# Deep Learning for Survival and Competing Risk Modelling - Online Companion

### Overview of the online companion

The online companion offers detailed empirical results from the experiments that are not included in the main body of the paper. Interested readers might find these results useful to obtain an even better and more detailed understanding of the relative performance of the competing risk models tested in the main body of the paper.

More specifically, **Appendix A** provides further information of the data employed in the study. It also provides a more detailed description of the experimental design and its implementations to facilitate replication of the study.

**Appendix B** elaborates on our approach to tune algorithmic meta-parameters for machine learning models and reports empirical results for the candidate parameter settings what we obtained from grid-search and random search.

**Appendix C** further elaborates on the estimation of variable importance for dataset 2, which, in the interest of brevity, was not discussed in depth in the main paper.

**Appendix D** focuses on confirming the robustness of the analysis and facilitating replication. To that end, it offers micro-level results of individual cross-validation samples.

**Appendix E** revisits the proposed approach to extract feature importance scores from DHT. We examine the sensitivity of the approach with respect to the way in which features are corrupted by random noise.

Finally, **Appendix F** examines the effect of class imbalance on survival models. To verify the robustness of our findings, we rerun selected experiments after remedying class imbalance using the SMOTE algorithm (Chawla, Bowyer, Hall, & Kegelmeyer, 2002)

# Appendix A: Programming environment, experimental design and data

To implement **DeepHit**, we use the Python code provided by Lee et al. (2018) via Github[1]. Our experimental design required sizeable adjustments and extensions of that code, which are available online[2]. We run experiments with **DeepHit** using **Google Colab** and a **Tensorflow** backend. For the benchmark models, we use the R environment and run all experiments on a Microsoft Surface 2 Laptop. We use the **riskRegression**-package for estimating cause-specific Cox models and the Fine-Gray models and train random survival forests using the **randomForestSRC**-package. To obtain feature importance scores of the random survival forest, we use the **ggRandomForests**-package. Furthermore, we use the **pec-package** to calculate the time-dependent concordance index. Since we consider two different programming environments, it is crucial to ensure that model results are comparable. We achieve this through first creating data samples in R and then importing these samples into Colab. To further ensure that the same training and testing splits are used for all samples among both programming environments, we set a random number seed using **scikit-learn's train_test_split** function. We extract the resulting sequences of indices (random integer numbers) for the training and test set and use these for data partitioning in R and Python.

To perform the experiments, the dataset from 1999 to 2009 was first split into a before-crisis dataset capturing the time from 1999 to 2006 and a crisis dataset containing all instances from 2009. Then, 13 samples were drawn without replacement from the before-crisis dataset, each containing 10,000 observations. The first sample was used for hyperparameter tuning of the machine learning models.[3] The subsequent ten samples were used to implement Exp. 1.1, Exp. 1.2, Exp. 1.3, and Exp. 2 from Analysis 1, while the last two of the 13 samples were used for Exp. 3 and Analysis 2, respectively. To implement Exp. 3, the respective sample was further divided into ten subsets, each consisting of 1,000 instances. For the implementation of Exp. 2, one additional sample containing 10,000 instances was drawn without replacement from the crisis dataset.

For the implementation of Exp. 4.1, Exp. 4.2, and Exp. 4.3, samples were drawn from the dataset capturing loans from 2010 to 2017. Due to the low portion of defaulted loans in this subset, one sample with the size of 10,000 instances would only contain few defaulted instances, which would not allow computing the concordance index at the time points of interest in many cases. To circumvent this problem, Dataset 2 was first split into a default and non-default dataset. Each sample was then constructed by adding a sample drawn without replacement and containing 100 instances from the default subset to a sample drawn without replacement and containing 9,900 instances from the non-default dataset. Thereby, the portion of defaulted loans was increased to 1% for each sample. By sampling without replacement, we ensured that no instance could be leaked into the test sets, which were later created for each sample. Yet, different to the previous experiments, one instance could be contained by more than one sample in Exp. 4.1, 4.2, and 4.3, which, however, does not affect the validity of the results. Due to the previously described structural break, it was

[1] https://github.com/chl8856/DeepHit
[2] We are still working on simplifying the code to ease replication. A URL to the Jupyter notebook will be inserted into the final version of the paper.
[3] See Appendix B for the documentation of the hyperparameter tuning results.

reasonable to reimplement hyperparameter tuning for the two machine learning models. Again, results are documented in Appendix B.

Based on the obtained samples, the models were trained based on 80% of each sample and performance was evaluated using the remaining 20%.[4] More specifically, performance was measured by calculating the concordance index at 24, 48, and 72 months after loan issuance for each event type. Based on these values, the cause-specific and total mean values of the concordance index were calculated for each sample. To obtain the final result for each model within each experiment, all results were averaged across the ten sample-specific results. Furthermore, based on the sample-specific values of the average concordance index, pairwise unequal variances t-tests were performed to assess whether the performance increase of the DeepHit model compared to the respective benchmark model was statistically significant.[5]

To perform the three experiments of Analysis 2, a DeepHit model was again first trained based on 80% of the respective sample and performance was measured using the remaining 20%. As in Analysis 1, performance was measured by calculating the concordance index at 24, 48, and 72 months after loan issuance for both event types and determining their cause-specific and total mean values. After that, a noise term containing values drawn from a normal distribution $\mathcal{N}(0, \sigma^2)$ was subsequently added to each variable within the test set, and performance was again recorded by applying the previously trained model on the noised-up dataset. Thereby, previously noised-up variables were restored back to their original values when examining the subsequent variable.

Based on the obtained values, differences between the performances when using the noise-free test set and the noised-up test set were calculated. After that, variables were ranked according to their estimated importance based on these differences. Thereby, a variable was considered as increasingly important, the higher the observed performance drop was. The entire procedure was then repeated by implementing different standard deviations for the noise term. More specifically, the standard deviation was iteratively set to $0.5$, $1$, $2$, $5$, and $10$. This was done to later assess the robustness of the proposed method. To assess the similarity between two variable importance estimates, ranking correlation in terms of Spearman's $\rho$ was calculated.

To further compare the obtained results with those from another model, variable importance was additionally estimated by using a random survival forest and the respective method described in Section 2.6 of the main paper. As event-specific variable importance estimates are calculated in this case, DeepHit rankings according to the average $C_1$- and $C_2$-index were used for comparison with the random survival forest. Again, Spearman's $\rho$ was calculated to measure the similarity between two variable importance rankings.

[4] One exception was made for Experiment 2. Here, the sample from the crisis dataset, which consists of 10,000 instances, was used as the test set.

[5] One problem that occurred throughout the experiments of Analysis 1 except for Experiment 4.1 was the fact that the implementation of the two statistical benchmark models returned error messages caused by high correlations among some explanatory variables. This problem was solved by manually excluding variables that caused the problem. Yet, we decided to still include these variables for the machine learning models, as the results would otherwise not reflect the advantage of machine learning models being able to handle imperfect multicollinearity autonomously. Furthermore, we still assume comparability between the models, as the exclusion of a variable that is highly correlated with another variable should not lead to a significant loss of information for the respective model.

*Table 1: Distribution of event occurrences and censoring instances over time*

| Year | Censored | Prepayment | Default |
|---|---|---|---|
| 1999 | 1.5% | 97.1% | 1.4% |
| 2000 | 0.8% | 97.7% | 1.5% |
| 2001 | 1.7% | 96.6% | 1.7% |
| 2002 | 3.2% | 94.7% | 2.1% |
| 2003 | 6.8% | 90.6% | 2.5% |
| 2004 | 8.0% | 87.7% | 4.3% |
| 2005 | 8.8% | 84.9% | 6.3% |
| 2006 | 7.4% | 83.6% | 8.9% |
| 2007 | 8.6% | 81.3% | 10.1% |
| 2008 | 7.9% | 86.8% | 5.3% |
| 2009 | 15.4% | 83.9% | 0.7% |
| 2010 | 25.0% | 74.6% | 0.4% |
| 2011 | 32.9% | 66.9% | 0.2% |
| 2012 | 56.8% | 43.1% | 0.1% |
| 2013 | 59.5% | 40.5% | 0.1% |
| 2014 | 54.7% | 45.2% | 0.1% |
| 2015 | 70.9% | 29.1% | 0.1% |
| 2016 | 83.8% | 16.2% | 0.0% |
| 2017 | 90.8% | 9.2% | 0.0% |

As our dataset consists of random samples from the population of all loans published by Freddie Mac, slight deviations from the recorded values might be apparent in our data.

*Table 2: Experiment overview*

<table>
<tr><th>Analysis</th><th>Purpose of the analysis</th><th>Experiment</th><th>Purpose of the experiment</th></tr>
<tr><td rowspan="8">Analysis 1</td><td rowspan="8">Compare model performances under different experiment settings</td><td>Experiment 1.1:<br>Training and testing models using loan-level variables</td><td rowspan="3">Compare model performances under different variable settings</td></tr>
<tr><td>Experiment 1.2:<br>Training and testing models using macroeconomic variables</td></tr>
<tr><td>Experiment 1.3:<br>Training and testing models using all available variables</td></tr>
<tr><td>Experiment 2:<br>Reimplementing Experiment 1.2, yet using the crisis dataset for out-of-time validation</td><td>Compare model performances when models are exposed to unusual conditions for predictions</td></tr>
<tr><td>Experiment 3:<br>Reimplementing Experiment 1.1, yet using decreased sample sizes</td><td>Compare model performances when data is scarce</td></tr>
<tr><td>Experiment 4.1:<br>Reimplementing Experiment 1.1, yet using more recent data</td><td rowspan="3">Validate results from the first three experiments based on a more recent dataset</td></tr>
<tr><td>Experiment 4.2:<br>Reimplementing Experiment 1.2, yet using more recent data</td></tr>
<tr><td>Experiment 4.3:<br>Reimplementing Experiment 1.3, yet using more recent data</td></tr>
<tr><td rowspan="3">Analysis 2</td><td rowspan="3">Implement the proposed method of estimating variable importance with DeepHit</td><td>Experiment A:<br>Estimating variable importance for loan-level variables</td><td rowspan="3">Perform variable importance analysis under different variable settings</td></tr>
<tr><td>Experiment B:<br>Estimating variable importance for macroeconomic variables</td></tr>
<tr><td>Experiment C:<br>Estimating variable importance for all available variables simultaneously</td></tr>
</table>

# Appendix B: Hyperparameter tuning for machine learning models

To find the optimal hyperparameters for the random survival forests, the respective tuning dataset of Dataset 1 and Dataset 2 was used with all available variables. More specifically, random survival forests with different hyperparameters were trained on 80% of the respective tuning data and tested on the remaining 20% by recording the out-of-sample average concordance index.[6]

Three hyperparameters were considered via a grid search: With `mtry`, the number of variables randomly selected as candidate variables for each split is adjusted. Thereby, the default value for a competing risk setting in the `randomForestSRC`-package is the rounded-up square root of the number of explanatory variables, which is equal to $5$ in our setting. To include higher and lower values than the default value, we tested the values $2$, $5$, and $10$.

The second hyperparameter of interest is `nodesize`, which denotes the average number of data points in a terminal node. While $15$ is the default value for a competing risk setting, we tested the values $6$, $15$, and $30$. With `ntree`, one determines the number of trees grown in one forest, which was set to $50$, $100$, and $200$, leading to 27 possible combinations of all three hyperparameters.

The best result[7] according to the chosen criterion was then obtained with the hyperparameter values $\texttt{mtry} = 2$, $\texttt{nodesize} = 30$, and $\texttt{ntree} = 100$ for both Dataset 1 and Dataset 2. These values were then implemented for all random survival forests of this study. Detailed results for all hyperparameter combinations can be found in Table 3 and Table 4 below.

Due to the number of possible hyperparameter combinations being significantly higher for the DeepHit model, a random search was implemented instead of a grid search by testing out 30 randomly chosen hyperparameter combinations. Thereby, the combinations were obtained by randomly selecting one value from a previously defined set of possible values for each hyperparameter. Again, the same 80% of the respective tuning data was used for testing and the remaining 20% was used to record the out-of-sample average concordance index.

Six hyperparameters were considered for the random search. For `h_dim_SH` and `h_dim_CS`, which denote the number of nodes for each hidden layer in the shared subnetwork and cause-specific subnetworks, respectively, values were randomly drawn from the set $\{50, 100, 200, 300\}$. Analogously, the parameters `n_lrs_SH` and `n_lrs_CS` denote the number of fully connected layers in the shared and cause-specific subnetworks and could take one value out of the set $\{1, 2, 3, 5\}$ activation function used for all nodes was either set to $relu$ or to $tanh$ via the `act_fn`-parameter. Lastly, the weighting factor for the ranking loss component in the DeepHit loss function, $\beta$, was alternated by randomly choosing one value

[6] Similar to the experiments, the average concordance index was calculated by $\emptyset C = [C_1(24) + C_1(48) + C_1(72) + C_2(24) + C_2(48) + C_2(72)]/6$.

[7] Note that the result could be considered as a further data point for Experiment 1.3, as the exact same setting was used.

out of $\{0.1, 0.5, 1, 3, 5\}$ for the `beta`-parameter. All results of the hyperparameter tuning for both data subsets are documented in Table 5 and Table 6 below. Thereby, the best result was obtained with `h_dim_SH` $= 300$, `h_dim_CS` $= 200$, `n_lrs_SH` $= 3$, `n_lrs_CS` $= 5$, `act_fn` $= relu$, and `beta` $= 5$ for Dataset 1 and with `h_dim_SH` $= 300$, `h_dim_CS` $= 100$, `n_lrs_SH` $= 1$, `n_lrs_CS` $= 3$, `act_fn` $= relu$, and `beta` $= 1$ for Dataset 2. Again, these values were implemented for all subsequent DeepHit models in this study, depending on whether samples from Dataset 1 or Dataset 2 were used for the respective experiment.

Besides these tested hyperparameters, some further neural network-related adjustments were performed manually. More specifically, the Adaptive Moment Estimation (Adam) optimizer was implemented for all networks, using a learning rate of $10^{-4}$. Furthermore, $3000$ iterations were performed to train one model, thereby using a batch size of $128$ instances for each iteration.[8] Figure 1 below shows different cross-validated $\emptyset C$-indexes when implementing different numbers of iterations, using the optimal hyperparameters and all available variables of the hyperparameter tuning subset from Dataset 1. To initialize all network parameters before training, Xavier initialization was used and dropout was implemented for all nodes of the network, using a dropout probability of 60%. Furthermore, all variables were normalized to a mean of zero and a standard deviation of one before training the network.

One particularly interesting observation made during hyperparameter tuning of the DeepHit model was the fact that most high-ranked models used high beta values for their loss functions, while lower beta values were observed for low-ranked models. This observation was more pronounced for Dataset 1 than for Dataset 2. Although increasing the weight on the ranking loss component of the loss function appears to improve model performance, this result should be treated with caution. More specifically, the fact that the ranking loss component utilizes the same concept of concordance as the implemented performance measure might have led to overfitting towards the used performance measure. Furthermore, due to implementing a random search, values are not necessarily occurring independently from each other. In other words, the occurrence of specific values in high-ranked models of one parameter might be apparent due to another parameter that has caused the effect and whose occurrence coincidentally correlated with the other parameter.

[8] To adjust to the decreased sample size, the iteration was decreased to 1500 in Experiment 3. Furthermore, the iteration was decreased to 1000 for Experiment 4.2, as pronounced overfitting occurred when implementing 3000 iterations.

*Table 3: Hyperparameter tuning for random survival forests (Dataset 1)*

| Ranking | `mtry` | `nodesize` | `ntree` | $\emptyset C$ |
|---|---|---|---|---|
| 1 | 2 | 30 | 100 | 91.55 |
| 2 | 2 | 30 | 200 | 91.53 |
| 3 | 5 | 30 | 200 | 91.45 |
| 4 | 2 | 30 | 50 | 91.28 |
| 5 | 5 | 30 | 50 | 91.26 |
| 6 | 5 | 15 | 200 | 91.20 |
| 7 | 2 | 15 | 200 | 91.20 |
| 8 | 5 | 30 | 100 | 91.13 |
| 9 | 2 | 15 | 100 | 91.05 |
| 10 | 2 | 15 | 50 | 90.62 |
| 11 | 2 | 6 | 200 | 90.48 |
| 12 | 5 | 15 | 100 | 90.22 |
| 13 | 2 | 6 | 100 | 89.91 |
| 14 | 2 | 6 | 50 | 89.81 |
| 15 | 10 | 30 | 100 | 89.78 |
| 16 | 10 | 30 | 200 | 89.67 |
| 17 | 5 | 6 | 200 | 89.66 |
| 18 | 5 | 15 | 50 | 89.40 |
| 19 | 10 | 15 | 200 | 89.12 |
| 20 | 10 | 15 | 100 | 89.07 |
| 21 | 5 | 6 | 100 | 89.02 |
| 22 | 5 | 6 | 50 | 88.79 |
| 23 | 10 | 30 | 50 | 88.76 |
| 24 | 10 | 15 | 50 | 88.73 |
| 25 | 10 | 6 | 200 | 88.64 |
| 26 | 10 | 6 | 100 | 88.26 |
| 27 | 10 | 6 | 50 | 87.65 |

*Table 4: Hyperparameter tuning for random survival forests (Dataset 2)*

| Ranking | `mtry` | `nodesize` | `ntree` | $\emptyset C$ |
|---|---|---|---|---|
| 1 | 2 | 30 | 100 | 93.57 |
| 2 | 2 | 30 | 200 | 93.19 |
| 3 | 2 | 6 | 200 | 93.06 |
| 4 | 2 | 6 | 100 | 92.85 |
| 5 | 2 | 15 | 200 | 92.84 |
| 6 | 2 | 30 | 50 | 92.78 |
| 7 | 2 | 15 | 100 | 92.55 |
| 8 | 2 | 15 | 50 | 92.45 |
| 9 | 5 | 30 | 100 | 92.34 |
| 10 | 5 | 30 | 50 | 92.29 |
| 11 | 5 | 30 | 200 | 92.24 |
| 12 | 5 | 15 | 100 | 91.88 |
| 13 | 5 | 15 | 200 | 91.86 |
| 14 | 5 | 15 | 50 | 91.73 |
| 15 | 5 | 6 | 200 | 91.68 |
| 16 | 10 | 30 | 50 | 91.29 |
| 17 | 5 | 6 | 100 | 91.14 |
| 18 | 10 | 30 | 200 | 91.12 |
| 19 | 10 | 15 | 200 | 91.10 |
| 20 | 10 | 6 | 200 | 90.99 |
| 21 | 10 | 30 | 100 | 90.97 |
| 22 | 10 | 15 | 100 | 90.90 |
| 23 | 10 | 6 | 50 | 90.71 |
| 24 | 10 | 15 | 50 | 90.64 |
| 25 | 10 | 6 | 100 | 90.46 |
| 26 | 2 | 6 | 50 | 89.93 |
| 27 | 5 | 6 | 50 | 88.95 |

