Are Basel III requirements up to the task? Evidence from bankruptcy prediction models

Additional results

April 2024

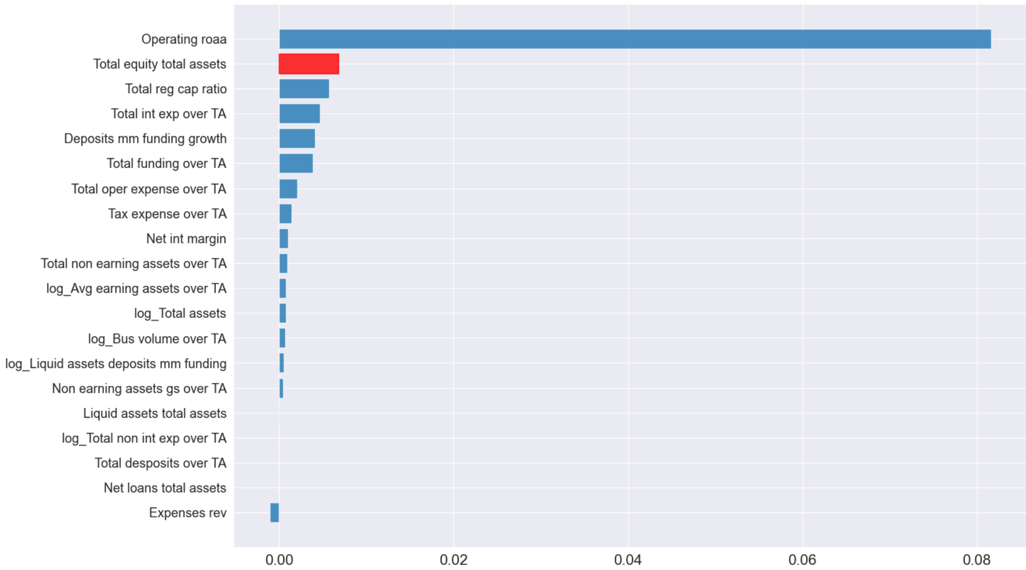
This document provides additional results to support the main results presented in the paper. In particular, results are presented for GBC and HGBC, which are the models that perform best alongside with RF and Logit (see Table 2, section 5.1. of the main document).

1 Determinants of bank default

1.1 Permutation feature importance

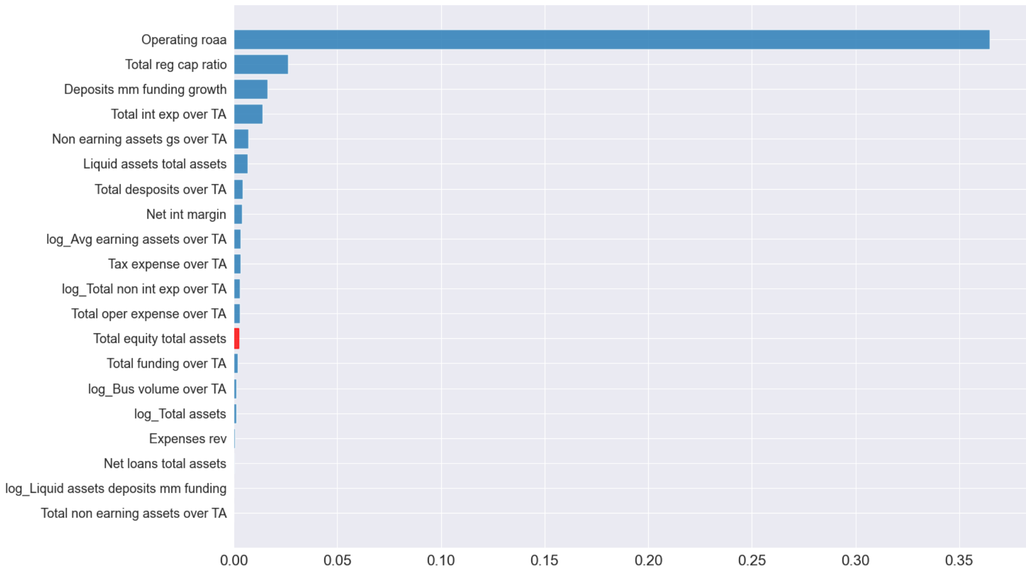
In the main document, total regulatory capital ratio (TRCR) and total equity over total assets (TE/TA) are identified as significant predictors of default in the RF model thanks to permutation feature importance. On the contrary, liquid assets over total assets (LA/TA) is not identified as a strong predictor. This result allows to conclude that capital (TE/TA and/or TRCR) is a greater predictor of default than liquidity. Results are here presented for GBC (Figure 1) and HGBC (Figure 2). The idea that capital is a stronger predictor of default than liquidity is corroborated by these figures: capital is always a stronger predictor of default than liquidity. We however notice that it is not possible to conclude, from these figures, which of TE/TA and TRCR is the strongest predictor.

