However, in practice output prices, quantities, production processes and inputs would all adjust to a transition. Modelling these dynamics is highly complex and beyond the scope of this exercise. Therefore, these results may be interpreted as an upper bound of the financial impact on firms due to the carbon taxation.

The median ICR of the listed firms, *pre-tax*, stands at comfortable 5.5X (**Figure 4.1.4**). With a carbon tax of USD 25/tCO_{2e}, a floor suggested in the IMF (2021), the median ICR drops to 4.6X while with a tax of USD50/tCO_{2e}, it further drops to 3.5X.

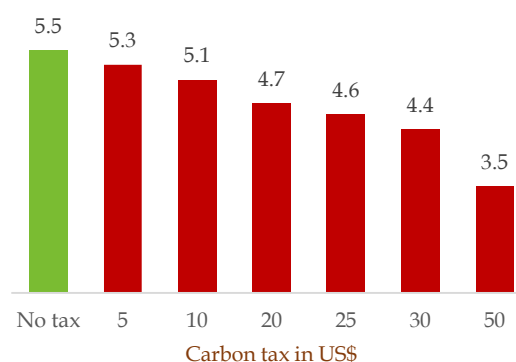
Median ICR numbers with carbon taxation are comfortable; however, there are some firms with weaker financial position. Pre-shock, the share of firms for which EBIT does not cover interest payments (ICR < 1X), i.e. debt-at-risk, is 5 percent and another 11 percent of the firms have an ICR between 1X and 2X.

The number of firms with debt-at-risk substantially increases with the imposition of carbon tax. For instance, at USD 25/tCO_{2e}, the share of firms with an ICR below 1X doubles to 10 percent whereas with a per ton carbon tax of USD 50, the share increases to 20 percent (**Figure 4.1.5**). Because of the significant increase of the debt-at-risk in the case of a USD50 tax, banks' credit risk would surge. Specifically, with implementation of IFRS-9, the transition adjusted expected credit losses of banks may rise.

At sectoral level, Fuel & Energy followed by the Chemical and Cement are the sectors most vulnerable to carbon taxation. This is expected given high emission levels in these sectors,