*Table 5: Hyperparameter tuning for DeepHit (Dataset 1)*

| Ranking | h_dim_SH | h_dim_CS | n_lrs_SH | n_lrs_CS | act_fn | beta | ØC |
|---|---|---|---|---|---|---|---|
| 1 | 300 | 200 | 3 | 5 | relu | 5 | 96.88 |
| 2 | 100 | 100 | 1 | 3 | relu | 3 | 96.02 |
| 3 | 200 | 50 | 5 | 2 | relu | 3 | 95.34 |
| 4 | 100 | 100 | 2 | 3 | relu | 1 | 94.06 |
| 5 | 100 | 300 | 1 | 1 | relu | 1 | 93.90 |
| 6 | 200 | 300 | 5 | 5 | relu | 1 | 93.80 |
| 7 | 100 | 100 | 1 | 2 | tanh | 1 | 93.74 |
| 8 | 200 | 50 | 5 | 3 | relu | 3 | 93.52 |
| 9 | 100 | 50 | 5 | 1 | tanh | 1 | 93.49 |
| 10 | 50 | 50 | 2 | 3 | tanh | 1 | 93.49 |
| 11 | 200 | 50 | 5 | 3 | tanh | 3 | 93.33 |
| 12 | 50 | 50 | 3 | 2 | tanh | 1 | 93.21 |
| 13 | 200 | 200 | 2 | 3 | tanh | 5 | 93.03 |
| 14 | 200 | 100 | 2 | 1 | relu | 3 | 92.80 |
| 15 | 300 | 300 | 5 | 2 | relu | 0.5 | 92.51 |
| 16 | 300 | 50 | 1 | 3 | relu | 0.1 | 92.50 |
| 17 | 50 | 300 | 2 | 1 | relu | 1 | 92.44 |
| 18 | 300 | 300 | 1 | 1 | relu | 0.5 | 92.26 |
| 19 | 200 | 300 | 5 | 1 | relu | 0.1 | 91.68 |
| 20 | 50 | 300 | 5 | 1 | relu | 0.5 | 91.35 |
| 21 | 100 | 100 | 3 | 2 | relu | 0.1 | 91.24 |
| 22 | 100 | 50 | 2 | 5 | relu | 5 | 90.97 |
| 23 | 50 | 50 | 2 | 3 | tanh | 0.1 | 90.02 |
| 24 | 100 | 50 | 2 | 5 | tanh | 1 | 89.65 |
| 25 | 100 | 200 | 3 | 5 | tanh | 0.5 | 89.62 |
| 26 | 100 | 100 | 3 | 1 | tanh | 0.1 | 89.59 |
| 27 | 100 | 50 | 5 | 5 | relu | 1 | 87.05 |
| 28 | 50 | 300 | 5 | 3 | tanh | 0.1 | 86.68 |
| 29 | 200 | 200 | 3 | 1 | tanh | 0.1 | 85.42 |
| 30 | 50 | 100 | 1 | 5 | tanh | 0.1 | 83.57 |

*Table 6: Hyperparameter tuning for DeepHit (Dataset 2)*

| Ranking | h_dim_SH | h_dim_CS | n_lrs_SH | n_lrs_CS | act_fn | beta | $\emptyset C$ |
|---|---|---|---|---|---|---|---|
| 1 | 300 | 100 | 1 | 3 | relu | 1 | 95.59 |
| 2 | 100 | 300 | 2 | 5 | relu | 3 | 94.73 |
| 3 | 50 | 100 | 1 | 1 | tanh | 5 | 94.69 |
| 4 | 100 | 300 | 1 | 3 | relu | 0.1 | 94.68 |
| 5 | 300 | 50 | 3 | 5 | relu | 0.1 | 94.61 |
| 6 | 200 | 50 | 2 | 1 | relu | 5 | 94.61 |
| 7 | 200 | 50 | 1 | 1 | relu | 5 | 94.48 |
| 8 | 300 | 200 | 5 | 1 | tanh | 5 | 94.48 |
| 9 | 300 | 300 | 3 | 2 | relu | 1 | 94.23 |
| 10 | 300 | 100 | 1 | 2 | tanh | 0.5 | 94.22 |
| 11 | 300 | 200 | 5 | 2 | tanh | 1 | 94.04 |
| 12 | 100 | 300 | 2 | 5 | tanh | 0.5 | 93.95 |
| 13 | 300 | 300 | 2 | 2 | tanh | 1 | 93.93 |
| 14 | 100 | 200 | 5 | 3 | relu | 0.5 | 93.92 |
| 15 | 200 | 50 | 2 | 3 | tanh | 1 | 93.77 |
| 16 | 50 | 300 | 3 | 1 | tanh | 3 | 93.61 |
| 17 | 100 | 50 | 2 | 5 | relu | 5 | 93.35 |
| 18 | 50 | 300 | 3 | 3 | tanh | 1 | 93.32 |
| 19 | 50 | 300 | 2 | 1 | relu | 1 | 93.17 |
| 20 | 200 | 50 | 2 | 5 | tanh | 0.5 | 93.04 |
| 21 | 200 | 300 | 3 | 5 | tanh | 0.5 | 92.86 |
| 22 | 100 | 200 | 5 | 1 | tanh | 0.5 | 92.83 |
| 23 | 100 | 300 | 3 | 1 | tanh | 0.1 | 92.47 |
| 24 | 300 | 100 | 5 | 3 | relu | 0.5 | 92.22 |
| 25 | 50 | 200 | 5 | 5 | relu | 0.5 | 92.09 |
| 26 | 50 | 50 | 2 | 1 | relu | 5 | 92.00 |
| 27 | 300 | 50 | 3 | 5 | relu | 1 | 91.96 |
| 28 | 100 | 50 | 2 | 5 | tanh | 0.5 | 91.44 |
| 29 | 50 | 100 | 3 | 3 | relu | 1 | 91.39 |
| 30 | 300 | 100 | 2 | 5 | tanh | 0.1 | 90.93 |

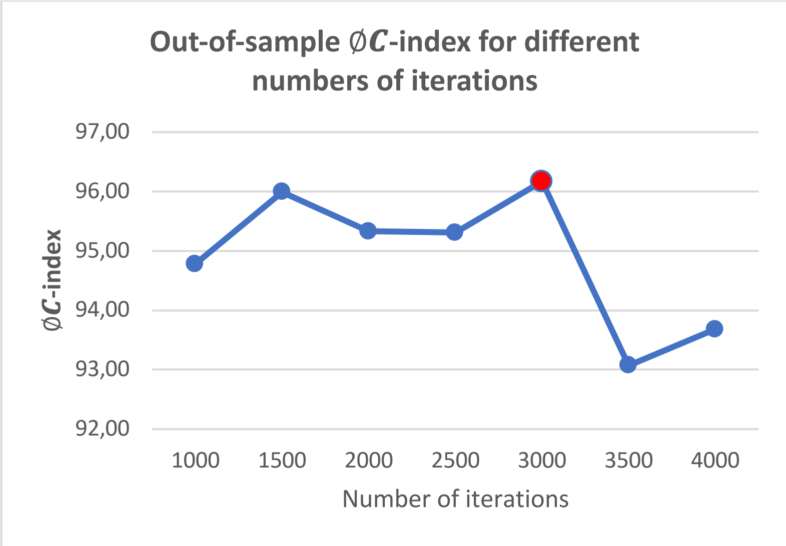


*Figure 1: Out-of-sample $\emptyset\boldsymbol{C}$-index for different numbers of iterations*

## Appendix C: Variable importance estimation for Dataset 2

To obtain variable importance estimates for Dataset 2, we draw a sample of 100 instances without replacement from the default subset and 9,900 loans without replacement from the non-default subset. Based on this sample, we implement Experiments D, E, and F analogously to Experiments A, B, and C from Dataset 1.[9] The variable importance estimates based on the $\emptyset C$-index can be found in Table 7 below. As also observed for Dataset 1, `bal.repaid`, `t.act.12m`, and house price index-related variables turned out to be the most predictive variables for Dataset 2.

To assess the extend to which estimates differ between Dataset 1 and Dataset 2 more accurately, we perform a sensitivity analysis by calculating the ranking correlation of the variable importance in terms of Spearman's $\rho$. As some macroeconomic variables are not available for Dataset 2, Experiments B and C were reimplemented based on the variables that are also available for Dataset 2. Detailed results of each experiment can be found from Table 9 - 14**Fout! Verwijzingsbron niet gevonden.** while Table 8 provides a higher-level summary. We observe small to medium positive correlations across pairs of experiments. The experiments A and D show the highest correlation. The effects of macro-economic variables, however, appear to differ in the periods before and after the financial crisis, which causes the correlations to decrease.

*Table 7: Variable importance estimates of DeepHit for Dataset 2*

*Experiment D*

| Variable | $\Delta\emptyset C$ | Rank |
|---|---|---|
| int.rate | -16.46 | 3 |
| orig.upb | -4.76 | 8 |
| fico.score | -3.84 | 9 |
| dti.r | -9.84 | 5 |
| ltv.r | -6.91 | 6 |
| bal.repaid | -33.36 | 2 |
| t.act.12m | -34.09 | 1 |
| t.del.30d.12m | -6.16 | 7 |
| t.del.60d.12m | -13.67 | 4 |

*Experiment E*

| Variable | $\Delta\emptyset C$ | Rank |
|---|---|---|
| hpi.st.d.t.o | -19.76 | 2 |
| ppi.c.FRMA | -15.27 | 4 |
| TB10Y.d.t.o | -13.45 | 8 |
| FRMA30Y.d.t.o | -21.57 | 1 |
| ppi.o.FRMA | -13.75 | 7 |
| hpi.r.st.us | -13.33 | 9 |
| st.unemp.r12m | -19.32 | 3 |
| st.unemp.r3m | -5.63 | 11 |
| TB10Y.r12m | -14.98 | 6 |
| T10Y3MM | -15.19 | 5 |
| T10Y3MM.r12m | -12.6 | 10 |

*Experiment F*

| Variable | $\Delta\emptyset C$ | Rank |
|---|---|---|
| int.rate | -32.39 | 3 |
| orig.upb | -3.83 | 19 |
| fico.score | -4.56 | 18 |
| dti.r | -6.41 | 14 |
| ltv.r | -5.44 | 15 |
| bal.repaid | -34.29 | 2 |
| t.act.12m | -26.18 | 6 |
| t.del.30d.12m | -5.21 | 16 |
| t.del.60d.12m | -13.71 | 9 |
| hpi.st.d.t.o | -37.45 | 1 |
| ppi.c.FRMA | -4.78 | 17 |
| TB10Y.d.t.o | -9.44 | 12 |
| FRMA30Y.d.t.o | -24.69 | 7 |
| ppi.o.FRMA | -30.57 | 4 |
| hpi.r.st.us | -18.91 | 8 |
| st.unemp.r12m | -26.52 | 5 |
| st.unemp.r3m | -2.52 | 20 |
| TB10Y.r12m | -6.75 | 13 |
| T10Y3MM | -10.03 | 10 |
| T10Y3MM.r12m | -9.67 | 11 |

[9] Analogously to Experiment 4.2, the number of iterations was reduced to 1000 for Experiment E.

*Table 8: Sensitivity analysis between Dataset 1 and Dataset 2*

*Sensitivity A – D*

| Variable | Exp. A | Exp. D |
|---|---|---|
| int.rate | 4 | 3 |
| orig.upb | 6 | 8 |
| fico.score | 7 | 9 |
| dti.r | 9 | 5 |
| ltv.r | 8 | 6 |
| bal.repaid | 1 | 2 |
| t.act.12m | 3 | 1 |
| t.del.30d.12m | 5 | 7 |
| t.del.60d.12m | 2 | 4 |
| Spearman's $\rho$ | 0.65 | |

*Sensitivity B – E*

| Variable | Exp. B | Exp. E |
|---|---|---|
| hpi.st.d.t.o | 1 | 2 |
| ppi.c.FRMA | 5 | 4 |
| TB10Y.d.t.o | 2 | 8 |
| FRMA30Y.d.t.o | 10 | 1 |
| ppi.o.FRMA | 12 | 7 |
| hpi.r.st.us | 7 | 9 |
| st.unemp.r12m | 13 | 3 |
| st.unemp.r3m | 14 | 11 |
| TB10Y.r12m | 3 | 6 |
| T10Y3MM | 4 | 5 |
| T10Y3MM.r12m | 8 | 10 |
| Spearman's $\rho$ | 0.21 | |

*Sensitivity C – F*

| Variable | Exp. C | Exp. F |
|---|---|---|
| int.rate | 18 | 3 |
| orig.upb | 19 | 19 |
| fico.score | 22 | 18 |
| dti.r | 25 | 14 |
| ltv.r | 20 | 15 |
| bal.repaid | 6 | 2 |
| t.act.12m | 15 | 6 |
| t.del.30d.12m | 21 | 16 |
| t.del.60d.12m | 8 | 9 |
| hpi.st.d.t.o | 1 | 1 |
| ppi.c.FRMA | 4 | 17 |
| TB10Y.d.t.o | 3 | 12 |
| FRMA30Y.d.t.o | 9 | 7 |
| ppi.o.FRMA | 14 | 4 |
| hpi.r.st.us | 13 | 8 |
| st.unemp.r12m | 17 | 5 |
| st.unemp.r3m | 16 | 20 |
| TB10Y.r12m | 2 | 13 |
| T10Y3MM | 5 | 10 |
| T10Y3MM.r12m | 12 | 11 |
| Spearman's $\rho$ | 0.35 | |

In the following, we report more detailed results of the feature importance analysis for different time horizons and the two risk types of default and prepayment.

*Table 9: Detailed results for Experiment A*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| No Noise | 89.87 | 88.21 | 64.20 | 97.21 | 94.58 | 92.82 | 80.76 | 94.87 | 87.82 |
| int.rate | 74.16 | 71.65 | 63.85 | 83.45 | 86.47 | 86.24 | 69.89 | 85.39 | 77.64 |
| orig.upb | 74.13 | 72.81 | 64.74 | 92.35 | 86.21 | 83.06 | 70.56 | 87.20 | 78.88 |
| fico.score | 87.62 | 83.11 | 63.75 | 90.87 | 88.66 | 87.33 | 78.16 | 88.95 | 83.56 |
| dti.r | 88.11 | 84.18 | 66.58 | 95.50 | 92.54 | 90.24 | 79.62 | 92.76 | 86.19 |
| ltv.r | 87.40 | 83.15 | 65.42 | 93.98 | 90.36 | 87.72 | 78.65 | 90.68 | 84.67 |
| bal.repaid | 51.55 | 51.48 | 51.54 | 55.05 | 56.94 | 56.13 | 51.52 | 56.04 | 53.78 |
| t.act.12m | 73.58 | 70.70 | 62.14 | 89.14 | 84.87 | 79.97 | 68.81 | 84.66 | 76.73 |
| t.del.30d.12m | 75.46 | 72.84 | 62.72 | 86.72 | 86.67 | 83.81 | 70.34 | 85.73 | 78.04 |
| t.del.60d.12m | 71.44 | 67.37 | 58.49 | 71.51 | 68.04 | 65.73 | 65.77 | 68.42 | 67.10 |
| No Noise | | | | | | | | | |
| int.rate | -15.71 | -16.56 | -0.35 | -13.76 | -8.11 | -6.58 | -10.87 | -9.48 | -10.18 |
| orig.upb | -15.74 | -15.40 | 0.54 | -4.86 | -8.38 | -9.76 | -10.20 | -7.67 | -8.93 |
| fico.score | -2.25 | -5.10 | -0.45 | -6.34 | -5.93 | -5.49 | -2.60 | -5.92 | -4.26 |
| dti.r | -1.75 | -4.04 | 2.38 | -1.71 | -2.05 | -2.59 | -1.14 | -2.12 | -1.63 |
| ltv.r | -2.47 | -5.06 | 1.22 | -3.23 | -4.23 | -5.10 | -2.10 | -4.19 | -3.15 |
| bal.repaid | -38.31 | -36.73 | -12.66 | -42.16 | -37.65 | -36.70 | -29.23 | -38.83 | -34.03 |
| t.act.12m | -16.29 | -17.51 | -2.06 | -8.07 | -9.71 | -12.85 | -11.95 | -10.21 | -11.08 |
| t.del.30d.12m | -14.41 | -15.37 | -1.48 | -10.49 | -7.92 | -9.01 | -10.42 | -9.14 | -9.78 |
| t.del.60d.12m | -18.42 | -20.84 | -5.71 | -25.70 | -26.55 | -27.10 | -14.99 | -26.45 | -20.72 |
| No Noise | | | | | | | | | |
| int.rate | 5 | 4 | 6 | 3 | 5 | 6 | 4 | 4 | 4 |
| orig.upb | 4 | 5 | 7 | 7 | 4 | 4 | 6 | 6 | 6 |
| fico.score | 8 | 7 | 5 | 6 | 7 | 7 | 7 | 7 | 7 |
| dti.r | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| ltv.r | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| bal.repaid | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| t.act.12m | 3 | 3 | 3 | 5 | 3 | 3 | 3 | 3 | 3 |
| t.del.30d.12m | 6 | 6 | 4 | 4 | 6 | 5 | 5 | 5 | 5 |
| t.del.60d.12m | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