Figure 1: Permutation feature importance (GBC)



Source: Authors' calculations.

Figure 2: Permutation feature importance (HGBC)



Source: Authors' calculations.

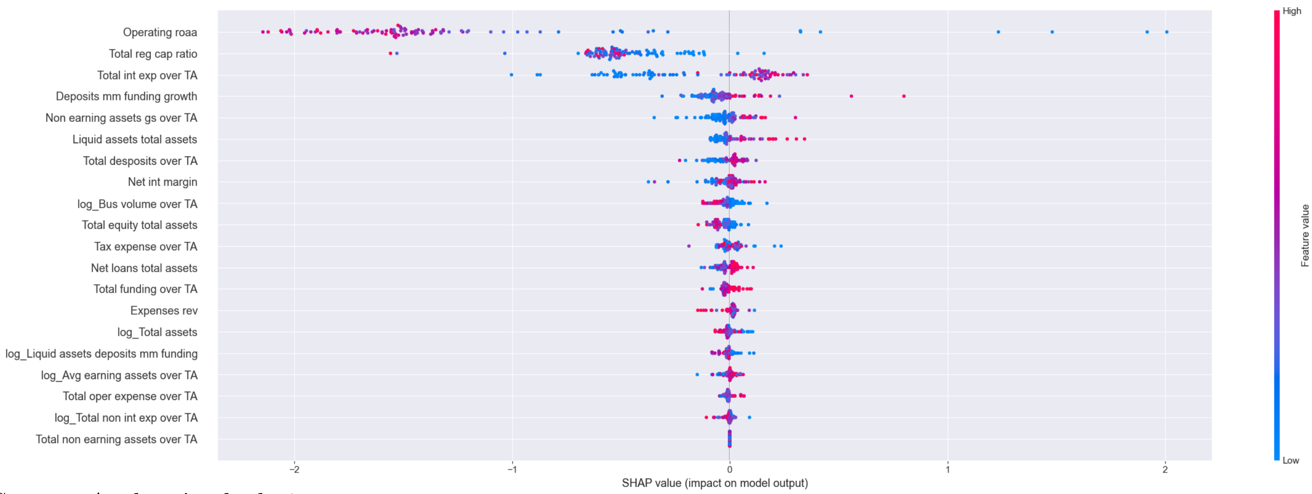
1.2 Shapley values

In the main document, Shapley values are used to assess the significance and the nature of the impact of the various predictors on the probability of default. In particular, from Shapley values, we conclude that both TRCR and TE/TA have a significant and negative impact on the probability of default, while the impact of LA/TA is less significant and ambiguous. Shapley values are here presented for GBC (Figure 3) and HGBC (Figure 4). These results are consistent with those of RF.

Figure 3: Shapley values (GBC)

Source: Authors' calculations.

Figure 4: Shapley values (HGBC)



