Box 4.1: Climate Transition Risk and Financial Stability in Pakistan

Introduction

Climate change poses significant threat to the Pakistan's economy. The country is ranked as 8th most vulnerable jurisdiction by German Watch's Global Climate Risk Index (CRI).[16] It is faced with some of the highest disaster risk levels, ranking 20th out of 191 countries on Inform Risk Index (2025).[17] This risk is driven in particular by country's exposure to climate change induced periodic flooding. Pakistan was the country most affected by climate change in 2022 (CRI 2025), mainly due to exceptionally high economic losses due to floods.[18]

Climate change can affect the financial system through physical and transition risks.[19] Physical risk arises when the financial system is exposed to counterparties that experience damage to their assets due to climate change induced hazards. This can lead to increased default risk or erosion in the value of financial assets. On the other hand, transition risks result from the process of adjustment towards a low carbon economy including changes in climate policy, technology and market sentiment. Financial institutions can incur losses on exposure to corporates and financial assets that are vulnerable to transition.

Given the country's economic vulnerability to climate change, SBP has issued Green Banking Guidelines and Environmental and Social Risk Management manual, which set regulatory expectations from banks to assess and manage the climate related risk. Also, the central bank has been incorporating the impact of physical risks through demand side variables in its annul stress tests published in the previous versions of FSR. The results of a detailed climate scenario analysis exercise were first time published in the FSR 2023, which attempted to quantify the vulnerability of Pakistan's banking sector to physical and transition risk. This box, continuing with previous exercise, focuses on the transition risk. Using data from latest financials and a larger sample of firms, it explores the impact of carbon tax on the financial health of non-financial corporates (NFCs) listed on Pakistan Stock Exchange (PSX) and the resulting impact on the credit risk of banking sector.

Impact of Carbon Tax on Probability of Default

Changes in climate policy such as carbon taxation, emissions regulation and renewable energy mandates, incentivize investment in clean energy and penalizes carbon intensive firms. As a result, companies with higher emission intensities face compliance costs affecting their profitability and market valuations.

Analysis presented in this section explores the impact of carbon taxation on the probability of default (PD) of listed NFCs. Carbon tax is expected to impact the profitability of firms, which in turn may have adverse impact on their key soundness indicators and credit worthiness, represented by probability of default in this scenario. PDs of NFCs are estimated at carbon tax imposed on tons of CO_2 emission (tCO_2e) levels from US$ 5/tCO_2 to US$ 50/tCO_2,[20] by employing a logit regression model using some indicators of Altman Z-Score, augmented with macroeconomic variables. The model is represented as:

$$\mathbf{Pr}(y_{it} = 1) = \Lambda(X_{it}\beta)$$

$$X = [\frac{WC}{TA}; \frac{Sales}{TA}; \frac{RetEarn}{TA}; \frac{Eqty}{TA}; \frac{EBIT}{TA}; GDP\_Growth; Int.Rate\ ]$$

[16] For details please see: German Watch – Global Climate Risk Index 2025

[17] For details please see: Inform Risk Index

[18] Post disaster needs assessment prepared by GoP in collaboration with the world bank estimated damages at nearly US$ 15 billion along with a reconstruction cost of US$ 16 billion.

[19] For details please see: Grippa, P., Schmittmann, J., Suntheim, F. (2019). Climate Change and Financial Risk, Finance & Development, December.

[20] Carbon tax range from US$ 5/tCO2e to US$ 50/tCO2e used for the study is well within plausible range as IMF (2021) suggests a floor of US$ 25/tCO2e for lower income emerging countries. Also, as per World Bank's Carbon Pricing Dashboard, 30 jurisdictions have imposed carbon taxes in the range of US$ 1/tCO2e (Ukraine) to US$ 156/tCO2e (Uruguay), with an average tax of US$ 36/tCO2e

Where TA represents the total assets of a firm, Sales represents sales of firm, WC denotes working capital, RetEarn represents Retained Earnings, Eqty shows equity of the firm and EBIT represents Earnings Before Interest and Taxes.