*Table 10: Detailed results for Experiment B*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| No Noise | 95.58 | 94.55 | 87.60 | 93.95 | 92.82 | 86.92 | 92.58 | 91.23 | 91.90 |
| hpi.st.d.t.o | 52.36 | 52.37 | 52.37 | 49.35 | 48.49 | 49.16 | 52.37 | 49.00 | 50.68 |
| hpi.zip.o | 63.60 | 63.01 | 63.12 | 62.20 | 62.29 | 61.11 | 63.24 | 61.86 | 62.55 |
| hpi.zip.d.t.o | 62.31 | 62.27 | 61.45 | 55.78 | 54.48 | 53.30 | 62.01 | 54.52 | 58.27 |
| ppi.c.FRMA | 80.10 | 79.10 | 75.25 | 80.09 | 79.22 | 77.04 | 78.15 | 78.78 | 78.47 |
| TB10Y.d.t.o | 83.93 | 81.89 | 75.26 | 86.00 | 84.10 | 84.00 | 80.36 | 84.70 | 82.53 |
| FRMA30Y.d.t.o | 75.80 | 75.81 | 76.60 | 67.33 | 67.58 | 66.97 | 76.07 | 67.29 | 71.68 |
| ppi.o.FRMA | 86.34 | 86.38 | 84.47 | 81.44 | 80.45 | 77.06 | 85.73 | 79.65 | 82.69 |
| equity.est | 91.03 | 88.66 | 80.46 | 90.97 | 89.30 | 86.76 | 86.72 | 89.01 | 87.86 |
| hpi.st.log12m | 58.00 | 57.52 | 57.36 | 61.53 | 60.26 | 59.44 | 57.62 | 60.41 | 59.02 |
| hpi.r.st.us | 64.78 | 63.99 | 63.21 | 58.00 | 58.82 | 59.80 | 63.99 | 58.87 | 61.43 |
| hpi.r.zip.st | 76.00 | 75.33 | 72.45 | 69.56 | 69.20 | 69.02 | 74.59 | 69.26 | 71.93 |
| st.unemp.r12m | 91.79 | 89.94 | 81.99 | 91.88 | 91.10 | 88.96 | 87.91 | 90.65 | 89.28 |
| st.unemp.r3m | 92.09 | 89.82 | 80.34 | 91.54 | 91.18 | 87.64 | 87.42 | 90.12 | 88.77 |
| TB10Y.r12m | 74.72 | 72.75 | 68.16 | 78.56 | 78.36 | 77.58 | 71.88 | 78.17 | 75.02 |
| T10Y3MM | 76.98 | 77.10 | 75.60 | 65.56 | 65.06 | 64.63 | 76.56 | 65.09 | 70.82 |
| T10Y3MM.r12m | 84.67 | 81.10 | 75.01 | 84.88 | 81.88 | 81.03 | 80.26 | 82.59 | 81.43 |
| No Noise | | | | | | | | | |
| hpi.st.d.t.o | -43.22 | -42.18 | -35.23 | -44.60 | -44.33 | -37.75 | -40.21 | -42.23 | -41.22 |
| hpi.zip.o | -31.98 | -31.54 | -24.48 | -31.75 | -30.53 | -25.81 | -29.33 | -29.36 | -29.35 |
| hpi.zip.d.t.o | -33.27 | -32.28 | -26.16 | -38.17 | -38.34 | -33.61 | -30.57 | -36.71 | -33.64 |
| ppi.c.FRMA | -15.48 | -15.45 | -12.35 | -13.86 | -13.60 | -9.88 | -14.43 | -12.45 | -13.44 |
| TB10Y.d.t.o | -11.65 | -12.66 | -12.34 | -7.95 | -8.72 | -2.92 | -12.22 | -6.53 | -9.37 |
| FRMA30Y.d.t.o | -19.77 | -18.73 | -11.01 | -26.62 | -25.24 | -19.95 | -16.50 | -23.93 | -20.22 |
| ppi.o.FRMA | -9.24 | -8.17 | -3.13 | -12.51 | -12.37 | -9.85 | -6.85 | -11.58 | -9.21 |
| equity.est | -4.55 | -5.89 | -7.14 | -2.98 | -3.52 | -0.15 | -5.86 | -2.22 | -4.04 |
| hpi.st.log12m | -37.58 | -37.03 | -30.24 | -32.42 | -32.56 | -27.48 | -34.95 | -30.82 | -32.88 |
| hpi.r.st.us | -30.80 | -30.56 | -24.39 | -35.95 | -34.01 | -27.12 | -28.58 | -32.36 | -30.47 |
| hpi.r.zip.st | -19.58 | -19.21 | -15.15 | -24.39 | -23.62 | -17.90 | -17.98 | -21.97 | -19.98 |
| st.unemp.r12m | -3.78 | -4.60 | -5.61 | -2.07 | -1.72 | 2.04 | -4.67 | -0.58 | -2.62 |
| st.unemp.r3m | -3.48 | -4.72 | -7.27 | -2.41 | -1.64 | 0.73 | -5.16 | -1.11 | -3.13 |
| TB10Y.r12m | -20.86 | -21.80 | -19.45 | -15.39 | -14.46 | -9.33 | -20.70 | -13.06 | -16.88 |
| T10Y3MM | -18.60 | -17.45 | -12.00 | -28.39 | -27.76 | -22.29 | -16.02 | -26.14 | -21.08 |
| T10Y3MM.r12m | -10.91 | -13.45 | -12.59 | -9.07 | -10.95 | -5.88 | -12.32 | -8.63 | -10.47 |
| No Noise | | | | | | | | | |
| hpi.st.d.t.o | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| hpi.zip.o | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 5 |
| hpi.zip.d.t.o | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| ppi.c.FRMA | 10 | 10 | 9 | 10 | 10 | 9 | 10 | 10 | 10 |
| TB10Y.d.t.o | 11 | 12 | 10 | 13 | 13 | 13 | 12 | 13 | 12 |
| FRMA30Y.d.t.o | 7 | 8 | 12 | 7 | 7 | 7 | 8 | 7 | 7 |
| ppi.o.FRMA | 13 | 13 | 16 | 11 | 11 | 10 | 13 | 11 | 13 |
| equity.est | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| hpi.st.log12m | 2 | 2 | 2 | 4 | 4 | 3 | 2 | 4 | 3 |
| hpi.r.st.us | 5 | 5 | 5 | 3 | 3 | 4 | 5 | 3 | 4 |
| hpi.r.zip.st | 8 | 7 | 7 | 8 | 8 | 8 | 7 | 8 | 8 |
| st.unemp.r12m | 15 | 16 | 15 | 16 | 15 | 16 | 16 | 16 | 16 |
| st.unemp.r3m | 16 | 15 | 13 | 15 | 16 | 15 | 15 | 15 | 15 |
| TB10Y.r12m | 6 | 6 | 6 | 9 | 9 | 11 | 6 | 9 | 9 |
| T10Y3MM | 9 | 9 | 11 | 6 | 6 | 6 | 9 | 6 | 6 |
| T10Y3MM.r12m | 12 | 11 | 8 | 12 | 12 | 12 | 11 | 12 | 11 |

*Table 11: Detailed results for Experiment C*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| No Noise | 95.90 | 95.20 | 94.67 | 98.76 | 97.80 | 92.97 | 95.26 | 96.51 | 95.88 |
| int.rate | 86.17 | 86.48 | 86.49 | 89.97 | 91.87 | 91.40 | 86.38 | 91.08 | 88.73 |
| orig.upb | 86.19 | 83.79 | 80.80 | 96.57 | 95.29 | 91.97 | 83.59 | 94.61 | 89.10 |
| fico.score | 92.96 | 91.50 | 88.86 | 93.79 | 93.87 | 90.57 | 91.11 | 92.74 | 91.93 |
| dti.r | 93.64 | 92.01 | 89.60 | 96.37 | 95.26 | 90.53 | 91.75 | 94.06 | 92.90 |
| ltv.r | 89.29 | 87.10 | 84.01 | 95.46 | 93.94 | 87.67 | 86.80 | 92.36 | 89.58 |
| bal.repaid | 67.95 | 67.77 | 67.53 | 81.01 | 76.38 | 73.99 | 67.75 | 77.13 | 72.44 |
| t.act.12m | 86.57 | 82.45 | 78.11 | 95.34 | 93.58 | 87.05 | 82.38 | 91.99 | 87.18 |
| t.del.30d.12m | 91.75 | 90.45 | 88.54 | 96.17 | 94.01 | 89.75 | 90.25 | 93.31 | 91.78 |
| t.del.60d.12m | 83.08 | 76.28 | 72.04 | 90.32 | 88.33 | 82.11 | 77.13 | 86.92 | 82.03 |
| hpi.st.d.t.o | 54.58 | 54.27 | 54.32 | 59.53 | 59.98 | 58.59 | 54.39 | 59.37 | 56.88 |
| hpi.zip.o | 65.55 | 64.90 | 64.97 | 66.05 | 68.38 | 68.66 | 65.14 | 67.70 | 66.42 |
| hpi.zip.d.t.o | 61.60 | 61.52 | 61.68 | 66.81 | 69.90 | 72.12 | 61.60 | 69.61 | 65.61 |
| ppi.c.FRMA | 78.94 | 78.60 | 78.41 | 89.94 | 88.41 | 87.04 | 78.65 | 88.47 | 83.56 |
| TB10Y.d.t.o | 84.59 | 82.74 | 79.93 | 92.28 | 90.40 | 87.36 | 82.42 | 90.01 | 86.22 |
| FRMA30Y.d.t.o | 82.98 | 82.35 | 81.05 | 91.06 | 90.05 | 86.43 | 82.12 | 89.18 | 85.65 |
| ppi.o.FRMA | 84.75 | 84.65 | 84.18 | 92.64 | 93.53 | 88.79 | 84.53 | 91.65 | 88.09 |
| equity.est | 83.79 | 83.05 | 81.87 | 92.53 | 93.60 | 88.89 | 82.90 | 91.67 | 87.29 |
| hpi.st.log12m | 58.69 | 58.49 | 58.25 | 60.54 | 62.58 | 58.97 | 58.47 | 60.70 | 59.58 |
| hpi.r.st.us | 65.68 | 65.07 | 65.31 | 71.22 | 72.27 | 75.46 | 65.35 | 72.98 | 69.17 |
| hpi.r.zip.st | 83.11 | 81.98 | 80.47 | 88.35 | 87.77 | 90.73 | 81.85 | 88.95 | 85.40 |
| st.unemp.r12m | 93.02 | 91.27 | 88.86 | 97.16 | 95.27 | 91.18 | 91.05 | 94.54 | 92.79 |
| st.unemp.r3m | 92.93 | 91.54 | 89.30 | 96.65 | 95.08 | 91.23 | 91.26 | 94.32 | 92.79 |
| TB10Y.r12m | 76.14 | 74.95 | 74.08 | 85.77 | 85.50 | 81.27 | 75.06 | 84.18 | 79.62 |
| T10Y3MM | 79.27 | 79.61 | 79.04 | 89.24 | 91.34 | 91.28 | 79.30 | 90.62 | 84.96 |
| T10Y3MM.r12m | 84.10 | 82.97 | 83.19 | 85.43 | 85.82 | 85.95 | 83.42 | 85.74 | 84.58 |
| No Noise | | | | | | | | | |
| int.rate | -9.73 | -8.72 | -8.18 | -8.79 | -5.93 | -1.57 | -8.87 | -5.43 | -7.15 |
| orig.upb | -9.71 | -11.41 | -13.87 | -2.19 | -2.52 | -1.00 | -11.66 | -1.90 | -6.78 |
| fico.score | -2.94 | -3.70 | -5.81 | -4.96 | -3.94 | -2.40 | -4.15 | -3.77 | -3.96 |
| dti.r | -2.26 | -3.19 | -5.07 | -2.39 | -2.54 | -2.44 | -3.51 | -2.45 | -2.98 |
| ltv.r | -6.61 | -8.10 | -10.66 | -3.30 | -3.86 | -5.30 | -8.46 | -4.15 | -6.31 |
| bal.repaid | -27.95 | -27.43 | -27.14 | -17.75 | -21.42 | -18.98 | -27.51 | -19.38 | -23.44 |
| t.act.12m | -9.32 | -12.75 | -16.56 | -3.42 | -4.23 | -5.92 | -12.88 | -4.52 | -8.70 |
| t.del.30d.12m | -4.15 | -4.75 | -6.13 | -2.59 | -3.80 | -3.22 | -5.01 | -3.20 | -4.11 |
| t.del.60d.12m | -12.82 | -18.92 | -22.63 | -8.44 | -9.48 | -10.86 | -18.12 | -9.59 | -13.86 |
| hpi.st.d.t.o | -41.32 | -40.93 | -40.35 | -39.23 | -37.83 | -34.38 | -40.86 | -37.14 | -39.00 |
| hpi.zip.o | -30.35 | -30.31 | -29.70 | -32.71 | -29.42 | -24.31 | -30.12 | -28.81 | -29.47 |
| hpi.zip.d.t.o | -34.30 | -33.68 | -32.99 | -31.95 | -27.91 | -20.85 | -33.66 | -26.90 | -30.28 |
| ppi.c.FRMA | -16.96 | -16.60 | -16.26 | -8.82 | -9.39 | -5.93 | -16.61 | -8.04 | -12.33 |
| TB10Y.d.t.o | -11.30 | -12.47 | -14.73 | -6.48 | -7.41 | -5.61 | -12.84 | -6.50 | -9.67 |
| FRMA30Y.d.t.o | -12.92 | -12.86 | -13.62 | -7.70 | -7.75 | -6.54 | -13.13 | -7.33 | -10.23 |
| ppi.o.FRMA | -11.14 | -10.55 | -10.49 | -6.12 | -4.27 | -4.18 | -10.73 | -4.86 | -7.79 |
| equity.est | -12.10 | -12.15 | -12.80 | -6.23 | -4.20 | -4.07 | -12.35 | -4.84 | -8.59 |
| hpi.st.log12m | -37.21 | -36.71 | -36.42 | -38.22 | -35.22 | -34.00 | -36.78 | -35.81 | -36.30 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| hpi.r.st.us | -30.22 | -30.13 | -29.36 | -27.54 | -25.54 | -17.51 | -29.90 | -23.53 | -26.72 |
| hpi.r.zip.st | -12.78 | -13.22 | -14.20 | -10.41 | -10.04 | -2.24 | -13.40 | -7.56 | -10.48 |
| st.unemp.r12m | -2.88 | -3.93 | -5.81 | -1.60 | -2.53 | -1.79 | -4.21 | -1.97 | -3.09 |
| st.unemp.r3m | -2.97 | -3.66 | -5.37 | -2.11 | -2.72 | -1.74 | -4.00 | -2.19 | -3.09 |
| TB10Y.r12m | -19.76 | -20.25 | -20.59 | -12.99 | -12.30 | -11.70 | -20.20 | -12.33 | -16.26 |
| T10Y3MM | -16.63 | -15.59 | -15.63 | -9.52 | -6.46 | -1.69 | -15.95 | -5.89 | -10.92 |
| T10Y3MM.r12m | -11.79 | -12.23 | -11.48 | -13.33 | -11.98 | -7.02 | -11.83 | -10.78 | -11.30 |
| No Noise | | | | | | | | | |
| int.rate | 17 | 19 | 20 | 12 | 15 | 24 | 19 | 15 | 18 |
| orig.upb | 18 | 17 | 14 | 23 | 25 | 25 | 17 | 25 | 19 |
| fico.score | 23 | 23 | 22 | 18 | 19 | 19 | 23 | 20 | 22 |
| dti.r | 25 | 25 | 25 | 22 | 23 | 18 | 25 | 22 | 25 |
| ltv.r | 20 | 20 | 18 | 20 | 20 | 14 | 20 | 19 | 20 |
| bal.repaid | 6 | 6 | 6 | 6 | 6 | 5 | 6 | 6 | 6 |
| t.act.12m | 19 | 13 | 9 | 19 | 17 | 12 | 13 | 18 | 15 |
| t.del.30d.12m | 21 | 21 | 21 | 21 | 21 | 17 | 21 | 21 | 21 |
| t.del.60d.12m | 11 | 8 | 7 | 13 | 10 | 8 | 8 | 9 | 8 |
| hpi.st.d.t.o | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| hpi.zip.o | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 4 |
| hpi.zip.d.t.o | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 3 |
| ppi.c.FRMA | 8 | 9 | 10 | 11 | 11 | 11 | 9 | 10 | 9 |
| TB10Y.d.t.o | 15 | 14 | 12 | 15 | 13 | 13 | 14 | 13 | 14 |
| FRMA30Y.d.t.o | 10 | 12 | 15 | 14 | 12 | 10 | 12 | 12 | 13 |
| ppi.o.FRMA | 16 | 18 | 19 | 17 | 16 | 15 | 18 | 16 | 17 |
| equity.est | 13 | 16 | 16 | 16 | 18 | 16 | 15 | 17 | 16 |
| hpi.st.log12m | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| hpi.r.st.us | 5 | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 |
| hpi.r.zip.st | 12 | 11 | 13 | 9 | 9 | 20 | 11 | 11 | 12 |
| st.unemp.r12m | 24 | 22 | 23 | 25 | 24 | 21 | 22 | 24 | 24 |
| st.unemp.r3m | 22 | 24 | 24 | 24 | 22 | 22 | 24 | 23 | 23 |
| TB10Y.r12m | 7 | 7 | 8 | 8 | 7 | 7 | 7 | 7 | 7 |
| T10Y3MM | 9 | 10 | 11 | 10 | 14 | 23 | 10 | 14 | 11 |
| T10Y3MM.r12m | 14 | 15 | 17 | 7 | 8 | 9 | 16 | 8 | 10 |

*Table 12: Detailed results for Experiment D*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 89.27 | 85.48 | 82.69 | 98.68 | 98.79 | 99.00 | 85.81 | 98.82 | 92.32 |
| `int.rate` | 71.39 | 62.74 | 58.07 | 82.59 | 89.70 | 90.67 | 64.06 | 87.66 | 75.86 |
| `orig.upb` | 80.56 | 77.03 | 72.74 | 97.74 | 98.52 | 98.75 | 76.77 | 98.34 | 87.55 |
| `fico.score` | 84.66 | 78.77 | 74.47 | 98.17 | 97.43 | 97.36 | 79.30 | 97.65 | 88.48 |
| `dti.r` | 74.19 | 66.74 | 64.12 | 95.22 | 97.06 | 97.54 | 68.35 | 96.61 | 82.48 |
| `ltv.r` | 73.17 | 73.22 | 71.00 | 97.33 | 98.77 | 98.95 | 72.46 | 98.35 | 85.40 |
| `bal.repaid` | 48.89 | 48.12 | 47.04 | 83.79 | 65.33 | 60.59 | 48.01 | 69.90 | 58.96 |
| `t.act.12m` | 58.85 | 57.42 | 55.00 | 59.06 | 59.57 | 59.50 | 57.09 | 59.38 | 58.23 |
| `t.del.30d.12m` | 78.24 | 75.25 | 71.83 | 94.82 | 98.11 | 98.71 | 75.11 | 97.21 | 86.16 |
| `t.del.60d.12m` | 68.80 | 62.19 | 55.08 | 92.76 | 95.84 | 97.20 | 62.02 | 95.26 | 78.64 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -17.88 | -22.75 | -24.62 | -16.09 | -9.09 | -8.32 | -21.75 | -11.17 | -16.46 |
| `orig.upb` | -8.71 | -8.45 | -9.95 | -0.94 | -0.28 | -0.25 | -9.04 | -0.49 | -4.76 |
| `fico.score` | -4.61 | -6.71 | -8.22 | -0.51 | -1.36 | -1.64 | -6.51 | -1.17 | -3.84 |
| `dti.r` | -15.08 | -18.74 | -18.57 | -3.46 | -1.73 | -1.46 | -17.46 | -2.21 | -9.84 |
| `ltv.r` | -16.10 | -12.26 | -11.69 | -1.35 | -0.03 | -0.05 | -13.35 | -0.48 | -6.91 |
| `bal.repaid` | -40.38 | -37.36 | -35.65 | -14.89 | -33.46 | -38.41 | -37.80 | -28.92 | -33.36 |
| `t.act.12m` | -30.42 | -28.06 | -27.69 | -39.62 | -39.22 | -39.50 | -28.72 | -39.45 | -34.09 |
| `t.del.30d.12m` | -11.03 | -10.24 | -10.86 | -3.86 | -0.68 | -0.29 | -10.71 | -1.61 | -6.16 |
| `t.del.60d.12m` | -20.47 | -23.30 | -27.61 | -5.92 | -2.96 | -1.80 | -23.79 | -3.56 | -13.67 |
| *No Noise* | | | | | | | | | |
| `int.rate` | 4 | 4 | 4 | 2 | 3 | 3 | 4 | 3 | 3 |
| `orig.upb` | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| `fico.score` | 9 | 9 | 9 | 9 | 6 | 5 | 9 | 7 | 9 |
| `dti.r` | 6 | 5 | 5 | 6 | 5 | 6 | 5 | 5 | 5 |
| `ltv.r` | 5 | 6 | 6 | 7 | 9 | 9 | 6 | 9 | 6 |
| `bal.repaid` | 1 | 1 | 1 | 3 | 2 | 2 | 1 | 2 | 2 |
| `t.act.12m` | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 |
| `t.del.30d.12m` | 7 | 7 | 7 | 5 | 7 | 7 | 7 | 6 | 7 |
| `t.del.60d.12m` | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 4 |