Median ICR under Carbon Tax Scenario for Listed PSX Firms

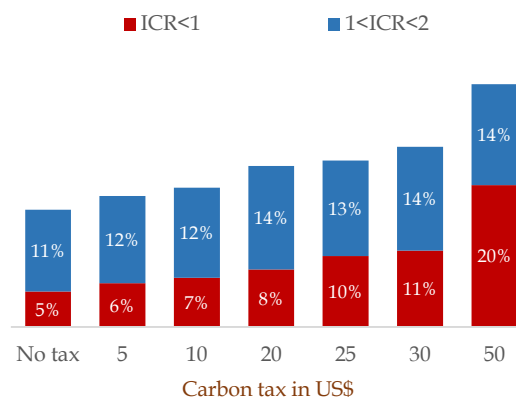
Figure 4.1.4



Source: SBP Staff Estimates

Share of Firms with Debt at Risk

Figure 4.1.5



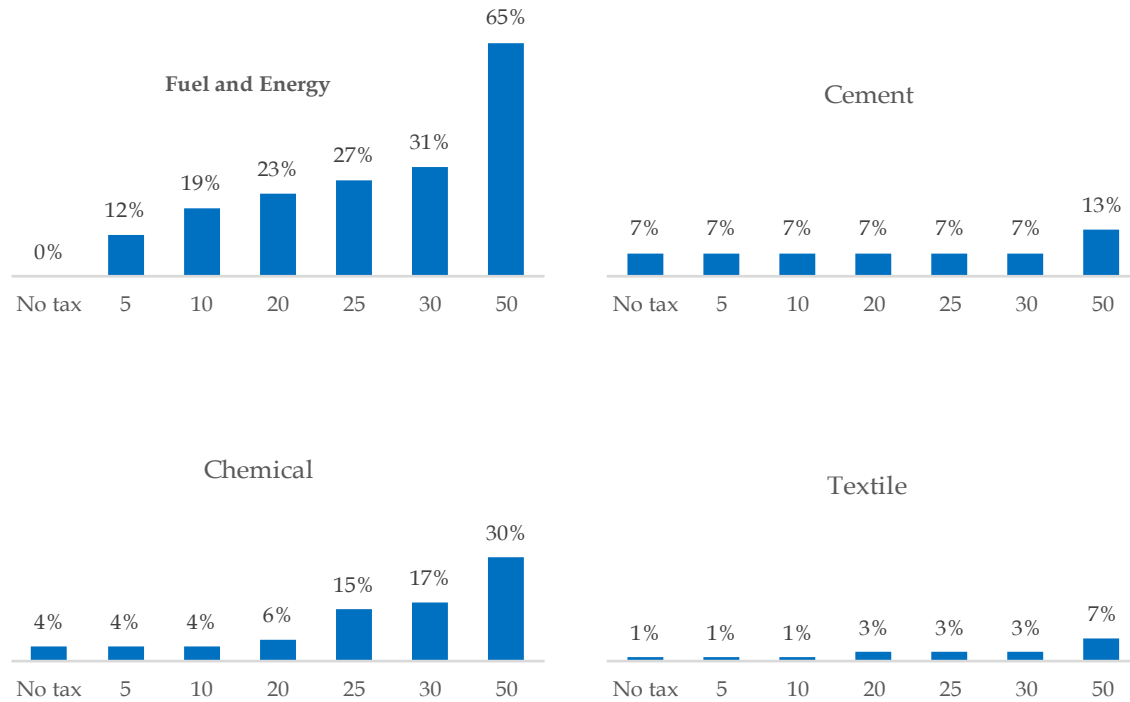
Source: SBP Staff Estimates

²⁶ Expected Credit Loss (ECL) = LGD x PD x EAD. NPL provision coverage ratio is used as a proxy for Loss Given Default (LGD), PDs are model based estimates and Exposure at Default (EAD) is the quantum of outstanding performing loans of the firms.

Share of Firms at Sectoral Level with Debt at Risk

Figure 4.1.6

In percent, ICR < 1, Carbon tax in US\$

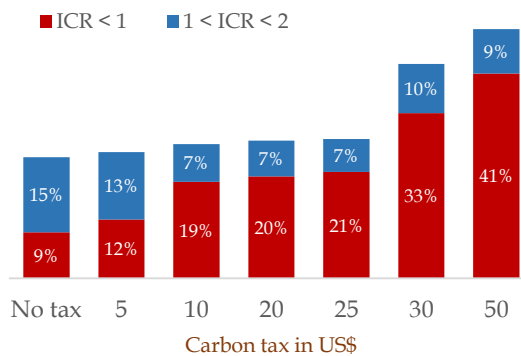


Source: SBP Staff Estimates

and it also suggests greater vulnerability of these sectors to transition risk. At a tax rate of USD25/tCO_{2e}, suggested in IMF (2021) for keeping the emissions below 2° C, 27 percent of the firms operating in Fuel & Energy sector may face impairment of their debt repayment capacity i.e. ICR<1. Percentage of firms in other sectors with debt-at-risk are estimated at 15 percent for Chemical and 3 percent for Textile (Figure 4.1.6).

Banks' exposure to transition risk is indirectly linked to their lending to corporates that may face a decline in their repayment capacity in response to the imposition of a carbon tax. Pre-shock, 9 percent of the banking sector's exposure to PSX listed firm is at-risk (ICR<1X). At a carbon tax of USD25/tCO_{2e}, 21 percent of the banking sector's lending portfolio becomes at-risk, which further increases to 41 percent at a tax of 50 USD/tCO_{2e} (Figure 4.1.7). Therefore, depending on the strategy to achieve the net-zero target, a gradual path with low carbon tax would entail a low transition risk while a more aggressive one with higher tax levels may enhance credit risk of the banking sector.

Share of Banking Sector's Exposure to PSX Listed Firms at Risk **Figure 4.1.7**



Source: SBP Staff Estimates