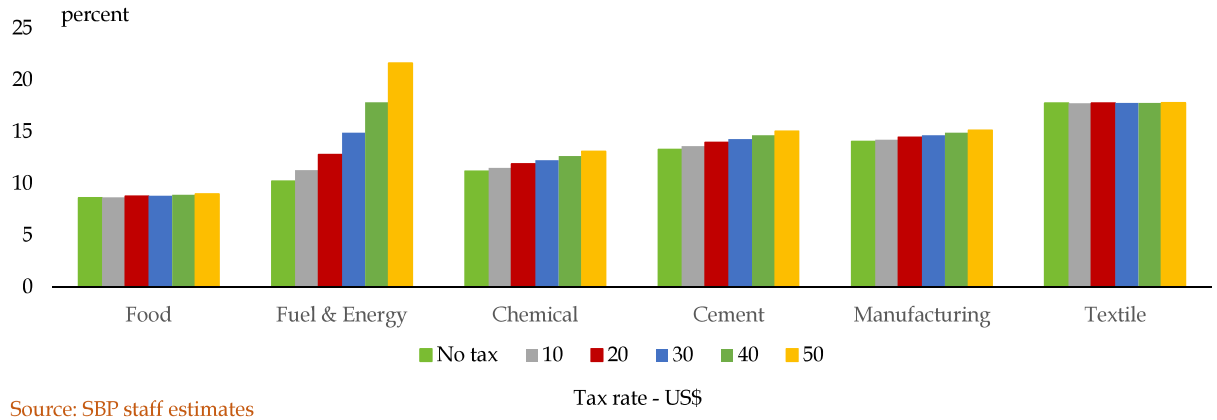
Using panel of 343 NFCs, spanning from 2018 to 2023, the model estimate pre and post-shock PDs of firms in response to various carbon tax levels, after adjusting the relevant variables for carbon tax. Default of a firm is proxied $(y_i = 1)$ using firm specific data from SBP's Credit Registry, where a firm is considered to have defaulted, if its credit obligations become overdue by 90 days or above (OD ≥ 90).

Carbon tax of a firm is calculated using Standard and Poor (S&P) sectorwise carbon emission intensities, expressed as tons of CO_2 emitted per million US$ of revenue.[21] Specifically,

$$Carbon\ emission = Emission\ intensity * Sales$$

$$Carbon\ tax = Carbon\ emission * Tax\ rate$$

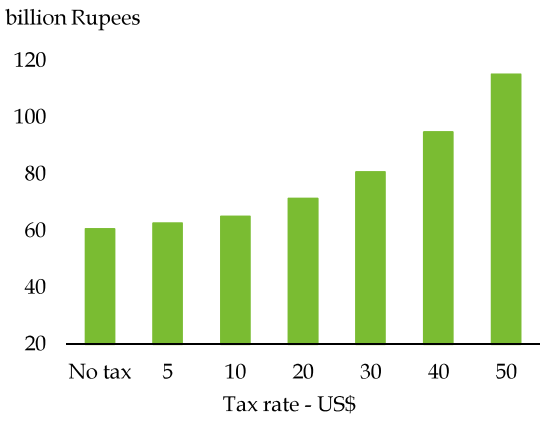
Sector wise PDs at various carbon tax levels (Top 5 sectors by outstanding exposure) **Figure 4.1.1**



Source: SBP staff estimates

Model estimates suggest a marginal increase in PDs of listed NFCs, as the average PD of the sample slightly increases by 170 bps from 14.9 percent before shock to 16.6 percent at the highest tax level of 50 USD/tCO_2. Sectoral PD distributions show minimal migration of firms to default zone (PD > 50 percent). However, sectors with higher emission intensities such as, fuel and energy, chemical, cement and manufacturing appear more vulnerable to transition as their PDs surge at higher tax levels. Specifically, firms operating in fuel and energy sector may face significant financial constraints, as the post shock PD of the sector rises to 21.6 percent at tax rate of US$ 50/tCO_2. On the other hand, textile sector, with the largest share of corporate loans and relatively higher pre-shock PD remains resilient in response to the imposition of carbon tax. This signifies robust financial health of the firms operating in the textile sector **(Figure 4.1.1).**

Expected Credit Loss **Figure 4.1.2**



Source: SBP Staff estimates

Results of the analysis provide some evidence that imposition of carbon tax could impact the PDs of listed NFCs, as their profitability declines. However, the impact on PDs may remain relatively contained due to the already available

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

financial cushions of these firms. Expected credit loss (ECL) estimates suggest an incremental increase of Rs 55 billion at the highest tax level of US$ 50/tCO_2 from pre-shock ECL of Rs 61 billion **(Figure 4.1.2)**.[22] Given the large capital base of the sector, this is expected to have a negligible impact on the solvency of banking sector. Nonetheless, pockets of vulnerability exist in sectors with higher emission intensities, which may require enhanced due diligence from the banks along with careful calibration of the carbon tax policy by the government.

Impact of Carbon Tax on Interest Coverage Ratio:

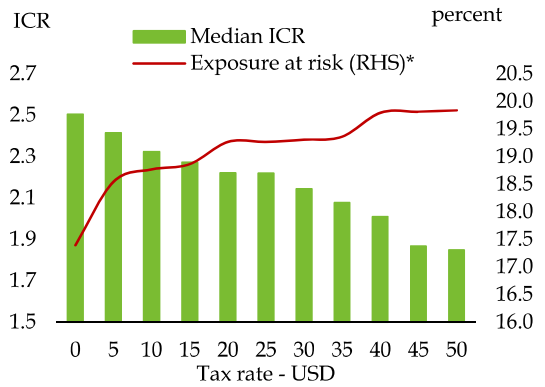
A PD-based model has the limitation of reliance on multitude of factors, in particular, the historically low delinquency rates and strong financial cushions, which are strong enough to dampen the aggregated impact of carbon tax on the PDs. To isolate the impact of carbon tax on the debt repayment capacity of corporates, Interest Coverage Ratio (ICR) of firms at different carbon tax levels is analyzed. ICR is a financial metric that is calculated as:

$$ICR = \frac{Earnings\ before\ interest\ and\ taxes\ (EBIT)}{Interest\ Expense}$$