*Table 13: Detailed results for Experiment E*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 88.31 | 68.43 | 56.82 | 87.88 | 79.26 | 73.65 | 71.18 | 80.26 | 75.72 |
| hpi.st.d.t.o | 59.60 | 60.93 | 51.83 | 57.46 | 52.58 | 53.36 | 57.45 | 54.47 | 55.96 |
| ppi.c.FRMA | 64.22 | 56.66 | 50.83 | 52.63 | 69.98 | 68.39 | 57.24 | 63.67 | 60.45 |
| TB10Y.d.t.o | 64.33 | 62.71 | 53.93 | 76.21 | 57.48 | 58.96 | 60.32 | 64.22 | 62.27 |
| FRMA30Y.d.t.o | 62.16 | 56.80 | 50.12 | 51.92 | 50.28 | 53.64 | 56.36 | 51.95 | 54.15 |
| ppi.o.FRMA | 72.56 | 57.90 | 51.41 | 55.30 | 69.79 | 64.85 | 60.63 | 63.32 | 61.97 |
| hpi.r.st.us | 72.58 | 57.25 | 49.42 | 59.03 | 69.20 | 66.90 | 59.75 | 65.05 | 62.40 |
| st.unemp.r12m | 54.97 | 52.60 | 44.25 | 63.86 | 62.01 | 60.73 | 50.60 | 62.20 | 56.40 |
| st.unemp.r3m | 82.94 | 52.88 | 42.02 | 84.63 | 81.30 | 76.81 | 59.28 | 80.91 | 70.10 |
| TB10Y.r12m | 73.70 | 53.23 | 47.57 | 63.30 | 65.12 | 61.55 | 58.17 | 63.32 | 60.75 |
| T10Y3MM | 62.58 | 58.36 | 50.49 | 82.90 | 53.74 | 55.13 | 57.14 | 63.92 | 60.53 |
| T10Y3MM.r12m | 73.48 | 55.85 | 51.36 | 69.22 | 65.83 | 62.98 | 60.23 | 66.01 | 63.12 |
| *No Noise* | | | | | | | | | |
| hpi.st.d.t.o | -28.71 | -7.50 | -4.98 | -30.42 | -26.69 | -20.28 | -13.73 | -25.80 | -19.76 |
| ppi.c.FRMA | -24.08 | -11.77 | -5.98 | -35.25 | -9.28 | -5.25 | -13.95 | -16.59 | -15.27 |
| TB10Y.d.t.o | -23.97 | -5.72 | -2.89 | -11.66 | -21.79 | -14.68 | -10.86 | -16.04 | -13.45 |
| FRMA30Y.d.t.o | -26.15 | -11.63 | -6.70 | -35.96 | -28.99 | -20.00 | -14.83 | -28.32 | -21.57 |
| ppi.o.FRMA | -15.75 | -10.53 | -5.40 | -32.58 | -9.47 | -8.79 | -10.56 | -16.95 | -13.75 |
| hpi.r.st.us | -15.73 | -11.18 | -7.40 | -28.84 | -10.06 | -6.74 | -11.44 | -15.22 | -13.33 |
| st.unemp.r12m | -33.34 | -15.83 | -12.57 | -24.02 | -17.25 | -12.92 | -20.58 | -18.06 | -19.32 |
| st.unemp.r3m | -5.37 | -15.56 | -14.79 | -3.25 | 2.04 | 3.17 | -11.90 | 0.65 | -5.63 |
| TB10Y.r12m | -14.61 | -15.20 | -9.24 | -24.57 | -14.15 | -12.09 | -13.02 | -16.94 | -14.98 |
| T10Y3MM | -25.73 | -10.07 | -6.33 | -4.98 | -25.52 | -18.52 | -14.04 | -16.34 | -15.19 |
| T10Y3MM.r12m | -14.83 | -12.58 | -5.46 | -18.65 | -13.44 | -10.66 | -10.96 | -14.25 | -12.60 |
| *No Noise* | | | | | | | | | |
| hpi.st.d.t.o | 2 | 10 | 10 | 4 | 2 | 1 | 5 | 2 | 2 |
| ppi.c.FRMA | 5 | 5 | 7 | 2 | 10 | 10 | 4 | 6 | 4 |
| TB10Y.d.t.o | 6 | 11 | 11 | 9 | 4 | 4 | 10 | 8 | 8 |
| FRMA30Y.d.t.o | 3 | 6 | 5 | 1 | 1 | 2 | 2 | 1 | 1 |
| ppi.o.FRMA | 7 | 8 | 9 | 3 | 9 | 8 | 11 | 4 | 7 |
| hpi.r.st.us | 8 | 7 | 4 | 5 | 8 | 9 | 8 | 9 | 9 |
| st.unemp.r12m | 1 | 1 | 2 | 7 | 5 | 5 | 1 | 3 | 3 |
| st.unemp.r3m | 11 | 2 | 1 | 11 | 11 | 11 | 7 | 11 | 11 |
| TB10Y.r12m | 10 | 3 | 3 | 6 | 6 | 6 | 6 | 5 | 6 |
| T10Y3MM | 4 | 9 | 6 | 10 | 3 | 3 | 3 | 7 | 5 |
| T10Y3MM.r12m | 9 | 4 | 8 | 8 | 7 | 7 | 9 | 10 | 10 |

*Table 14: Detailed results for Experiment F*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 94.03 | 92.49 | 91.01 | 98.83 | 99.28 | 99.00 | 92.51 | 99.04 | 95.78 |
| int.rate | 60.94 | 59.38 | 58.67 | 68.08 | 65.96 | 67.31 | 59.66 | 67.11 | 63.39 |
| orig.upb | 88.46 | 85.85 | 84.04 | 98.68 | 98.24 | 96.39 | 86.12 | 97.77 | 91.94 |
| fico.score | 88.82 | 85.91 | 84.00 | 98.83 | 96.85 | 92.88 | 86.24 | 96.19 | 91.21 |
| dti.r | 85.22 | 81.52 | 79.40 | 98.37 | 96.15 | 95.53 | 82.05 | 96.68 | 89.37 |
| ltv.r | 89.04 | 84.11 | 81.75 | 98.70 | 95.40 | 92.99 | 84.97 | 95.70 | 90.33 |
| bal.repaid | 59.43 | 57.63 | 56.64 | 71.28 | 65.90 | 58.00 | 57.90 | 65.06 | 61.48 |
| t.act.12m | 74.77 | 73.89 | 67.43 | 69.71 | 64.32 | 67.42 | 72.03 | 67.15 | 69.59 |
| t.del.30d.12m | 85.77 | 83.29 | 79.90 | 99.16 | 98.25 | 96.98 | 82.99 | 98.13 | 90.56 |
| t.del.60d.12m | 76.05 | 74.18 | 71.61 | 99.03 | 88.91 | 82.59 | 73.95 | 90.18 | 82.06 |
| hpi.st.d.t.o | 61.86 | 62.44 | 61.86 | 60.76 | 53.60 | 49.40 | 62.05 | 54.59 | 58.32 |
| ppi.c.FRMA | 88.07 | 85.31 | 81.83 | 98.63 | 96.87 | 95.25 | 85.07 | 96.92 | 90.99 |
| TB10Y.d.t.o | 77.94 | 78.32 | 75.99 | 98.98 | 92.93 | 93.82 | 77.42 | 95.25 | 86.33 |
| FRMA30Y.d.t.o | 69.08 | 66.36 | 64.64 | 86.23 | 71.97 | 68.21 | 66.69 | 75.47 | 71.08 |
| ppi.o.FRMA | 71.33 | 69.88 | 68.77 | 73.21 | 54.68 | 53.35 | 69.99 | 60.41 | 65.20 |
| hpi.r.st.us | 77.08 | 74.50 | 72.71 | 74.76 | 81.80 | 80.36 | 74.76 | 78.98 | 76.87 |
| st.unemp.r12m | 58.94 | 57.30 | 56.63 | 99.59 | 73.77 | 69.32 | 57.62 | 80.89 | 69.26 |
| st.unemp.r3m | 89.23 | 88.60 | 86.36 | 98.73 | 98.63 | 97.96 | 88.06 | 98.44 | 93.25 |
| TB10Y.r12m | 86.29 | 81.05 | 76.68 | 98.58 | 95.99 | 95.56 | 81.34 | 96.71 | 89.02 |
| T10Y3MM | 80.11 | 77.47 | 75.65 | 98.58 | 92.81 | 89.85 | 77.75 | 93.75 | 85.75 |
| T10Y3MM.r12m | 82.25 | 79.43 | 75.88 | 97.56 | 91.82 | 89.70 | 79.19 | 93.02 | 86.11 |
| *No Noise* | | | | | | | | | |
| int.rate | -33.09 | -33.11 | -32.35 | -30.75 | -33.33 | -31.70 | -32.85 | -31.93 | -32.39 |
| orig.upb | -5.57 | -6.64 | -6.97 | -0.15 | -1.04 | -2.62 | -6.39 | -1.27 | -3.83 |
| fico.score | -5.21 | -6.58 | -7.02 | 0.00 | -2.44 | -6.13 | -6.27 | -2.85 | -4.56 |
| dti.r | -8.80 | -10.97 | -11.61 | -0.46 | -3.13 | -3.48 | -10.46 | -2.36 | -6.41 |
| ltv.r | -4.99 | -8.38 | -9.26 | -0.13 | -3.89 | -6.01 | -7.54 | -3.34 | -5.44 |
| bal.repaid | -34.60 | -34.86 | -34.37 | -27.55 | -33.38 | -41.01 | -34.61 | -33.98 | -34.29 |
| t.act.12m | -19.26 | -18.59 | -23.58 | -29.12 | -34.96 | -31.58 | -20.48 | -31.89 | -26.18 |
| t.del.30d.12m | -8.26 | -9.20 | -11.11 | 0.33 | -1.03 | -2.02 | -9.52 | -0.91 | -5.21 |
| t.del.60d.12m | -17.97 | -18.31 | -19.41 | 0.20 | -10.37 | -16.41 | -18.56 | -8.86 | -13.71 |
| hpi.st.d.t.o | -32.17 | -30.05 | -29.15 | -38.07 | -45.68 | -49.60 | -30.46 | -44.45 | -37.45 |
| ppi.c.FRMA | -5.96 | -7.18 | -9.18 | -0.20 | -2.41 | -3.75 | -7.44 | -2.12 | -4.78 |
| TB10Y.d.t.o | -16.09 | -14.17 | -15.03 | 0.15 | -6.35 | -5.18 | -15.09 | -3.79 | -9.44 |
| FRMA30Y.d.t.o | -24.95 | -26.13 | -26.37 | -12.60 | -27.32 | -30.79 | -25.82 | -23.57 | -24.69 |
| ppi.o.FRMA | -22.70 | -22.60 | -22.25 | -25.62 | -44.60 | -45.66 | -22.52 | -38.63 | -30.57 |
| hpi.r.st.us | -16.95 | -17.99 | -18.30 | -24.07 | -17.48 | -18.64 | -17.75 | -20.06 | -18.91 |
| st.unemp.r12m | -35.09 | -35.19 | -34.39 | 0.76 | -25.51 | -29.69 | -34.89 | -18.15 | -26.52 |
| st.unemp.r3m | -4.80 | -3.89 | -4.66 | -0.10 | -0.65 | -1.05 | -4.45 | -0.60 | -2.52 |
| TB10Y.r12m | -7.74 | -11.44 | -14.33 | -0.25 | -3.30 | -3.44 | -11.17 | -2.33 | -6.75 |
| T10Y3MM | -13.92 | -15.02 | -15.36 | -0.25 | -6.47 | -9.15 | -14.76 | -5.29 | -10.03 |
| T10Y3MM.r12m | -11.78 | -13.06 | -15.13 | -1.27 | -7.47 | -9.31 | -13.32 | -6.02 | -9.67 |
| *No Noise* | | | | | | | | | |
| int.rate | 3 | 3 | 3 | 2 | 5 | 4 | 3 | 4 | 3 |
| orig.upb | 17 | 18 | 19 | 13 | 18 | 18 | 18 | 18 | 19 |
| fico.score | 18 | 19 | 18 | 16 | 16 | 12 | 19 | 14 | 18 |
| dti.r | 13 | 14 | 14 | 9 | 15 | 16 | 14 | 15 | 14 |
| ltv.r | 19 | 16 | 16 | 14 | 13 | 13 | 16 | 13 | 15 |
| bal.repaid | 2 | 2 | 2 | 4 | 4 | 3 | 2 | 3 | 2 |
| t.act.12m | 7 | 7 | 6 | 3 | 3 | 5 | 7 | 5 | 6 |
| t.del.30d.12m | 14 | 15 | 15 | 19 | 19 | 19 | 15 | 19 | 16 |
| t.del.60d.12m | 8 | 8 | 8 | 18 | 9 | 9 | 8 | 9 | 9 |
| hpi.st.d.t.o | 4 | 4 | 4 | 1 | 1 | 1 | 4 | 1 | 1 |
| ppi.c.FRMA | 16 | 17 | 17 | 12 | 17 | 15 | 17 | 17 | 17 |
| TB10Y.d.t.o | 10 | 11 | 12 | 17 | 12 | 14 | 10 | 12 | 12 |
| FRMA30Y.d.t.o | 5 | 5 | 5 | 7 | 6 | 6 | 5 | 6 | 7 |
| ppi.o.FRMA | 6 | 6 | 7 | 5 | 2 | 2 | 6 | 2 | 4 |
| hpi.r.st.us | 9 | 9 | 9 | 6 | 8 | 8 | 9 | 7 | 8 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| st.unemp.r12m | 1 | 1 | 1 | 20 | 7 | 7 | 1 | 8 | 5 |
| st.unemp.r3m | 20 | 20 | 20 | 15 | 20 | 20 | 20 | 20 | 20 |
| TB10Y.r12m | 15 | 13 | 13 | 10 | 14 | 17 | 13 | 16 | 13 |
| T10Y3MM | 11 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 10 |
| T10Y3MM.r12m | 12 | 12 | 11 | 8 | 10 | 10 | 12 | 10 | 11 |

# Appendix D: Detailed results for Analysis 1

*Table 15: Detailed results for Experiment 1.1*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 80.30 | 48.50 | 52.73 | 97.47 | 96.37 | 63.88 | 60.51 | 85.91 | 73.21 |
| 2 | 75.88 | 46.45 | 59.59 | 97.01 | 70.47 | 52.58 | 60.64 | 73.35 | 67.00 |
| 3 | 77.51 | 46.89 | 48.83 | 92.69 | 74.05 | 52.22 | 57.75 | 72.99 | 65.37 |
| 4 | 82.92 | 63.37 | 55.94 | 94.82 | 95.23 | 95.81 | 67.41 | 95.29 | 81.35 |
| 5 | 78.22 | 53.66 | 50.17 | 95.57 | 49.83 | 64.04 | 60.68 | 69.82 | 65.25 |
| 6 | 75.45 | 50.91 | 46.84 | 97.81 | 81.29 | 40.15 | 57.73 | 73.08 | 65.41 |
| 7 | 79.43 | 51.67 | 52.47 | 97.25 | 69.89 | 48.49 | 61.19 | 71.88 | 66.53 |
| 8 | 81.51 | 59.61 | 48.79 | 98.34 | 97.02 | 93.59 | 63.30 | 96.32 | 79.81 |
| 9 | 79.04 | 49.69 | 51.99 | 94.19 | 67.39 | 58.77 | 60.24 | 73.45 | 66.84 |
| 10 | 70.94 | 51.22 | 52.74 | 94.95 | 62.99 | 49.70 | 58.30 | 69.22 | 63.76 |
| Mean | 78.12 | 52.20 | 52.01 | 96.01 | 76.46 | 61.92 | 60.78 | 78.13 | 69.45 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 84.11 | 83.91 | 83.88 | 96.90 | 97.42 | 96.72 | 83.96 | 97.02 | 90.49 |
| 2 | 79.76 | 79.56 | 79.55 | 97.64 | 95.72 | 94.05 | 79.62 | 95.81 | 87.71 |
| 3 | 83.29 | 82.77 | 82.76 | 94.67 | 95.70 | 94.95 | 82.94 | 95.11 | 89.02 |
| 4 | 82.37 | 82.03 | 82.04 | 92.83 | 93.53 | 94.00 | 82.15 | 93.46 | 87.80 |
| 5 | 83.13 | 82.68 | 82.67 | 96.10 | 96.60 | 96.48 | 82.83 | 96.39 | 89.61 |
| 6 | 80.54 | 80.20 | 80.20 | 97.32 | 95.98 | 94.42 | 80.31 | 95.90 | 88.11 |
| 7 | 81.94 | 81.39 | 81.41 | 96.12 | 96.52 | 96.29 | 81.58 | 96.31 | 88.95 |
| 8 | 81.48 | 81.18 | 81.16 | 97.00 | 95.92 | 95.96 | 81.27 | 96.29 | 88.78 |
| 9 | 84.06 | 83.72 | 83.70 | 94.36 | 94.76 | 92.46 | 83.82 | 93.86 | 88.84 |
| 10 | 78.55 | 78.19 | 78.21 | 98.06 | 98.01 | 96.89 | 78.32 | 97.65 | 87.99 |
| Mean | 81.92 | 81.56 | 81.56 | 96.10 | 96.02 | 95.22 | 81.68 | 95.78 | 88.73 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 87.90 | 83.17 | 79.56 | 99.57 | 99.43 | 99.34 | 83.54 | 99.45 | 91.50 |
| 2 | 86.48 | 79.69 | 75.86 | 99.46 | 99.32 | 99.27 | 80.68 | 99.35 | 90.01 |
| 3 | 87.10 | 81.31 | 77.85 | 99.28 | 99.20 | 99.14 | 82.08 | 99.21 | 90.65 |
| 4 | 86.99 | 79.12 | 74.50 | 99.23 | 99.09 | 98.99 | 80.20 | 99.10 | 89.65 |
| 5 | 87.36 | 81.83 | 76.49 | 99.13 | 99.10 | 99.03 | 81.89 | 99.09 | 90.49 |
| 6 | 87.30 | 81.16 | 76.16 | 99.40 | 99.22 | 99.16 | 81.54 | 99.26 | 90.40 |
| 7 | 87.62 | 81.90 | 78.15 | 99.37 | 99.29 | 99.23 | 82.56 | 99.29 | 90.93 |
| 8 | 87.52 | 80.68 | 77.54 | 99.32 | 99.10 | 99.01 | 81.91 | 99.14 | 90.53 |
| 9 | 88.10 | 82.16 | 77.87 | 99.20 | 99.02 | 98.95 | 82.71 | 99.06 | 90.88 |
| 10 | 86.26 | 79.65 | 74.34 | 99.20 | 99.08 | 99.00 | 80.08 | 99.09 | 89.59 |
| Mean | 87.26 | 81.07 | 76.83 | 99.32 | 99.19 | 99.11 | 81.72 | 99.20 | 90.46 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 89.51 | 85.14 | 70.87 | 99.19 | 99.25 | 99.25 | 81.84 | 99.23 | 90.53 |
| 2 | 84.29 | 78.39 | 68.56 | 98.34 | 98.52 | 98.56 | 77.08 | 98.47 | 87.78 |
| 3 | 88.35 | 84.98 | 87.18 | 98.21 | 97.34 | 96.93 | 86.84 | 97.49 | 92.16 |
| 4 | 85.53 | 82.50 | 72.77 | 99.07 | 99.36 | 99.36 | 80.27 | 99.26 | 89.76 |
| 5 | 88.05 | 77.36 | 76.19 | 99.07 | 96.31 | 84.63 | 80.53 | 93.34 | 86.93 |
| 6 | 87.23 | 85.26 | 85.19 | 98.72 | 97.62 | 97.78 | 85.89 | 98.04 | 91.96 |
| 7 | 87.12 | 86.21 | 85.66 | 97.58 | 97.21 | 97.10 | 86.33 | 97.30 | 91.81 |
| 8 | 90.50 | 88.77 | 87.85 | 100.00 | 99.74 | 99.74 | 89.04 | 99.83 | 94.43 |
| 9 | 85.23 | 83.77 | 82.70 | 100.00 | 99.38 | 99.38 | 83.90 | 99.59 | 91.74 |
| 10 | 89.08 | 85.11 | 61.86 | 97.24 | 96.21 | 97.27 | 78.68 | 96.91 | 87.79 |
| Mean | 87.49 | 83.75 | 77.88 | 98.74 | 98.09 | 97.00 | 83.04 | 97.94 | 90.49 |