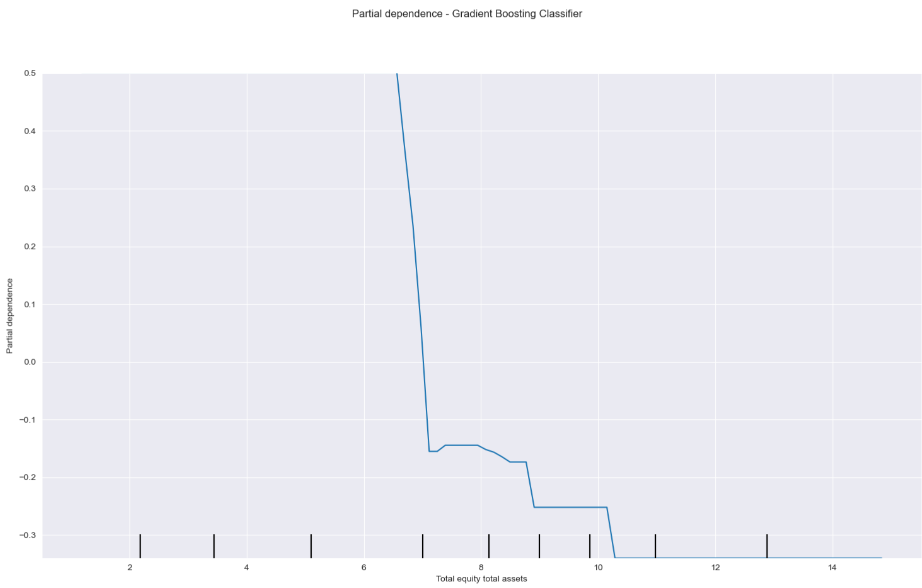
Source: Authors' calculations.

2 Optimal capital ratio

2.1 Partial dependent plots (PDPs)

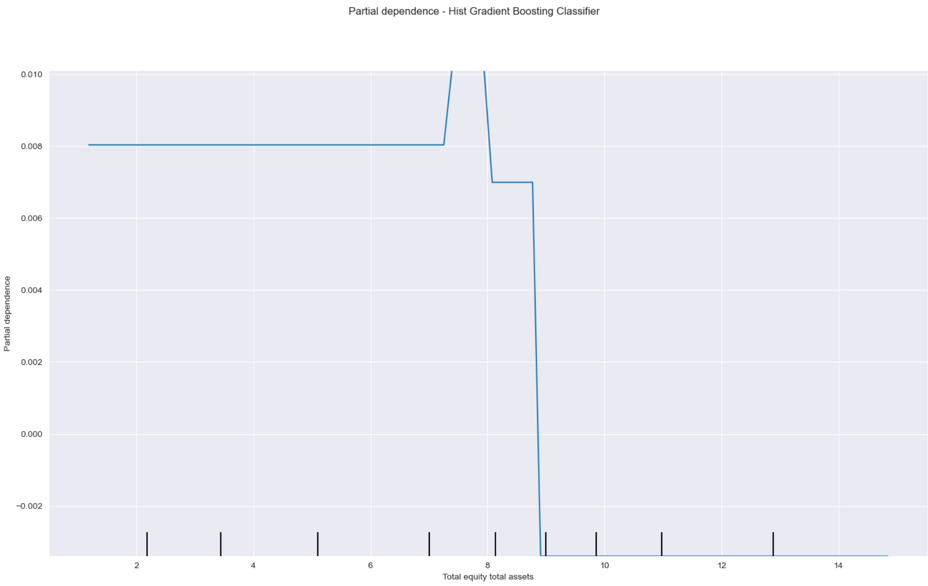
In the main document, PDPs are used to assess the nature of the impact of TE/TA and that of TRCR on the probability of default. Both predictors have a non-linear impact on the probability of default which allows to identify threshold values of TE/TA and TRCR such that below them the probability of default is large and above them the probability of default is low. Results are here presented for GBC (Figures 5 and 7) and HGBC (Figures 6 and 8). Figures 5 and 6 suggest that the impact of TE/TA on the the probability of default is indeed non-linear and that the threshold value of 10 is consistent. Similarly, Figures 7 and 8 corroborate the results presented in the main document concerning the impact of TRCR on the probability of default.