ICR measures the extent the EBIT of a firm can cover its interest expense. Generally, a higher ratio implies that a firm is in better position to repay its interest obligations and vice versa. ICR value above two is considered safer and reflects the ability of a firm to pay its interest expense more than twice with its earnings. On other hand, ICR below two (2) is considered risky, while a value below one (1) shows the inability of a company's earnings to cover its interest expense.

Based on annual financial statement data of 2023,[23] median ICR of listed NFCs is 2.51 times (2.51X). Lower pre-tax ICR is attributed to historically high interest rates that prevailed during CY23, substantially raising the interest expense of firms. With the imposition of carbon tax, median ICR falls to 2.2X at a rate of US$ 25/tCO_2 and further to 1.85X at the highest tax level of US$ 50/tCO_2. Decline in median ICR at higher tax rates suggest increased vulnerability of firms with higher emission intensities to transition risk. Pre-shock, outstanding exposure of corporates with debt at risk (ICR<2) to total private sector credit is 17.4 percent, which may rise by 244 bps to 19.8 percent at the highest tax level of US$ 50/tCO_2 **(Figure 4.1.3),** indicating that this level of carbon-tax shock to the firms' earning may involve some financial stability concerns.

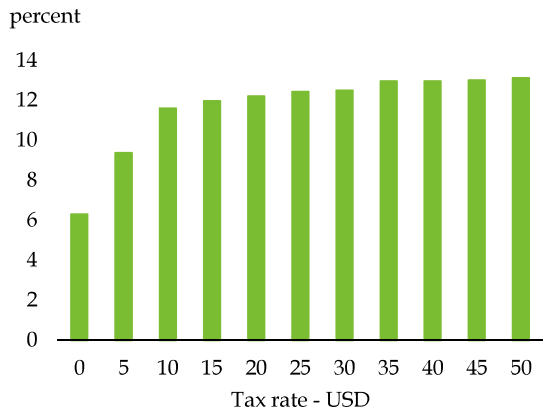
Median ICR **Figure 4.1.3**



* Exposure of firms with ICR<2 to private sector credit
Source: SBP staff estimates

Assuming that ICR below 1 is a critical level, it is estimated that after shock, the non-performing loans ratio (NPLR) may increase from the current level of 6.3 percent to 12.4 percent at carbon tax of US$ 25/tCO_2 and further to 13.1 percent at the level of US$ 50/tCO_2 **(Figure 4.1.4)**. This suggests that the banking sector has significant number of borrowers with higher emission intensity and relatively weaker debt repayment capacity to absorb the shock. Sectoral analysis

Non Performing Loans Ratio **Figure 4.1.4**



Source: SBP staff estimates

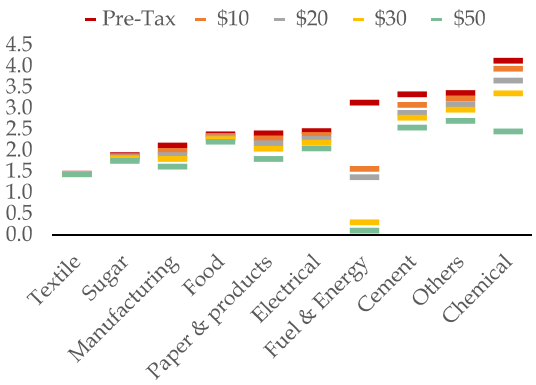
[22] ECL is calculate as PD x LGD x EAD. Loss given default (LGD) is proxied with provision coverage ratio, whereas exposure at default (EAD) is the outstanding exposure of the firm, sourced from SBP credit registry.
[23] Source: Financial Statements Analysis (Non-financial Companies) Listed on Pakistan Stock Exchange

further shows that firms operating in fuel & energy, cement and chemical sectors face the most decline in their post-shock median ICR, accentuating their vulnerability to transition. **(Figure 4.1.5)**

Estimates are based on assumption that the firms fully absorb the carbon tax levied on their emissions. However, in practice, output prices, quantities, production processes and inputs would all adjust to the 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.

From a financial stability perspective, the analysis provides some evidence that listed non-financial firms, which are the major user of bank credit in Pakistan, may face financial challenges in the face of imposition of carbon tax. This will likely affect the riskiness of credit exposure of the banking system with implications for its solvency. Therefore, policies driving the country's transition towards a low carbon economy will need to be designed carefully to ensure a smooth transition.

Sector-wise ICR **Figure 4.1.5**



Source: State Bank of Pakistan