*Table 16: Detailed results for Experiment 1.2*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 79.51 | 65.33 | 56.24 | 79.46 | 73.18 | 71.35 | 67.03 | 74.67 | 70.85 |
| 2 | 78.16 | 65.34 | 57.72 | 78.38 | 70.13 | 67.17 | 67.07 | 71.89 | 69.48 |
| 3 | 79.47 | 65.87 | 58.10 | 66.82 | 64.79 | 62.90 | 67.81 | 64.84 | 66.32 |
| 4 | 78.77 | 63.59 | 56.03 | 80.10 | 66.20 | 65.42 | 66.13 | 70.57 | 68.35 |
| 5 | 78.84 | 68.09 | 61.57 | 78.75 | 79.16 | 78.90 | 69.50 | 78.94 | 74.22 |
| 6 | 79.63 | 69.28 | 62.53 | 79.81 | 76.93 | 75.26 | 70.48 | 77.33 | 73.91 |
| 7 | 77.86 | 66.99 | 60.19 | 78.39 | 75.34 | 74.21 | 68.35 | 75.98 | 72.17 |
| 8 | 79.92 | 68.65 | 62.18 | 84.41 | 74.62 | 73.34 | 70.25 | 77.46 | 73.85 |
| 9 | 79.92 | 64.35 | 56.16 | 73.56 | 68.44 | 65.84 | 66.81 | 69.28 | 68.04 |
| 10 | 79.03 | 70.18 | 64.40 | 77.09 | 68.54 | 66.75 | 71.20 | 70.79 | 71.00 |
| Mean | 79.11 | 66.77 | 59.51 | 77.68 | 71.73 | 70.11 | 68.46 | 73.17 | 70.82 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 80.02 | 77.67 | 77.40 | 82.34 | 76.93 | 74.42 | 78.37 | 77.90 | 78.13 |
| 2 | 78.82 | 76.87 | 76.69 | 73.52 | 70.47 | 69.30 | 77.46 | 71.10 | 74.28 |
| 3 | 79.94 | 77.39 | 77.23 | 63.14 | 66.25 | 65.05 | 78.19 | 64.81 | 71.50 |
| 4 | 79.27 | 77.37 | 77.14 | 75.39 | 68.47 | 67.16 | 77.93 | 70.34 | 74.13 |
| 5 | 79.13 | 77.06 | 76.87 | 72.91 | 77.05 | 77.63 | 77.69 | 75.86 | 76.77 |
| 6 | 80.26 | 78.12 | 77.95 | 78.60 | 78.02 | 76.68 | 78.78 | 77.77 | 78.27 |
| 7 | 78.34 | 76.17 | 75.94 | 76.90 | 76.88 | 75.75 | 76.82 | 76.51 | 76.66 |
| 8 | 80.37 | 78.12 | 77.84 | 81.29 | 73.28 | 72.49 | 78.78 | 75.68 | 77.23 |
| 9 | 80.25 | 77.65 | 77.34 | 70.13 | 69.08 | 66.70 | 78.41 | 68.63 | 73.52 |
| 10 | 79.52 | 77.64 | 77.44 | 72.17 | 69.34 | 68.88 | 78.20 | 70.13 | 74.16 |
| Mean | 79.59 | 77.41 | 77.19 | 74.64 | 72.58 | 71.41 | 78.06 | 72.87 | 75.47 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 89.35 | 80.26 | 70.01 | 82.26 | 77.95 | 76.27 | 79.87 | 78.83 | 79.35 |
| 2 | 88.82 | 77.60 | 68.08 | 76.95 | 73.33 | 74.60 | 78.17 | 74.96 | 76.56 |
| 3 | 89.14 | 78.67 | 68.71 | 75.76 | 74.56 | 74.63 | 78.84 | 74.99 | 76.91 |
| 4 | 88.70 | 78.65 | 70.69 | 76.75 | 70.23 | 70.00 | 79.34 | 72.33 | 75.84 |
| 5 | 89.14 | 79.19 | 72.52 | 77.47 | 76.64 | 75.21 | 80.28 | 76.44 | 78.36 |
| 6 | 90.37 | 80.43 | 71.98 | 72.55 | 73.79 | 74.74 | 80.93 | 73.69 | 77.31 |
| 7 | 88.62 | 79.01 | 71.16 | 70.70 | 64.56 | 66.13 | 79.60 | 67.13 | 73.36 |
| 8 | 89.47 | 80.73 | 73.87 | 77.57 | 69.34 | 69.14 | 81.35 | 72.02 | 76.69 |
| 9 | 88.60 | 75.46 | 66.18 | 77.03 | 71.98 | 70.44 | 76.75 | 73.15 | 74.95 |
| 10 | 89.78 | 80.63 | 74.14 | 72.00 | 66.27 | 67.05 | 81.51 | 68.44 | 74.98 |
| Mean | 89.20 | 79.06 | 70.73 | 75.90 | 71.86 | 71.82 | 79.66 | 73.20 | 76.43 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 95.93 | 95.19 | 93.09 | 96.73 | 95.50 | 92.13 | 94.74 | 94.79 | 94.76 |
| 2 | 95.19 | 93.94 | 88.92 | 95.93 | 94.78 | 88.93 | 92.68 | 93.21 | 92.95 |
| 3 | 94.46 | 92.56 | 88.26 | 93.70 | 91.34 | 73.62 | 91.76 | 86.22 | 88.99 |
| 4 | 94.34 | 93.08 | 83.75 | 94.39 | 91.21 | 70.11 | 90.39 | 85.24 | 87.81 |
| 5 | 93.91 | 91.60 | 83.49 | 91.51 | 89.64 | 60.47 | 89.67 | 80.54 | 85.10 |
| 6 | 95.54 | 94.09 | 87.93 | 95.16 | 93.24 | 84.34 | 92.52 | 90.91 | 91.72 |
| 7 | 95.05 | 92.86 | 84.83 | 94.43 | 91.91 | 71.39 | 90.91 | 85.91 | 88.41 |
| 8 | 93.55 | 91.52 | 82.87 | 88.28 | 71.26 | 58.57 | 89.31 | 72.70 | 81.01 |
| 9 | 94.49 | 92.10 | 89.03 | 93.80 | 90.10 | 68.21 | 91.87 | 84.04 | 87.95 |
| 10 | 95.51 | 94.36 | 82.52 | 95.99 | 94.59 | 89.94 | 90.80 | 93.51 | 92.15 |
| Mean | 94.80 | 93.13 | 86.47 | 93.99 | 90.35 | 75.77 | 91.47 | 86.70 | 89.09 |

*Table 17: Detailed results for Experiment 1.3*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 79.55 | 55.34 | 52.67 | 97.65 | 88.34 | 67.57 | 62.52 | 84.52 | 73.52 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 78.82 | 54.70 | 53.67 | 97.46 | 69.81 | 52.58 | 62.40 | 73.28 | 67.84 |
| 3 | 78.84 | 58.64 | 52.33 | 91.22 | 63.03 | 45.86 | 63.27 | 66.70 | 64.99 |
| 4 | 83.46 | 62.67 | 55.93 | 95.72 | 94.85 | 89.39 | 67.36 | 93.32 | 80.34 |
| 5 | 78.28 | 59.49 | 49.57 | 95.90 | 61.57 | 43.18 | 62.45 | 66.88 | 64.67 |
| 6 | 77.89 | 57.76 | 54.81 | 98.31 | 67.43 | 43.73 | 63.49 | 69.82 | 66.65 |
| 7 | 79.23 | 57.07 | 51.48 | 97.50 | 64.50 | 53.16 | 62.59 | 71.72 | 67.16 |
| 8 | 82.56 | 59.60 | 51.67 | 98.89 | 94.49 | 62.01 | 64.61 | 85.13 | 74.87 |
| 9 | 80.54 | 59.19 | 48.20 | 94.57 | 51.90 | 51.68 | 62.64 | 66.05 | 64.35 |
| 10 | 75.54 | 59.70 | 51.30 | 96.33 | 52.02 | 55.14 | 62.18 | 67.83 | 65.00 |
| Mean | 79.47 | 58.42 | 52.16 | 96.35 | 70.79 | 56.43 | 63.35 | 74.53 | 68.94 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 84.99 | 83.92 | 83.63 | 96.81 | 97.20 | 96.40 | 84.18 | 96.80 | 90.49 |
| 2 | 83.20 | 82.26 | 82.14 | 97.08 | 95.35 | 93.33 | 82.54 | 95.25 | 88.89 |
| 3 | 84.40 | 83.16 | 82.63 | 95.59 | 95.17 | 95.29 | 83.39 | 95.35 | 89.37 |
| 4 | 83.87 | 82.93 | 82.62 | 96.98 | 94.75 | 94.01 | 83.14 | 95.25 | 89.19 |
| 5 | 84.33 | 83.32 | 82.83 | 94.44 | 95.74 | 95.65 | 83.49 | 95.28 | 89.39 |
| 6 | 83.58 | 82.48 | 82.25 | 97.84 | 95.77 | 94.39 | 82.77 | 96.00 | 89.39 |
| 7 | 82.91 | 81.85 | 81.65 | 96.15 | 96.43 | 96.10 | 82.13 | 96.23 | 89.18 |
| 8 | 83.96 | 82.92 | 82.72 | 97.61 | 96.01 | 95.40 | 83.20 | 96.34 | 89.77 |
| 9 | 85.70 | 84.63 | 84.34 | 95.03 | 94.73 | 92.20 | 84.89 | 93.99 | 89.44 |
| 10 | 82.24 | 81.38 | 81.23 | 98.20 | 97.57 | 96.85 | 81.61 | 97.54 | 89.58 |
| Mean | 83.92 | 82.88 | 82.60 | 96.57 | 95.87 | 94.96 | 83.14 | 95.80 | 89.47 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 91.99 | 84.56 | 76.99 | 99.73 | 99.56 | 99.51 | 84.51 | 99.60 | 92.06 |
| 2 | 90.89 | 80.98 | 71.74 | 99.64 | 99.42 | 99.33 | 81.20 | 99.46 | 90.33 |
| 3 | 91.13 | 81.89 | 73.85 | 99.51 | 99.43 | 99.37 | 82.29 | 99.44 | 90.86 |
| 4 | 91.02 | 81.67 | 73.35 | 99.43 | 99.13 | 99.06 | 82.02 | 99.21 | 90.61 |
| 5 | 90.96 | 82.23 | 75.06 | 99.31 | 99.16 | 99.04 | 82.75 | 99.17 | 90.96 |
| 6 | 91.51 | 82.79 | 74.47 | 99.57 | 99.32 | 99.23 | 82.92 | 99.38 | 91.15 |
| 7 | 90.74 | 81.96 | 74.12 | 99.41 | 99.09 | 99.03 | 82.28 | 99.18 | 90.73 |
| 8 | 91.65 | 82.71 | 76.42 | 99.52 | 99.23 | 99.12 | 83.59 | 99.29 | 91.44 |
| 9 | 91.56 | 81.50 | 72.65 | 99.43 | 99.25 | 99.19 | 81.90 | 99.29 | 90.60 |
| 10 | 91.28 | 81.96 | 74.29 | 99.29 | 99.13 | 99.10 | 82.51 | 99.17 | 90.84 |
| Mean | 91.27 | 82.22 | 74.29 | 99.48 | 99.27 | 99.20 | 82.60 | 99.32 | 90.96 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 94.78 | 93.52 | 92.48 | 99.05 | 92.48 | 99.25 | 93.59 | 96.93 | 95.26 |
| 2 | 93.55 | 93.05 | 92.91 | 100.00 | 98.52 | 98.32 | 93.17 | 98.95 | 96.06 |
| 3 | 93.74 | 93.14 | 92.26 | 93.97 | 97.13 | 97.54 | 93.05 | 96.21 | 94.63 |
| 4 | 93.68 | 92.88 | 89.74 | 98.51 | 98.39 | 91.97 | 92.10 | 96.29 | 94.20 |
| 5 | 93.58 | 92.64 | 91.86 | 99.30 | 99.18 | 99.18 | 92.69 | 99.22 | 95.96 |
| 6 | 94.08 | 92.93 | 92.14 | 100.00 | 97.62 | 97.04 | 93.05 | 98.22 | 95.63 |
| 7 | 93.48 | 93.30 | 91.67 | 97.74 | 96.77 | 85.92 | 92.82 | 93.48 | 93.15 |
| 8 | 93.85 | 93.31 | 91.80 | 98.70 | 99.22 | 99.48 | 92.99 | 99.13 | 96.06 |
| 9 | 94.46 | 92.93 | 92.77 | 100.00 | 100.00 | 100.00 | 93.39 | 100.00 | 96.69 |
| 10 | 93.97 | 92.15 | 90.89 | 97.93 | 97.67 | 97.54 | 92.34 | 97.71 | 95.03 |
| Mean | 93.92 | 92.99 | 91.85 | 98.52 | 97.70 | 96.62 | 92.92 | 97.61 | 95.27 |

*Table 18: Detailed results for Experiment 2*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 57.60 | 49.37 | 50.13 | 70.18 | 67.44 | 62.43 | 52.37 | 66.68 | 59.53 |
| 2 | 59.91 | 51.79 | 51.56 | 69.45 | 67.46 | 62.78 | 54.42 | 66.56 | 60.49 |
| 3 | 57.95 | 50.71 | 50.49 | 65.76 | 62.62 | 60.89 | 53.05 | 63.09 | 58.07 |
| 4 | 62.83 | 54.27 | 54.16 | 65.28 | 62.79 | 61.82 | 57.08 | 63.30 | 60.19 |
| 5 | 61.20 | 56.66 | 56.24 | 66.97 | 59.27 | 58.96 | 58.03 | 61.73 | 59.88 |
| 6 | 56.23 | 50.84 | 52.30 | 66.43 | 62.37 | 61.80 | 53.12 | 63.53 | 58.33 |
| 7 | 59.29 | 56.81 | 56.02 | 66.63 | 58.39 | 61.54 | 57.37 | 62.19 | 59.78 |
| 8 | 58.34 | 52.08 | 52.13 | 69.26 | 60.52 | 60.35 | 54.18 | 63.38 | 58.78 |
| 9 | 60.19 | 54.29 | 54.09 | 67.01 | 64.28 | 63.40 | 56.19 | 64.90 | 60.54 |
| 10 | 51.18 | 51.61 | 52.03 | 67.85 | 62.05 | 61.02 | 51.61 | 63.64 | 57.62 |
| Mean | 58.47 | 52.84 | 52.92 | 67.48 | 62.72 | 61.50 | 54.74 | 63.90 | 59.32 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 48.87 | 52.75 | 52.08 | 74.71 | 70.37 | 68.33 | 51.23 | 71.13 | 61.18 |
| 2 | 50.26 | 53.92 | 52.97 | 68.30 | 65.17 | 64.77 | 52.38 | 66.08 | 59.23 |
| 3 | 49.76 | 53.54 | 52.62 | 67.13 | 63.92 | 63.93 | 51.97 | 64.99 | 58.48 |
| 4 | 51.29 | 54.24 | 53.11 | 66.56 | 65.98 | 65.08 | 52.88 | 65.87 | 59.38 |
| 5 | 51.03 | 54.50 | 53.64 | 66.27 | 62.68 | 61.94 | 53.06 | 63.63 | 58.34 |
| 6 | 49.70 | 53.27 | 52.61 | 69.35 | 67.28 | 65.63 | 51.86 | 67.42 | 59.64 |
| 7 | 50.43 | 54.27 | 53.49 | 65.17 | 62.51 | 61.94 | 52.73 | 63.21 | 57.97 |
| 8 | 50.00 | 53.12 | 52.33 | 71.45 | 68.30 | 66.18 | 51.82 | 68.64 | 60.23 |
| 9 | 50.76 | 54.33 | 53.28 | 63.48 | 62.14 | 62.97 | 52.79 | 62.86 | 57.83 |
| 10 | 47.49 | 52.15 | 51.93 | 71.70 | 64.57 | 63.10 | 50.52 | 66.46 | 58.49 |
| Mean | 49.96 | 53.61 | 52.81 | 68.41 | 65.29 | 64.39 | 52.12 | 66.03 | 59.08 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 76.22 | 64.10 | 56.10 | 72.38 | 62.09 | 62.03 | 65.47 | 65.50 | 65.49 |
| 2 | 80.49 | 75.86 | 69.34 | 65.78 | 54.40 | 52.67 | 75.23 | 57.62 | 66.42 |
| 3 | 82.25 | 66.03 | 62.95 | 59.52 | 48.55 | 48.28 | 70.41 | 52.12 | 61.26 |
| 4 | 72.19 | 75.03 | 69.03 | 61.98 | 46.16 | 42.83 | 72.09 | 50.32 | 61.20 |
| 5 | 85.47 | 82.30 | 74.06 | 55.18 | 43.08 | 43.61 | 80.61 | 47.29 | 63.95 |
| 6 | 82.12 | 76.45 | 71.07 | 66.47 | 50.78 | 49.46 | 76.55 | 55.57 | 66.06 |
| 7 | 79.45 | 74.15 | 66.62 | 55.05 | 39.23 | 42.48 | 73.41 | 45.59 | 59.50 |
| 8 | 77.56 | 80.67 | 72.96 | 59.63 | 39.46 | 41.03 | 77.06 | 46.71 | 61.89 |
| 9 | 80.28 | 72.57 | 67.12 | 54.61 | 41.87 | 43.63 | 73.33 | 46.70 | 60.01 |
| 10 | 81.90 | 71.15 | 66.59 | 61.76 | 50.43 | 49.99 | 73.21 | 54.06 | 63.64 |
| Mean | 79.79 | 73.83 | 67.59 | 61.23 | 47.61 | 47.60 | 73.74 | 52.15 | 62.94 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 64.44 | 67.06 | 66.77 | 81.11 | 84.44 | 85.18 | 66.09 | 83.58 | 74.83 |
| 2 | 62.92 | 64.72 | 56.29 | 81.96 | 89.67 | 90.80 | 61.31 | 87.48 | 74.39 |
| 3 | 63.62 | 64.81 | 60.79 | 86.80 | 92.33 | 86.07 | 63.07 | 88.40 | 75.74 |
| 4 | 63.11 | 64.65 | 47.46 | 89.50 | 81.84 | 78.50 | 58.41 | 83.28 | 70.84 |
| 5 | 66.44 | 67.00 | 57.76 | 84.20 | 88.20 | 88.72 | 63.73 | 87.04 | 75.39 |
| 6 | 64.92 | 64.22 | 60.19 | 82.62 | 86.76 | 86.36 | 63.11 | 85.25 | 74.18 |
| 7 | 64.51 | 66.96 | 62.54 | 73.79 | 79.67 | 80.23 | 64.67 | 77.90 | 71.28 |
| 8 | 65.59 | 72.16 | 62.75 | 77.78 | 80.69 | 82.67 | 66.83 | 80.38 | 73.61 |
| 9 | 69.97 | 69.78 | 55.41 | 81.81 | 85.87 | 85.31 | 65.05 | 84.33 | 74.69 |
| 10 | 66.04 | 64.58 | 61.74 | 82.23 | 85.20 | 91.16 | 64.12 | 86.20 | 75.16 |
| Mean | 65.16 | 66.59 | 59.17 | 82.18 | 85.47 | 85.50 | 63.64 | 84.38 | 74.01 |