Figure 5: Partial Dependence Plots (PDPs) – TE/TA – GBC



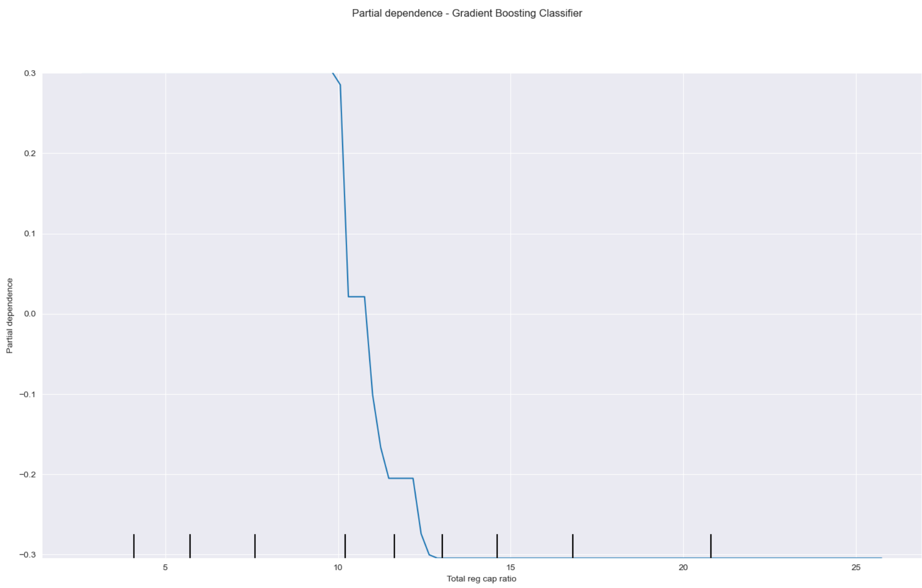
Source: Authors' calculations.

Figure 6: Partial Dependence Plots (PDPs) – TE/TA – HGBC



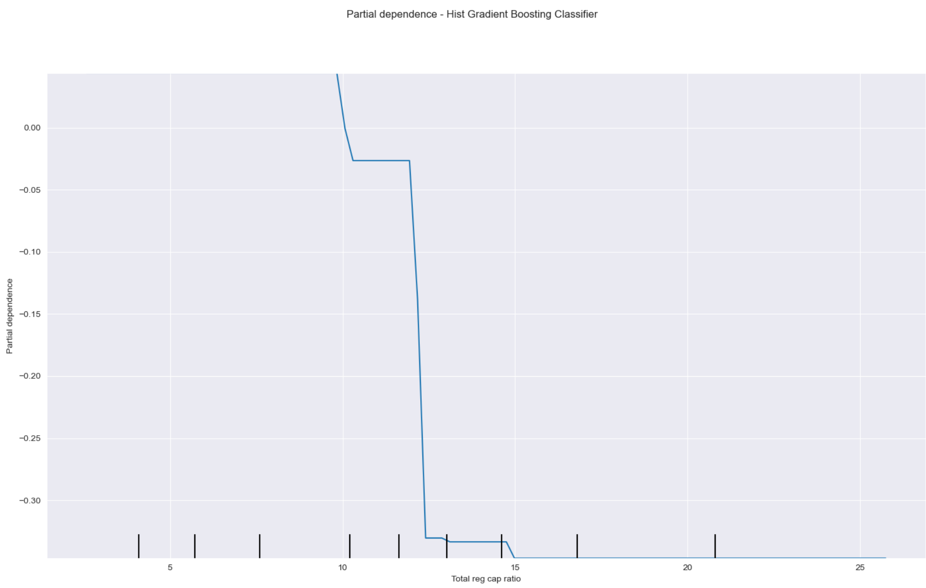
Source: Authors' calculations.

Figure 7: Partial Dependence Plots (PDPs) – TRCR – GBC



Source: Authors' calculations.