*Table 19: Detailed results for Experiment 3*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 76.94 | 53.04 | 45.59 | 97.69 | 61.30 | 59.95 | 58.52 | 72.98 | 65.75 |
| 2 | 65.81 | 52.70 | 44.05 | 94.42 | 74.81 | 75.31 | 54.19 | 81.51 | 67.85 |
| 3 | 74.32 | 47.35 | 48.64 | 97.24 | 60.88 | 62.27 | 56.77 | 73.47 | 65.12 |
| 4 | 77.00 | 75.75 | 72.03 | 94.78 | 97.61 | 98.04 | 74.93 | 96.81 | 85.87 |
| 5 | 74.78 | 52.94 | 51.76 | 99.49 | 39.63 | 37.59 | 59.83 | 58.90 | 59.37 |
| 6 | 56.26 | 50.21 | 47.58 | 96.97 | 52.12 | 65.01 | 51.35 | 71.37 | 61.36 |
| 7 | 74.52 | 42.25 | 53.77 | 74.01 | 33.87 | 58.43 | 56.85 | 55.44 | 56.14 |
| 8 | 80.92 | 45.97 | 40.15 | 88.83 | 66.16 | 66.16 | 55.68 | 73.72 | 64.70 |
| 9 | 74.79 | 58.02 | 54.33 | 100.00 | 0.00 | 0.00 | 62.38 | 33.33 | 47.86 |
| 10 | 74.73 | 40.41 | 41.15 | 99.24 | 94.42 | 32.86 | 52.10 | 75.50 | 63.80 |
| Mean | 73.01 | 51.86 | 49.91 | 94.27 | 58.08 | 55.56 | 58.26 | 69.30 | 63.78 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 82.04 | 81.88 | 81.93 | 99.15 | 93.24 | 93.24 | 81.95 | 95.21 | 88.58 |
| 2 | 72.20 | 72.54 | 72.56 | 97.97 | 98.47 | 97.55 | 72.43 | 98.00 | 85.22 |
| 3 | 82.48 | 82.62 | 82.60 | 93.98 | 85.20 | 85.20 | 82.57 | 88.13 | 85.35 |
| 4 | 75.93 | 75.86 | 75.87 | 88.17 | 91.99 | 91.99 | 75.88 | 90.71 | 83.30 |
| 5 | 80.80 | 80.28 | 80.23 | 99.66 | 99.08 | 99.08 | 80.44 | 99.27 | 89.86 |
| 6 | 67.37 | 67.95 | 67.98 | 99.49 | 97.63 | 98.22 | 67.77 | 98.45 | 83.11 |
| 7 | 77.08 | 77.44 | 77.50 | 73.69 | 82.21 | 84.64 | 77.34 | 80.18 | 78.76 |
| 8 | 86.27 | 85.76 | 85.71 | 99.49 | 99.49 | 99.49 | 85.91 | 99.49 | 92.70 |
| 9 | 78.99 | 78.52 | 78.51 | 100.00 | 100.00 | 100.00 | 78.67 | 100.00 | 89.34 |
| 10 | 79.50 | 78.59 | 78.62 | 95.19 | 95.94 | 97.45 | 78.90 | 96.19 | 87.55 |
| Mean | 78.27 | 78.14 | 78.15 | 94.68 | 94.33 | 94.69 | 78.19 | 94.56 | 86.38 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 88.07 | 79.76 | 74.91 | 99.23 | 98.91 | 99.10 | 80.91 | 99.08 | 89.99 |
| 2 | 83.71 | 79.68 | 68.94 | 99.66 | 99.11 | 99.29 | 77.44 | 99.35 | 88.40 |
| 3 | 85.67 | 78.20 | 74.58 | 99.69 | 99.49 | 99.27 | 79.48 | 99.48 | 89.48 |
| 4 | 85.43 | 77.65 | 73.58 | 98.60 | 98.81 | 98.81 | 78.89 | 98.74 | 88.81 |
| 5 | 86.59 | 83.18 | 80.70 | 99.15 | 99.28 | 99.39 | 83.49 | 99.28 | 91.38 |
| 6 | 85.84 | 79.97 | 73.86 | 99.49 | 99.32 | 99.24 | 79.89 | 99.35 | 89.62 |
| 7 | 86.03 | 78.31 | 74.88 | 99.24 | 99.23 | 99.12 | 79.74 | 99.20 | 89.47 |
| 8 | 88.43 | 78.60 | 70.94 | 100.00 | 99.83 | 99.83 | 79.32 | 99.89 | 89.61 |
| 9 | 84.86 | 76.29 | 70.71 | 100.00 | 100.00 | 100.00 | 77.29 | 100.00 | 88.64 |
| 10 | 86.34 | 79.22 | 69.31 | 99.75 | 98.48 | 98.88 | 78.29 | 99.03 | 88.66 |
| Mean | 86.10 | 79.09 | 73.24 | 99.48 | 99.25 | 99.29 | 79.47 | 99.34 | 89.41 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 88.85 | 86.83 | 68.14 | 98.51 | 98.50 | 97.99 | 81.27 | 98.33 | 89.81 |
| 2 | 84.26 | 79.19 | 60.49 | 98.34 | 98.52 | 98.56 | 74.65 | 98.47 | 86.56 |
| 3 | 87.95 | 87.17 | 68.10 | 88.17 | 92.01 | 90.98 | 81.07 | 90.39 | 85.73 |
| 4 | 84.33 | 83.23 | 81.96 | 98.88 | 98.88 | 98.88 | 83.17 | 98.88 | 91.03 |
| 5 | 87.14 | 86.00 | 85.59 | 98.36 | 97.75 | 97.75 | 86.24 | 97.95 | 92.10 |
| 6 | 87.06 | 85.80 | 84.23 | 98.72 | 97.62 | 97.78 | 85.70 | 98.04 | 91.87 |
| 7 | 86.25 | 85.45 | 62.61 | 86.13 | 89.13 | 96.95 | 78.10 | 90.74 | 84.42 |
| 8 | 90.80 | 89.04 | 85.27 | 99.48 | 98.96 | 98.96 | 88.37 | 99.13 | 93.75 |
| 9 | 84.39 | 83.08 | 82.91 | 99.38 | 99.38 | 99.38 | 83.46 | 99.38 | 91.42 |
| 10 | 88.54 | 85.63 | 84.64 | 94.14 | 96.79 | 96.99 | 86.27 | 95.97 | 91.12 |
| Mean | 86.96 | 85.14 | 76.39 | 96.01 | 96.75 | 97.42 | 82.83 | 96.73 | 89.78 |

*Table 20: Detailed results for Experiment 4.1*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 82.88 | 79.93 | 62.05 | 99.93 | 99.86 | 97.24 | 74.95 | 99.01 | 86.98 |
| 2 | 81.45 | 78.63 | 72.79 | 98.72 | 86.19 | 90.58 | 77.63 | 91.83 | 84.73 |
| 3 | 82.19 | 79.70 | 68.07 | 98.97 | 93.43 | 94.95 | 76.65 | 95.79 | 86.22 |
| 4 | 82.07 | 79.12 | 65.91 | 99.66 | 99.17 | 99.25 | 75.70 | 99.36 | 87.53 |
| 5 | 81.15 | 78.61 | 70.77 | 99.52 | 99.64 | 99.55 | 76.84 | 99.57 | 88.21 |
| 6 | 81.86 | 79.04 | 67.78 | 99.45 | 98.79 | 98.96 | 76.23 | 99.07 | 87.65 |
| 7 | 80.95 | 77.99 | 71.15 | 98.90 | 93.94 | 94.56 | 76.70 | 95.80 | 86.25 |
| 8 | 82.32 | 79.45 | 74.39 | 99.13 | 98.05 | 99.09 | 78.72 | 98.76 | 88.74 |
| 9 | 82.91 | 79.57 | 71.26 | 98.66 | 99.02 | 98.90 | 77.91 | 98.86 | 88.39 |
| 10 | 83.08 | 79.45 | 69.94 | 99.88 | 99.13 | 93.04 | 77.49 | 97.35 | 87.42 |
| Mean | 82.09 | 79.15 | 69.41 | 99.28 | 96.72 | 96.61 | 76.88 | 97.54 | 87.21 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 82.31 | 79.69 | 62.52 | 99.75 | 99.71 | 94.45 | 74.84 | 97.97 | 86.40 |
| 2 | 81.14 | 78.41 | 72.87 | 98.20 | 99.05 | 99.46 | 77.47 | 98.90 | 88.19 |
| 3 | 81.82 | 79.45 | 68.25 | 97.07 | 98.97 | 99.25 | 76.51 | 98.43 | 87.47 |
| 4 | 81.60 | 78.97 | 66.43 | 99.11 | 99.24 | 99.48 | 75.67 | 99.28 | 87.47 |
| 5 | 80.79 | 78.42 | 71.00 | 98.87 | 99.14 | 99.48 | 76.73 | 99.16 | 87.95 |
| 6 | 81.42 | 78.86 | 68.12 | 98.37 | 98.60 | 98.74 | 76.13 | 98.57 | 87.35 |
| 7 | 80.37 | 77.68 | 71.21 | 96.24 | 98.17 | 98.46 | 76.42 | 97.62 | 87.02 |
| 8 | 81.84 | 79.23 | 74.81 | 98.67 | 98.34 | 99.70 | 78.63 | 98.90 | 88.76 |
| 9 | 82.49 | 79.36 | 71.58 | 97.06 | 98.53 | 98.85 | 77.81 | 98.15 | 87.98 |
| 10 | 82.62 | 79.23 | 70.20 | 99.87 | 98.87 | 92.01 | 77.35 | 96.91 | 87.13 |
| Mean | 81.64 | 78.93 | 69.70 | 98.32 | 98.86 | 97.99 | 76.76 | 98.39 | 87.57 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 89.90 | 84.78 | 75.35 | 99.97 | 99.82 | 95.52 | 83.35 | 98.43 | 90.89 |
| 2 | 89.46 | 83.68 | 72.95 | 100.00 | 99.23 | 99.17 | 82.03 | 99.47 | 90.75 |
| 3 | 89.54 | 84.93 | 63.63 | 99.97 | 99.15 | 99.21 | 79.37 | 99.44 | 89.40 |
| 4 | 88.58 | 83.39 | 69.58 | 99.95 | 99.29 | 99.46 | 80.52 | 99.57 | 90.04 |
| 5 | 89.00 | 84.12 | 78.97 | 99.90 | 99.65 | 99.60 | 84.03 | 99.72 | 91.87 |
| 6 | 89.48 | 84.48 | 79.66 | 99.95 | 99.34 | 99.49 | 84.54 | 99.59 | 92.07 |
| 7 | 88.75 | 83.66 | 70.74 | 99.76 | 99.31 | 99.30 | 81.05 | 99.46 | 90.25 |
| 8 | 89.62 | 84.85 | 81.86 | 99.72 | 99.60 | 99.45 | 85.45 | 99.59 | 92.52 |
| 9 | 89.05 | 83.76 | 71.21 | 99.95 | 99.44 | 99.10 | 81.34 | 99.50 | 90.42 |
| 10 | 90.08 | 85.04 | 74.93 | 98.93 | 99.18 | 93.50 | 83.35 | 97.20 | 90.28 |
| Mean | 89.35 | 84.27 | 73.89 | 99.81 | 99.40 | 98.38 | 82.50 | 99.20 | 90.85 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 88.86 | 86.04 | 83.82 | 99.64 | 99.61 | 93.39 | 86.24 | 97.55 | 91.89 |
| 2 | 89.18 | 86.07 | 84.05 | 99.04 | 98.74 | 98.94 | 86.44 | 98.91 | 92.67 |
| 3 | 89.19 | 86.61 | 84.46 | 98.66 | 98.73 | 97.15 | 86.75 | 98.18 | 92.47 |
| 4 | 88.08 | 85.30 | 82.60 | 99.25 | 99.30 | 99.37 | 85.33 | 99.31 | 92.32 |
| 5 | 88.52 | 85.21 | 81.59 | 98.41 | 98.82 | 99.05 | 85.11 | 98.76 | 91.93 |
| 6 | 88.43 | 86.24 | 84.71 | 98.86 | 99.34 | 98.24 | 86.46 | 98.82 | 92.64 |
| 7 | 89.09 | 85.62 | 82.45 | 98.73 | 98.99 | 99.09 | 85.72 | 98.94 | 92.33 |
| 8 | 89.74 | 85.45 | 81.64 | 99.33 | 98.98 | 95.79 | 85.61 | 98.03 | 91.82 |
| 9 | 89.57 | 86.34 | 84.47 | 98.63 | 98.80 | 98.88 | 86.79 | 98.77 | 92.78 |
| 10 | 89.18 | 82.55 | 80.16 | 99.44 | 99.18 | 95.72 | 83.96 | 98.11 | 91.04 |
| Mean | 88.98 | 85.54 | 83.00 | 99.00 | 99.05 | 97.56 | 85.84 | 98.54 | 92.19 |

*Table 21: Detailed results for Experiment 4.2*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 83.41 | 81.02 | 71.94 | 74.32 | 61.87 | 61.33 | 78.79 | 65.84 | 72.32 |
| 2 | 83.67 | 80.86 | 72.71 | 79.49 | 56.58 | 70.80 | 79.08 | 68.96 | 74.02 |
| 3 | 83.02 | 80.76 | 76.94 | 75.04 | 63.21 | 73.18 | 80.24 | 70.47 | 75.36 |
| 4 | 83.42 | 80.77 | 64.99 | 69.19 | 61.31 | 67.33 | 76.39 | 65.94 | 71.17 |
| 5 | 82.94 | 80.68 | 76.30 | 76.66 | 74.71 | 75.69 | 79.97 | 75.69 | 77.83 |
| 6 | 82.78 | 81.06 | 78.58 | 82.03 | 82.41 | 73.48 | 80.81 | 79.31 | 80.06 |
| 7 | 83.23 | 81.21 | 74.08 | 74.05 | 73.22 | 74.11 | 79.50 | 73.80 | 76.65 |
| 8 | 83.28 | 80.79 | 79.29 | 80.96 | 65.05 | 91.56 | 81.12 | 79.19 | 80.15 |
| 9 | 84.01 | 81.30 | 69.82 | 69.11 | 70.20 | 69.50 | 78.38 | 69.60 | 73.99 |
| 10 | 82.86 | 80.56 | 74.68 | 68.32 | 77.78 | 74.01 | 79.37 | 73.37 | 76.37 |
| Mean | 83.26 | 80.90 | 73.93 | 74.92 | 68.64 | 73.10 | 79.37 | 72.22 | 75.79 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 83.45 | 81.21 | 72.50 | 64.11 | 60.57 | 63.98 | 79.05 | 62.89 | 70.97 |
| 2 | 83.67 | 80.96 | 73.24 | 73.66 | 45.39 | 63.86 | 79.29 | 60.97 | 70.13 |
| 3 | 83.08 | 81.04 | 77.69 | 69.17 | 59.86 | 70.58 | 80.61 | 66.53 | 73.57 |
| 4 | 83.41 | 81.11 | 65.62 | 66.15 | 50.44 | 59.76 | 76.71 | 58.78 | 67.75 |
| 5 | 83.06 | 81.12 | 77.34 | 75.09 | 77.21 | 77.23 | 80.51 | 76.51 | 78.51 |
| 6 | 82.86 | 81.16 | 78.90 | 82.79 | 82.18 | 77.83 | 80.97 | 80.93 | 80.95 |
| 7 | 83.33 | 81.33 | 74.49 | 70.22 | 69.08 | 71.47 | 79.72 | 70.26 | 74.99 |
| 8 | 83.32 | 81.12 | 80.30 | 74.00 | 61.61 | 91.38 | 81.58 | 75.66 | 78.62 |
| 9 | 84.06 | 81.38 | 70.02 | 53.80 | 65.32 | 67.79 | 78.49 | 62.31 | 70.40 |
| 10 | 82.94 | 80.95 | 75.52 | 68.39 | 70.61 | 67.75 | 79.80 | 68.92 | 74.36 |
| Mean | 83.32 | 81.14 | 74.56 | 69.74 | 64.23 | 71.16 | 79.67 | 68.38 | 74.02 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 90.51 | 83.89 | 63.73 | 77.48 | 67.38 | 68.35 | 79.38 | 71.07 | 75.22 |
| 2 | 89.76 | 83.49 | 74.53 | 99.72 | 72.53 | 76.39 | 82.59 | 82.88 | 82.74 |
| 3 | 89.78 | 83.63 | 74.34 | 69.50 | 70.06 | 72.54 | 82.58 | 70.70 | 76.64 |
| 4 | 89.33 | 83.07 | 75.93 | 76.46 | 59.78 | 67.35 | 82.78 | 67.86 | 75.32 |
| 5 | 89.77 | 83.00 | 79.24 | 63.15 | 72.10 | 77.17 | 84.00 | 70.81 | 77.41 |
| 6 | 89.89 | 82.86 | 77.67 | 54.44 | 75.75 | 75.21 | 83.47 | 68.46 | 75.97 |
| 7 | 89.42 | 83.26 | 73.05 | 52.12 | 70.19 | 73.23 | 81.91 | 65.18 | 73.54 |
| 8 | 89.81 | 82.95 | 81.64 | 75.91 | 80.81 | 95.84 | 84.80 | 84.18 | 84.49 |
| 9 | 90.28 | 84.04 | 73.71 | 68.25 | 73.58 | 74.41 | 82.68 | 72.08 | 77.38 |
| 10 | 89.97 | 83.25 | 73.35 | 60.64 | 76.40 | 71.07 | 82.19 | 69.37 | 75.78 |
| Mean | 89.85 | 83.34 | 74.72 | 69.77 | 71.86 | 75.16 | 82.64 | 72.26 | 77.45 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 90.07 | 85.16 | 77.66 | 92.31 | 81.94 | 77.89 | 84.30 | 84.04 | 84.17 |
| 2 | 89.05 | 84.89 | 82.40 | 85.21 | 72.47 | 72.29 | 85.45 | 76.65 | 81.05 |
| 3 | 89.29 | 86.41 | 84.57 | 87.50 | 86.62 | 79.64 | 86.76 | 84.59 | 85.67 |
| 4 | 89.22 | 84.60 | 82.69 | 88.86 | 85.63 | 80.25 | 85.50 | 84.92 | 85.21 |
| 5 | 90.00 | 86.58 | 83.03 | 67.52 | 68.82 | 65.72 | 86.53 | 67.35 | 76.94 |
| 6 | 89.61 | 86.44 | 83.54 | 78.48 | 76.38 | 73.68 | 86.53 | 76.18 | 81.35 |
| 7 | 89.74 | 86.66 | 82.84 | 78.15 | 74.26 | 71.25 | 86.42 | 74.55 | 80.48 |
| 8 | 89.61 | 86.42 | 85.39 | 75.67 | 71.22 | 69.01 | 87.14 | 71.97 | 79.56 |
| 9 | 89.95 | 86.58 | 83.29 | 70.60 | 76.92 | 74.72 | 86.61 | 74.08 | 80.34 |
| 10 | 89.58 | 85.91 | 83.83 | 87.53 | 82.17 | 78.51 | 86.44 | 82.74 | 84.59 |
| Mean | 89.61 | 85.96 | 82.92 | 81.18 | 77.64 | 74.29 | 86.17 | 77.71 | 81.94 |