Figure 8: Partial Dependence Plots (PDPs) – TRCR – HGBC

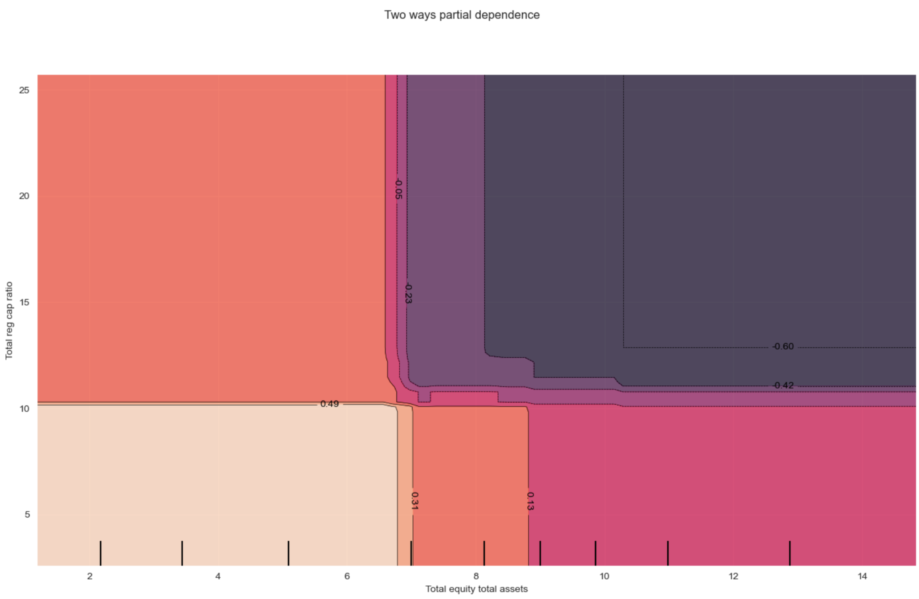


Source: Authors' calculations.

2.2 Two-way PDPs

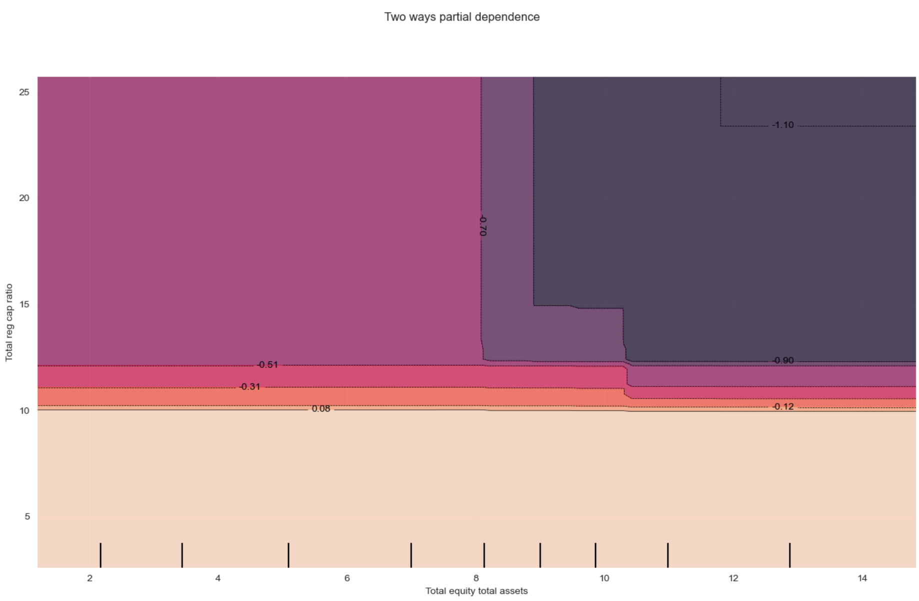
In the main document, two-way PDPs allow to study the impact of the interaction between TE/TA and TRCR on the probability of default. In particular, two-way PDPs allow to identify which values of these two variables allow to reach the space where the probability of default is the lowest. Two-way PDPs are here reported for GBC (Figure 9) and for HGBC (Figure 10). Consistently with the conclusion reached in the main document based on RF, we notice that the probability of default is the lowest when TRCR is above 15 and TE/TA above 10.

Figure 9: Two-way Partial Dependence Plots (PDPs) between TE/TA and TRCR – GBC



Source: Authors' calculations.

Figure 10: Two-way Partial Dependence Plots (PDPs) between TE/TA and TRCR – HGBC

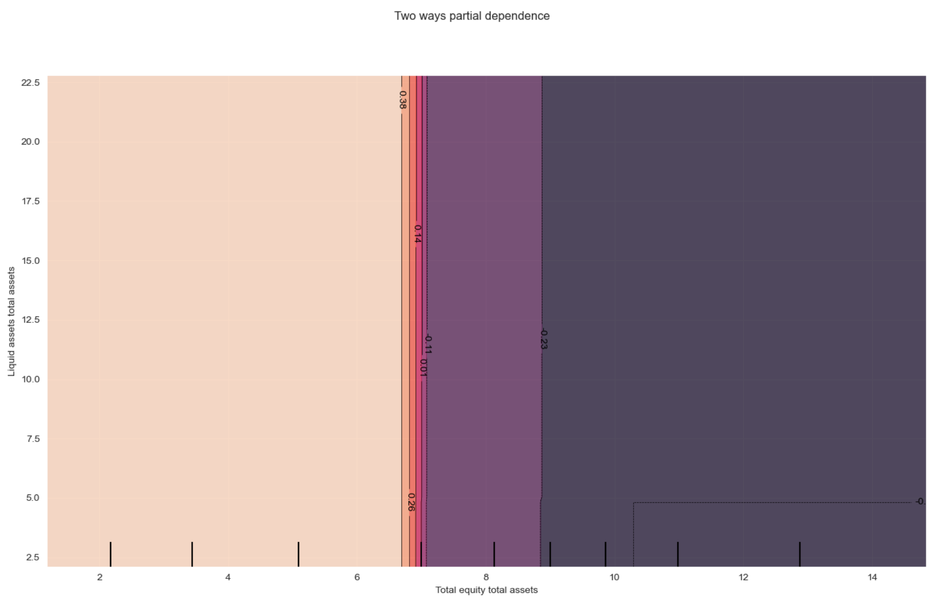


Source: Authors' calculations.

3 Interaction between liquidity and solvency risks

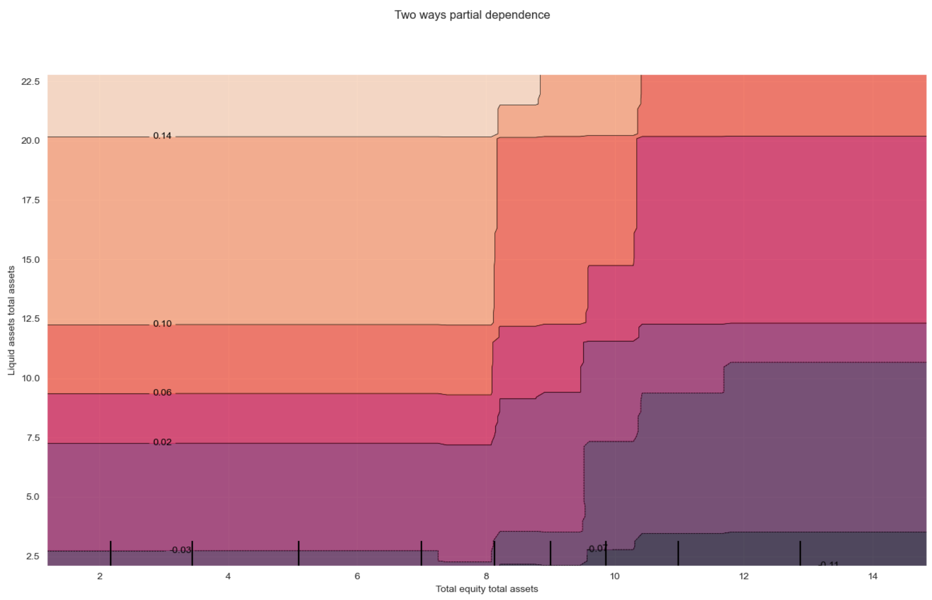
In the main document, we study the impact of the interaction between capital variables (TE/TA and TRCR) and LA/TA. We conclude that, most of the times, the impact of this interaction on the probability of default is driven by the variable accounting for capital. This idea is supported by results coming from GBC and HGBC. In particular, Figures 11, 13 and 14 unambiguously outline that the impact of the interaction between capital and liquidity on the probability of default is driven by the variable accounting for capital. Figure 12 qualifies this result. However, recalling that TE/TA is not a significant predictor of default according to HGBC (see Figures 2 and 4 above), interpretations coming from the reading of PDPs when TE/TA is considered need to be done cautiously.