*Table 22: Detailed results for Experiment 4.3*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 87.09 | 83.58 | 67.97 | 99.92 | 99.31 | 93.63 | 79.55 | 97.62 | 88.58 |
| 2 | 86.88 | 83.44 | 73.63 | 99.52 | 99.29 | 99.15 | 81.32 | 99.32 | 90.32 |
| 3 | 86.93 | 83.87 | 76.27 | 99.00 | 99.39 | 99.19 | 82.36 | 99.19 | 90.77 |
| 4 | 87.19 | 82.87 | 62.75 | 99.58 | 99.56 | 99.46 | 77.60 | 99.53 | 88.57 |
| 5 | 86.30 | 83.30 | 72.05 | 99.77 | 99.25 | 98.98 | 80.55 | 99.34 | 89.94 |
| 6 | 86.16 | 83.09 | 73.68 | 99.47 | 98.73 | 98.60 | 80.98 | 98.94 | 89.96 |
| 7 | 86.70 | 83.67 | 74.90 | 97.58 | 98.54 | 97.81 | 81.76 | 97.98 | 89.87 |
| 8 | 86.86 | 83.04 | 79.24 | 98.34 | 99.40 | 99.66 | 83.04 | 99.13 | 91.09 |
| 9 | 88.31 | 84.50 | 73.21 | 98.37 | 97.38 | 97.04 | 82.01 | 97.60 | 89.80 |
| 10 | 87.20 | 83.23 | 74.79 | 99.85 | 99.07 | 93.30 | 81.74 | 97.41 | 89.57 |
| Mean | 86.96 | 83.46 | 72.85 | 99.14 | 98.99 | 97.68 | 81.09 | 98.60 | 89.85 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 86.57 | 84.48 | 70.25 | 99.72 | 99.75 | 91.37 | 80.43 | 96.95 | 88.69 |
| 2 | 86.38 | 83.97 | 75.36 | 99.15 | 99.14 | 99.46 | 81.90 | 99.25 | 90.58 |
| 3 | 86.48 | 84.36 | 78.19 | 97.17 | 98.90 | 99.21 | 83.01 | 98.43 | 90.72 |
| 4 | 86.79 | 84.49 | 65.71 | 99.31 | 99.28 | 99.48 | 79.00 | 99.36 | 89.18 |
| 5 | 86.01 | 84.19 | 74.63 | 99.00 | 99.19 | 99.47 | 81.61 | 99.22 | 90.42 |
| 6 | 85.58 | 84.12 | 77.13 | 98.50 | 98.91 | 99.02 | 82.28 | 98.81 | 90.54 |
| 7 | 85.97 | 83.93 | 76.81 | 96.72 | 98.43 | 98.71 | 82.24 | 97.95 | 90.10 |
| 8 | 86.54 | 84.65 | 83.65 | 98.67 | 98.09 | 99.65 | 84.94 | 98.80 | 91.87 |
| 9 | 87.79 | 85.12 | 75.13 | 96.98 | 98.58 | 98.91 | 82.68 | 98.16 | 90.42 |
| 10 | 86.54 | 84.15 | 77.87 | 99.78 | 98.88 | 92.40 | 82.85 | 97.02 | 89.94 |
| Mean | 86.46 | 84.35 | 75.47 | 98.50 | 98.91 | 97.77 | 82.09 | 98.39 | 90.24 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 93.84 | 87.59 | 66.63 | 99.97 | 99.76 | 98.44 | 82.69 | 99.39 | 91.04 |
| 2 | 93.40 | 87.15 | 76.85 | 99.97 | 99.33 | 99.38 | 85.80 | 99.56 | 92.68 |
| 3 | 93.42 | 87.25 | 69.53 | 99.87 | 99.32 | 99.32 | 83.40 | 99.51 | 91.45 |
| 4 | 93.86 | 87.10 | 72.98 | 99.82 | 99.14 | 99.47 | 84.65 | 99.48 | 92.06 |
| 5 | 93.36 | 86.54 | 79.78 | 99.90 | 99.73 | 99.59 | 86.56 | 99.74 | 93.15 |
| 6 | 93.39 | 86.56 | 77.71 | 99.85 | 99.45 | 99.44 | 85.88 | 99.58 | 92.73 |
| 7 | 93.05 | 86.91 | 73.11 | 99.67 | 99.43 | 99.44 | 84.36 | 99.51 | 91.93 |
| 8 | 93.49 | 86.95 | 81.94 | 99.63 | 99.72 | 99.69 | 87.46 | 99.68 | 93.57 |
| 9 | 93.46 | 87.77 | 74.22 | 99.96 | 99.51 | 99.55 | 85.15 | 99.67 | 92.41 |
| 10 | 93.76 | 86.39 | 70.76 | 98.98 | 99.29 | 93.59 | 83.64 | 97.29 | 90.46 |
| Mean | 93.50 | 87.02 | 74.35 | 99.76 | 99.47 | 98.79 | 84.96 | 99.34 | 92.15 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 94.84 | 92.27 | 90.89 | 99.82 | 97.68 | 95.70 | 92.67 | 97.74 | 95.20 |
| 2 | 94.57 | 92.08 | 89.85 | 99.27 | 99.20 | 99.09 | 92.17 | 99.18 | 95.67 |
| 3 | 93.01 | 91.18 | 89.97 | 99.21 | 98.35 | 91.16 | 91.39 | 96.24 | 93.81 |
| 4 | 93.94 | 91.80 | 90.73 | 99.49 | 99.38 | 98.68 | 92.15 | 99.18 | 95.67 |
| 5 | 94.42 | 91.92 | 90.23 | 99.15 | 99.35 | 97.36 | 92.19 | 98.62 | 95.40 |
| 6 | 94.78 | 92.28 | 90.96 | 99.38 | 95.34 | 88.06 | 92.67 | 94.26 | 93.47 |
| 7 | 93.84 | 91.78 | 90.77 | 99.58 | 97.14 | 88.96 | 92.13 | 95.23 | 93.68 |
| 8 | 93.14 | 90.83 | 89.50 | 99.42 | 98.97 | 98.66 | 91.15 | 99.02 | 95.08 |
| 9 | 94.57 | 92.53 | 90.97 | 98.95 | 99.06 | 98.98 | 92.69 | 99.00 | 95.85 |
| 10 | 94.75 | 91.91 | 89.69 | 99.67 | 98.71 | 96.22 | 92.12 | 98.20 | 95.16 |
| Mean | 94.18 | 91.86 | 90.35 | 99.39 | 98.32 | 95.29 | 92.13 | 97.67 | 94.90 |

# Appendix E: Robustness of feature importance scores

The approach to compute feature importance scores that we propose in Section 2.6 of the main paper is based on corrupting feature values by adding random noise. We propose sampling the noise terms from a normal distribution with zero mean and variance equal to $\sigma_l^2$ where the index $l$ refers to an individual feature in the data and its variance is estimated from the training data. The general concept of permutation-based feature importance is to compare the predictive performance of a model before and after breaking the relationship between one feature and the target variable. We acknowledge that adding random noise and the specific way in which we draw noise terms are heuristic and just one way to implement this concept. While a fully-comprehensive analysis of various different implementations of permutation feature importance is beyond the scope of this paper, we have performed an analysis to verify the robustness of our approach with respect to the variance of the noise terms and report corresponding results in the following.

The variance of individual features may differ across features. Therefore, we propose estimating the variance of a feature based on the training data and using feature-specific variances for sampling noise. An alternative, simpler approach to corrupt a feature would be to draw noise from a normal distribution with fixed variance, that is using the name noise for corrupting all features. We could then consider different noise intensities by altering $\sigma$ and ask whether the final feature importance scores differ across noise intensities. Ideally, feature importance scores would prove robust toward noise intensities.

In our robustness analysis, we first examine the degree to which feature importance rankings differ when using a fixed noise term $\sigma = 10$ compared to estimating a feature-specific noise term $\sigma_l$. Corresponding results for Experiment A – F are available below in Table 23 - 28 for the overall feature importance ranking and the event-specific feature importance rankings. We measure the similarity between importance rankings using Spearman's rank correlation coefficient. In the majority of cases, we find high to very high correlation. The only exception is Experiment E, in which we observe a small correlation in the rankings for event 2 (default). In Experiment E, survival models use only macroeconomic variables. Table 27 suggest that the specific way in which variables are corrupted to compute feature importance has an impact. Given that the results for all other experiments and event types do not give rise to a similar conclusions, we find little evidence to question the proposed approach to compute feature importance. Rather, in view of Table 23 – 28, one may consider a simplification of the proposed approach by using a fixed variance $\sigma$ instead of estimating feature-specific variances when calculating noise terms for feature corruption.

To further substantiate the robustness analysis and viability of a fixed noise term, we replicate the feature importance tests with different noise intensities. We consider five candidate settings of $\sigma = 0.5, 1.0, 2.0, 5.0, 10.0$ and calculate feature importance for different time horizons and event types for the data of Experiment A to C. Since previous results provided strong evidence for the comparability of results in Experiment A to C and D to F, we refrain from also considering the latter three settings (i.e., Dataset 2). Empirical results are available in Table 30 – 44 while Table 29 provides a summary by reporting the correlation in feature importance rankings across different settings of $\sigma$. We once again observe high correlations, which lets us conclude that, when considering a fixed variance to calculate feature importance scores, the specific setting of the variance does not impact results. This conclusion is valid for the above specific settings of $\sigma$ and data sets employed in the analysis. While future tests using different data sets are beneficial to further support the evidence provided here, we believe that the large number of tests and high consistency in observed results warrant the more general conclusion that the proposed approach to extract feature importance scores from DHT is sound and robust towards implementation details concerning $\sigma$.

*Table 23: Comparison of feature importance rankings with a fixed and feature-specific noise term in Experiment A*

| Overall | $\sigma$ | $\sigma_l$ |
|---|---|---|
| int.rate | 5 | 4 |
| orig.upb | 6 | 6 |
| fico.score | 8 | 7 |
| dti.r | 9 | 9 |
| ltv.r | 7 | 8 |
| bal.repaid | 1 | 1 |
| t.act.12m | 2 | 3 |
| t.del.30d.12m | 4 | 5 |
| t.del.60d.12m | 3 | 2 |
| Spearman | 0.95 | |

| Event 1 | $\sigma$ | $\sigma_l$ |
|---|---|---|
| int.rate | 5 | 4 |
| orig.upb | 4 | 6 |
| fico.score | 7 | 7 |
| dti.r | 9 | 9 |
| ltv.r | 6 | 8 |
| bal.repaid | 1 | 1 |
| t.act.12m | 3 | 3 |
| t.del.30d.12m | 8 | 5 |
| t.del.60d.12m | 2 | 2 |
| Spearman | 0.85 | |

| Event 2 | $\sigma$ | $\sigma_l$ |
|---|---|---|
| int.rate | 6 | 4 |
| orig.upb | 7 | 6 |
| fico.score | 8 | 7 |
| dti.r | 9 | 9 |
| ltv.r | 5 | 8 |
| bal.repaid | 1 | 1 |
| t.act.12m | 2 | 3 |
| t.del.30d.12m | 4 | 5 |
| t.del.60d.12m | 3 | 2 |
| Spearman | 0.85 | |

*Table 24: Comparison of feature importance rankings with a fixed and feature-specific noise term in Experiment B*

| Overall | $\sigma$ | $\sigma_l$ | | Event 1 | $\sigma$ | $\sigma_l$ | | Event 2 | $\sigma$ | $\sigma_l$ |
|---|---|---|---|---|---|---|---|---|---|---|
| hpi.st.d.t.o | 1 | 1 | | hpi.st.d.t.o | 1 | 1 | | hpi.st.d.t.o | 2 | 1 |
| hpi.zip.o | 5 | 5 | | hpi.zip.o | 3 | 4 | | hpi.zip.o | 6 | 5 |
| hpi.zip.d.t.o | 3 | 2 | | hpi.zip.d.t.o | 5 | 3 | | hpi.zip.d.t.o | 3 | 2 |
| ppi.c.FRMA | 9 | 10 | | ppi.c.FRMA | 9 | 10 | | ppi.c.FRMA | 8 | 10 |
| TB10Y.d.t.o | 11 | 12 | | TB10Y.d.t.o | 10 | 12 | | TB10Y.d.t.o | 10 | 13 |
| FRMA30Y.d.t.o | 10 | 7 | | FRMA30Y.d.t.o | 11 | 8 | | FRMA30Y.d.t.o | 9 | 7 |
| ppi.o.FRMA | 13 | 13 | | ppi.o.FRMA | 14 | 13 | | ppi.o.FRMA | 12 | 11 |
| equity.est | 14 | 14 | | equity.est | 13 | 14 | | equity.est | 16 | 14 |
| hpi.st.log12m | 2 | 3 | | hpi.st.log12m | 2 | 2 | | hpi.st.log12m | 1 | 4 |
| hpi.r.st.us | 4 | 4 | | hpi.r.st.us | 4 | 5 | | hpi.r.st.us | 4 | 3 |
| hpi.r.zip.st | 7 | 8 | | hpi.r.zip.st | 8 | 7 | | hpi.r.zip.st | 7 | 8 |
| st.unemp.r12m | 16 | 16 | | st.unemp.r12m | 16 | 16 | | st.unemp.r12m | 15 | 16 |
| st.unemp.r3m | 15 | 15 | | st.unemp.r3m | 15 | 15 | | st.unemp.r3m | 14 | 15 |
| TB10Y.r12m | 8 | 9 | | TB10Y.r12m | 6 | 6 | | TB10Y.r12m | 11 | 9 |
| T10Y3MM | 6 | 6 | | T10Y3MM | 7 | 9 | | T10Y3MM | 5 | 6 |
| T10Y3MM.r12m | 12 | 11 | | T10Y3MM.r12m | 12 | 11 | | T10Y3MM.r12m | 13 | 12 |
| Spearman | 0.98 | | | Spearman | 0.96 | | | Spearman | 0.94 | |

*Table 25: Comparison of feature importance rankings with a fixed and feature-specific noise term in Experiment C*

| Overall | $\sigma$ | $\sigma_l$ | | Event 1 | $\sigma$ | $\sigma_l$ | | Event 2 | $\sigma$ | $\sigma_l$ |
|---|---|---|---|---|---|---|---|---|---|---|
| int.rate | 17 | 18 | | int.rate | 19 | 19 | | int.rate | 13 | 15 |
| orig.upb | 18 | 19 | | orig.upb | 17 | 17 | | orig.upb | 23 | 25 |
| fico.score | 23 | 22 | | fico.score | 23 | 23 | | fico.score | 22 | 20 |
| dti.r | 25 | 25 | | dti.r | 25 | 25 | | dti.r | 24 | 22 |
| ltv.r | 21 | 20 | | ltv.r | 20 | 20 | | ltv.r | 25 | 19 |
| bal.repaid | 4 | 6 | | bal.repaid | 6 | 6 | | bal.repaid | 3 | 6 |
| t.act.12m | 14 | 15 | | t.act.12m | 16 | 13 | | t.act.12m | 9 | 18 |
| t.del.30d.12m | 20 | 21 | | t.del.30d.12m | 21 | 21 | | t.del.30d.12m | 18 | 21 |
| t.del.60d.12m | 7 | 8 | | t.del.60d.12m | 7 | 8 | | t.del.60d.12m | 6 | 9 |
| hpi.st.d.t.o | 1 | 1 | | hpi.st.d.t.o | 1 | 1 | | hpi.st.d.t.o | 1 | 1 |
| hpi.zip.o | 6 | 4 | | hpi.zip.o | 5 | 4 | | hpi.zip.o | 5 | 3 |
| hpi.zip.d.t.o | 2 | 3 | | hpi.zip.d.t.o | 3 | 3 | | hpi.zip.d.t.o | 2 | 4 |
| ppi.c.FRMA | 15 | 9 | | ppi.c.FRMA | 14 | 9 | | ppi.c.FRMA | 12 | 10 |
| TB10Y.d.t.o | 12 | 14 | | TB10Y.d.t.o | 13 | 14 | | TB10Y.d.t.o | 11 | 13 |
| FRMA30Y.d.t.o | 9 | 13 | | FRMA30Y.d.t.o | 9 | 12 | | FRMA30Y.d.t.o | 10 | 12 |
| ppi.o.FRMA | 19 | 17 | | ppi.o.FRMA | 18 | 18 | | ppi.o.FRMA | 20 | 16 |
| equity.est | 13 | 16 | | equity.est | 12 | 15 | | equity.est | 16 | 17 |
| hpi.st.log12m | 3 | 2 | | hpi.st.log12m | 2 | 2 | | hpi.st.log12m | 4 | 2 |
| hpi.r.st.us | 5 | 5 | | hpi.r.st.us | 4 | 5 | | hpi.r.st.us | 7 | 5 |
| hpi.r.zip.st | 16 | 12 | | hpi.r.zip.st | 15 | 11 | | hpi.r.zip.st | 17 | 11 |
| st.unemp.r12m | 22 | 24 | | st.unemp.r12m | 22 | 22 | | st.unemp.r12m | 14 | 24 |
| st.unemp.r3m | 24 | 23 | | st.unemp.r3m | 24 | 24 | | st.unemp.r3m | 19 | 23 |
| TB10Y.r12m | 10 | 7 | | TB10Y.r12m | 8 | 7 | | TB10Y.r12m | 21 | 7 |
| T10Y3MM | 8 | 11 | | T10Y3MM | 10 | 10 | | T10Y3MM | 8 | 14 |
| T10Y3MM.r12m | 11 | 10 | | T10Y3MM.r12m | 11 | 16 | | T10Y3MM.r12m | 15 | 8 |
| Spearman | 0.95 | | | Spearman | 0.96 | | | Spearman | 0.75 | |

*Table 26: Comparison of feature importance rankings with a fixed and feature-specific noise term in Experiment D*

| Overall | $\sigma$ | $\sigma_l$ | | Event 1 | $\sigma$ | $\sigma_l$ | | Event 2 | $\sigma$ | $\sigma_l$ |
|---|---|---|---|---|---|---|---|---|---|---|
| int.rate | 3 | 3 | | int.rate | 3 | 4 | | int.rate | 6 | 3 |
| orig.upb | 6 | 8 | | orig.upb | 8 | 8 | | orig.upb | 3 | 8 |
| fico.score | 8 | 9 | | fico.score | 9 | 9 | | fico.score | 5 | 7 |
| dti.r | 7 | 5 | | dti.r | 6 | 5 | | dti.r | 9 | 5 |
| ltv.r | 9 | 6 | | ltv.r | 7 | 6 | | ltv.r | 8 | 9 |
| bal.repaid | 1 | 2 | | bal.repaid | 1 | 1 | | bal.repaid | 1 | 2 |
| t.act.12m | 2 | 1 | | t.act.12m | 2 | 2 | | t.act.12m | 2 | 1 |
| t.del.30d.12m | 5 | 7 | | t.del.30d.12m | 5 | 7 | | t.del.30d.12m | 7 | 6 |
| t.del.60d.12m | 4 | 4 | | t.del.60d.12m | 4 | 3 | | t.del.60d.12m | 4 | 4 |
| Spearman | 0,80 | | | Spearman | 0,93 | | | Spearman | 0,52 | |