Figure 11: Two-way Partial Dependence Plots (PDPs) – TE/TA and LA/TA – GBC



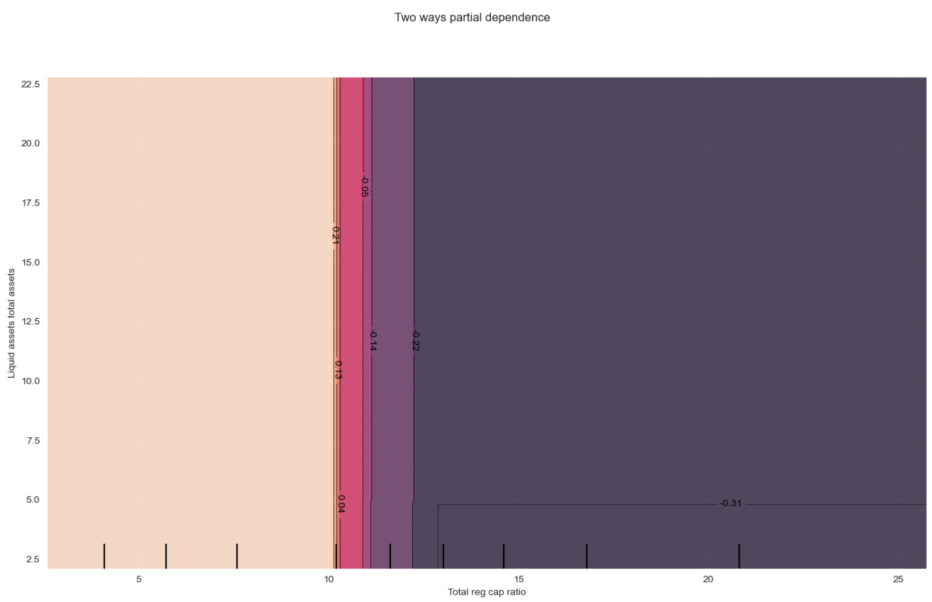
Source: Authors' calculations.

Figure 12: Two-way Partial Dependence Plots (PDPs) – TE/TA and LA/TA – HGBC



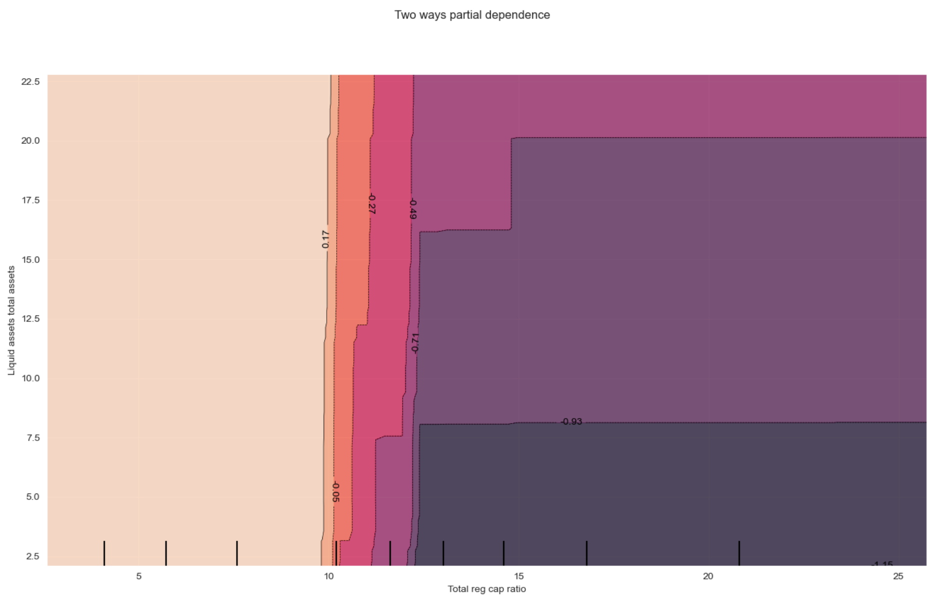
Source: Authors' calculations.

Figure 13: Two-way Partial Dependence Plots (PDPs) – TRCR and LA/TA – GBC



Source: Authors' calculations.

Figure 14: Two-way Partial Dependence Plots (PDPs) – TRCR and LA/TA – HGBC



Source: Authors' calculations.