*Table 27: Comparison of feature importance rankings with a fixed and feature-specific noise term in Experiment E*

| Overall | $\sigma$ | $\sigma_l$ | | Event 1 | $\sigma$ | $\sigma_l$ | | Event 2 | $\sigma$ | $\sigma_l$ |
|---|---|---|---|---|---|---|---|---|---|---|
| hpi.st.d.t.o | 5 | 2 | | hpi.st.d.t.o | 1 | 5 | | hpi.st.d.t.o | 7 | 2 |
| ppi.c.FRMA | 4 | 4 | | ppi.c.FRMA | 4 | 4 | | ppi.c.FRMA | 5 | 6 |
| TB10Y.d.t.o | 11 | 8 | | TB10Y.d.t.o | 10 | 10 | | TB10Y.d.t.o | 11 | 8 |
| FRMA30Y.d.t.o | 7 | 1 | | FRMA30Y.d.t.o | 3 | 2 | | FRMA30Y.d.t.o | 8 | 1 |
| ppi.o.FRMA | 8 | 7 | | ppi.o.FRMA | 8 | 11 | | ppi.o.FRMA | 6 | 4 |
| hpi.r.st.us | 1 | 9 | | hpi.r.st.us | 5 | 8 | | hpi.r.st.us | 2 | 9 |
| st.unemp.r12m | 3 | 3 | | st.unemp.r12m | 2 | 1 | | st.unemp.r12m | 3 | 3 |
| st.unemp.r3m | 10 | 11 | | st.unemp.r3m | 11 | 7 | | st.unemp.r3m | 10 | 11 |
| TB10Y.r12m | 6 | 6 | | TB10Y.r12m | 7 | 6 | | TB10Y.r12m | 4 | 5 |
| T10Y3MM | 2 | 5 | | T10Y3MM | 6 | 3 | | T10Y3MM | 1 | 7 |
| T10Y3MM.r12m | 9 | 10 | | T10Y3MM.r12m | 9 | 9 | | T10Y3MM.r12m | 9 | 10 |
| Spearman | 0,41 | | | Spearman | 0,72 | | | Spearman | 0,20 | |

*Table 28: Comparison of feature importance rankings with a fixed and feature-specific noise term in Experiment F*

| Overall | $\sigma$ | $\sigma_l$ | | Event 1 | $\sigma$ | $\sigma_l$ | | Event 2 | $\sigma$ | $\sigma_l$ |
|---|---|---|---|---|---|---|---|---|---|---|
| int.rate | 4 | 3 | | int.rate | 3 | 3 | | int.rate | 4 | 4 |
| orig.upb | 16 | 19 | | orig.upb | 15 | 18 | | orig.upb | 15 | 18 |
| fico.score | 12 | 18 | | fico.score | 17 | 19 | | fico.score | 8 | 14 |
| dti.r | 19 | 14 | | dti.r | 19 | 14 | | dti.r | 17 | 15 |
| ltv.r | 13 | 15 | | ltv.r | 13 | 16 | | ltv.r | 11 | 13 |
| bal.repaid | 3 | 2 | | bal.repaid | 2 | 2 | | bal.repaid | 3 | 3 |
| t.act.12m | 7 | 6 | | t.act.12m | 9 | 7 | | t.act.12m | 5 | 5 |
| t.del.30d.12m | 18 | 16 | | t.del.30d.12m | 16 | 15 | | t.del.30d.12m | 20 | 19 |
| t.del.60d.12m | 9 | 9 | | t.del.60d.12m | 7 | 8 | | t.del.60d.12m | 12 | 9 |
| hpi.st.d.t.o | 1 | 1 | | hpi.st.d.t.o | 4 | 4 | | hpi.st.d.t.o | 1 | 1 |
| ppi.c.FRMA | 17 | 17 | | ppi.c.FRMA | 18 | 17 | | ppi.c.FRMA | 16 | 17 |
| TB10Y.d.t.o | 15 | 12 | | TB10Y.d.t.o | 14 | 10 | | TB10Y.d.t.o | 14 | 12 |
| FRMA30Y.d.t.o | 8 | 7 | | FRMA30Y.d.t.o | 5 | 5 | | FRMA30Y.d.t.o | 9 | 6 |
| ppi.o.FRMA | 5 | 4 | | ppi.o.FRMA | 8 | 6 | | ppi.o.FRMA | 6 | 2 |
| hpi.r.st.us | 6 | 8 | | hpi.r.st.us | 6 | 9 | | hpi.r.st.us | 7 | 7 |
| st.unemp.r12m | 2 | 5 | | st.unemp.r12m | 1 | 1 | | st.unemp.r12m | 2 | 8 |
| st.unemp.r3m | 20 | 20 | | st.unemp.r3m | 20 | 20 | | st.unemp.r3m | 19 | 20 |
| TB10Y.r12m | 11 | 13 | | TB10Y.r12m | 10 | 13 | | TB10Y.r12m | 13 | 16 |
| T10Y3MM | 10 | 10 | | T10Y3MM | 11 | 11 | | T10Y3MM | 10 | 11 |
| T10Y3MM.r12m | 14 | 11 | | T10Y3MM.r12m | 12 | 12 | | T10Y3MM.r12m | 18 | 10 |
| Spearman | 0,91 | | | Spearman | 0,93 | | | Spearman | 0,85 | |

*Table 29: Rank correlation (Spearman's $\rho$) of feature importance rankings across different noise intensities for Experiment A, B, and C*

***Experiment A***

| $\sigma$ | 0.5 | 1 | 2 | 5 | 10 |
|---|---|---|---|---|---|
| 0.5 | 1 | 0.92 | 0.80 | 0.75 | 0.82 |
| 1 | | 1 | 0.88 | 0.80 | 0.90 |
| 2 | | | 1 | 0.95 | 0.92 |
| 5 | | | | 1 | 0.92 |
| 10 | | | | | 1 |

***Experiment B***

| $\sigma$ | 0.5 | 1 | 2 | 5 | 10 |
|---|---|---|---|---|---|
| 0.5 | 1 | 0.84 | 0.84 | 0.89 | 0.86 |
| 1 | | 1 | 0.87 | 0.95 | 0.93 |
| 2 | | | 1 | 0.89 | 0.92 |
| 5 | | | | 1 | 0.98 |
| 10 | | | | | 1 |

***Experiment C***

| $\sigma$ | 0.5 | 1 | 2 | 5 | 10 |
|---|---|---|---|---|---|
| 0.5 | 1 | 0.94 | 0.94 | 0.91 | 0.88 |
| 1 | | 1 | 0.98 | 0.96 | 0.95 |
| 2 | | | 1 | 0.97 | 0.96 |
| 5 | | | | 1 | 0.99 |
| 10 | | | | | 1 |

*Table 30: Detailed results for Experiment A ($\sigma = 0.5$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 89.90 | 88.62 | 64.19 | 97.95 | 97.40 | 97.29 | 80.9 | 97.55 | 89.22 |
| `int.rate` | 89.56 | 88.26 | 63.94 | 98.00 | 97.42 | 97.28 | 80.59 | 97.57 | 89.08 |
| `orig.upb` | 89.78 | 88.49 | 64.19 | 97.90 | 97.34 | 97.24 | 80.82 | 97.49 | 89.16 |
| `fico.score` | 89.86 | 88.57 | 64.12 | 97.96 | 97.41 | 97.30 | 80.85 | 97.55 | 89.20 |
| `dti.r` | 89.89 | 88.62 | 64.15 | 97.94 | 97.38 | 97.27 | 80.89 | 97.53 | 89.21 |
| `ltv.r` | 89.86 | 88.59 | 64.06 | 98.00 | 97.48 | 97.34 | 80.84 | 97.61 | 89.22 |
| `bal.repaid` | 64.94 | 64.97 | 64.75 | 87.81 | 89.06 | 87.58 | 64.89 | 88.15 | 76.52 |
| `t.act.12m` | 89.78 | 88.57 | 63.65 | 97.97 | 97.40 | 97.28 | 80.67 | 97.55 | 89.11 |
| `t.del.30d.12m` | 89.78 | 88.53 | 63.44 | 98.00 | 97.44 | 97.29 | 80.58 | 97.58 | 89.08 |
| `t.del.60d.12m` | 89.62 | 88.39 | 64.58 | 97.93 | 97.32 | 97.07 | 80.86 | 97.44 | 89.15 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -0.34 | -0.35 | -0.25 | 0.05 | 0.02 | 0.00 | -0.31 | 0.02 | -0.15 |
| `orig.upb` | -0.12 | -0.13 | 0.00 | -0.05 | -0.06 | -0.04 | -0.09 | -0.05 | -0.07 |
| `fico.score` | -0.04 | -0.04 | -0.07 | 0.01 | 0.00 | 0.01 | -0.05 | 0.01 | -0.02 |
| `dti.r` | -0.01 | 0.00 | -0.04 | -0.02 | -0.02 | -0.02 | -0.02 | -0.02 | -0.02 |
| `ltv.r` | -0.04 | -0.03 | -0.13 | 0.05 | 0.08 | 0.05 | -0.07 | 0.06 | 0.00 |
| `bal.repaid` | -24.96 | -23.64 | 0.56 | -10.14 | -8.34 | -9.70 | -16.02 | -9.39 | -12.71 |
| `t.act.12m` | -0.12 | -0.05 | -0.54 | 0.01 | 0.00 | -0.01 | -0.23 | 0.00 | -0.12 |
| `t.del.30d.12m` | -0.12 | -0.09 | -0.75 | 0.04 | 0.04 | 0.00 | -0.32 | 0.03 | -0.15 |
| `t.del.60d.12m` | -0.28 | -0.23 | 0.39 | -0.03 | -0.08 | -0.21 | -0.04 | -0.11 | -0.07 |
| *No Noise* | | | | | | | | | |
| `int.rate` | 2 | 2 | 3 | 9 | 7 | 6 | 3 | 7 | 3 |
| `orig.upb` | 4 | 4 | 7 | 2 | 3 | 3 | 5 | 3 | 6 |
| `fico.score` | 8 | 7 | 5 | 5 | 6 | 8 | 7 | 6 | 7 |
| `dti.r` | 9 | 9 | 6 | 4 | 4 | 4 | 9 | 4 | 8 |
| `ltv.r` | 7 | 8 | 4 | 8 | 9 | 9 | 6 | 9 | 9 |
| `bal.repaid` | 1 | 1 | 9 | 1 | 1 | 1 | 1 | 1 | 1 |
| `t.act.12m` | 6 | 6 | 2 | 6 | 5 | 5 | 4 | 5 | 4 |
| `t.del.30d.12m` | 5 | 5 | 1 | 7 | 8 | 7 | 2 | 8 | 2 |
| `t.del.60d.12m` | 3 | 3 | 8 | 3 | 2 | 2 | 8 | 2 | 5 |

*Table 31: Detailed results for Experiment A ($\sigma = 1$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 89.90 | 88.62 | 64.19 | 97.95 | 97.40 | 97.29 | 80.90 | 97.55 | 89.22 |
| `int.rate` | 88.90 | 87.64 | 63.52 | 98.09 | 97.51 | 97.23 | 80.02 | 97.61 | 88.81 |
| `orig.upb` | 89.29 | 87.94 | 64.59 | 98.13 | 97.56 | 97.15 | 80.61 | 97.61 | 89.11 |
| `fico.score` | 89.76 | 88.38 | 63.51 | 97.81 | 97.30 | 97.29 | 80.55 | 97.47 | 89.01 |
| `dti.r` | 89.88 | 88.57 | 63.95 | 97.99 | 97.40 | 97.26 | 80.80 | 97.55 | 89.17 |
| `ltv.r` | 89.85 | 88.54 | 63.95 | 97.86 | 97.30 | 97.17 | 80.78 | 97.44 | 89.11 |
| `bal.repaid` | 58.11 | 58.27 | 58.70 | 62.98 | 66.45 | 68.02 | 58.36 | 65.82 | 62.09 |
| `t.act.12m` | 89.58 | 88.21 | 62.60 | 97.85 | 97.36 | 97.17 | 80.13 | 97.46 | 88.79 |
| `t.del.30d.12m` | 89.73 | 88.46 | 62.49 | 97.78 | 97.25 | 97.12 | 80.23 | 97.38 | 88.81 |
| `t.del.60d.12m` | 88.89 | 87.23 | 65.49 | 97.80 | 97.19 | 96.61 | 80.54 | 97.20 | 88.87 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -1.00 | -0.98 | -0.67 | 0.14 | 0.11 | -0.06 | -0.89 | 0.06 | -0.41 |
| `orig.upb` | -0.61 | -0.68 | 0.40 | 0.18 | 0.16 | -0.14 | -0.29 | 0.07 | -0.11 |
| `fico.score` | -0.14 | -0.24 | -0.68 | -0.14 | -0.10 | 0.00 | -0.35 | -0.08 | -0.22 |
| `dti.r` | -0.02 | -0.05 | -0.24 | 0.03 | 0.00 | -0.03 | -0.10 | 0.00 | -0.05 |
| `ltv.r` | -0.05 | -0.07 | -0.24 | -0.10 | -0.10 | -0.12 | -0.12 | -0.11 | -0.11 |
| `bal.repaid` | -31.79 | -30.35 | -5.49 | -34.98 | -30.95 | -29.26 | -22.55 | -31.73 | -27.14 |
| `t.act.12m` | -0.32 | -0.41 | -1.59 | -0.10 | -0.04 | -0.12 | -0.77 | -0.09 | -0.43 |
| `t.del.30d.12m` | -0.16 | -0.16 | -1.70 | -0.17 | -0.15 | -0.17 | -0.68 | -0.16 | -0.42 |
| `t.del.60d.12m` | -1.01 | -1.39 | 1.30 | -0.16 | -0.21 | -0.68 | -0.37 | -0.35 | -0.36 |
| *No Noise* | | | | | | | | | |
| `int.rate` | 3 | 3 | 5 | 8 | 8 | 7 | 2 | 8 | 4 |
| `orig.upb` | 4 | 4 | 8 | 9 | 9 | 4 | 7 | 9 | 7 |
| `fico.score` | 7 | 6 | 4 | 4 | 4 | 9 | 6 | 6 | 6 |
| `dti.r` | 9 | 9 | 7 | 7 | 7 | 8 | 9 | 7 | 9 |
| `ltv.r` | 8 | 8 | 6 | 6 | 4 | 6 | 8 | 4 | 8 |
| `bal.repaid` | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| `t.act.12m` | 5 | 5 | 3 | 5 | 6 | 5 | 3 | 5 | 2 |
| `t.del.30d.12m` | 6 | 7 | 2 | 2 | 3 | 3 | 4 | 3 | 3 |
| `t.del.60d.12m` | 2 | 2 | 9 | 3 | 2 | 2 | 5 | 2 | 5 |

*Table 32: Detailed results for Experiment A ($\sigma = 2$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 89.90 | 88.62 | 64.19 | 97.95 | 97.40 | 97.29 | 80.90 | 97.55 | 89.22 |
| `int.rate` | 86.79 | 85.62 | 62.52 | 97.84 | 97.52 | 96.95 | 78.31 | 97.44 | 87.87 |
| `orig.upb` | 88.56 | 87.12 | 64.98 | 97.60 | 97.10 | 97.02 | 80.22 | 97.24 | 88.73 |
| `fico.score` | 89.35 | 87.88 | 62.89 | 97.71 | 97.21 | 97.24 | 80.04 | 97.39 | 88.71 |
| `dti.r` | 89.72 | 88.42 | 63.70 | 97.98 | 97.39 | 97.26 | 80.61 | 97.54 | 89.08 |
| `ltv.r` | 89.35 | 87.94 | 63.47 | 97.88 | 97.31 | 97.19 | 80.25 | 97.46 | 88.86 |
| `bal.repaid` | 53.84 | 54.34 | 54.68 | 66.27 | 71.30 | 69.17 | 54.29 | 68.91 | 61.60 |
| `t.act.12m` | 88.41 | 86.05 | 62.15 | 97.44 | 96.72 | 95.98 | 78.87 | 96.71 | 87.79 |
| `t.del.30d.12m` | 89.16 | 87.92 | 61.59 | 97.94 | 97.39 | 97.16 | 79.56 | 97.50 | 88.53 |
| `t.del.60d.12m` | 86.96 | 83.75 | 65.28 | 96.14 | 94.13 | 92.44 | 78.66 | 94.24 | 86.45 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -3.11 | -3.00 | -1.67 | -0.11 | 0.12 | -0.33 | -2.59 | -0.11 | -1.35 |
| `orig.upb` | -1.34 | -1.50 | 0.79 | -0.35 | -0.30 | -0.26 | -0.68 | -0.31 | -0.49 |
| `fico.score` | -0.55 | -0.74 | -1.30 | -0.25 | -0.19 | -0.04 | -0.86 | -0.16 | -0.51 |
| `dti.r` | -0.18 | -0.20 | -0.49 | 0.03 | -0.01 | -0.03 | -0.29 | 0.00 | -0.15 |
| `ltv.r` | -0.55 | -0.68 | -0.72 | -0.07 | -0.09 | -0.10 | -0.65 | -0.09 | -0.37 |
| `bal.repaid` | -36.06 | -34.27 | -9.51 | -31.69 | -26.10 | -28.11 | -26.61 | -28.63 | -27.62 |
| `t.act.12m` | -1.49 | -2.57 | -2.04 | -0.51 | -0.68 | -1.31 | -2.03 | -0.83 | -1.43 |
| `t.del.30d.12m` | -0.74 | -0.69 | -2.60 | -0.01 | -0.01 | -0.12 | -1.34 | -0.05 | -0.70 |
| `t.del.60d.12m` | -2.94 | -4.87 | 1.09 | -1.82 | -3.27 | -4.85 | -2.24 | -3.31 | -2.77 |
| *No Noise* | | | | | | | | | |
| `int.rate` | 2 | 3 | 4 | 6 | 9 | 4 | 2 | 6 | 4 |
| `orig.upb` | 5 | 5 | 8 | 4 | 4 | 5 | 7 | 4 | 7 |
| `fico.score` | 7 | 6 | 5 | 5 | 5 | 8 | 6 | 5 | 6 |
| `dti.r` | 9 | 9 | 7 | 9 | 7 | 9 | 9 | 9 | 9 |
| `ltv.r` | 8 | 8 | 6 | 7 | 6 | 7 | 8 | 7 | 8 |
| `bal.repaid` | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| `t.act.12m` | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 |
| `t.del.30d.12m` | 6 | 7 | 2 | 8 | 7 | 6 | 5 | 8 | 5 |
| `t.del.60d.12m` | 3 | 2 | 9 | 2 | 2 | 2 | 3 | 2 | 2 |

*Table 33: Detailed results for Experiment A ($\sigma = 5$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 89.90 | 88.62 | 64.19 | 97.95 | 97.40 | 97.29 | 80.90 | 97.55 | 89.22 |
| `int.rate` | 81.86 | 81.58 | 63.33 | 95.82 | 95.95 | 96.06 | 75.59 | 95.95 | 85.77 |
| `orig.upb` | 83.37 | 81.71 | 66.81 | 96.79 | 96.03 | 94.46 | 77.30 | 95.76 | 86.53 |
| `fico.score` | 87.00 | 84.87 | 62.29 | 97.64 | 97.14 | 96.74 | 78.05 | 97.17 | 87.61 |
| `dti.r` | 88.87 | 87.02 | 65.58 | 97.66 | 97.18 | 96.83 | 80.49 | 97.22 | 88.86 |
| `ltv.r` | 87.22 | 84.93 | 64.00 | 97.62 | 96.94 | 96.39 | 78.72 | 96.98 | 87.85 |
| `bal.repaid` | 51.98 | 52.11 | 52.57 | 46.74 | 54.83 | 54.40 | 52.22 | 51.99 | 52.11 |
| `t.act.12m` | 82.13 | 77.15 | 60.77 | 90.10 | 89.78 | 87.80 | 73.35 | 89.22 | 81.29 |
| `t.del.30d.12m` | 86.96 | 85.96 | 62.99 | 96.66 | 96.40 | 96.34 | 78.64 | 96.46 | 87.55 |
| `t.del.60d.12m` | 78.15 | 72.55 | 59.50 | 88.67 | 85.64 | 82.90 | 70.07 | 85.74 | 77.90 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -8.04 | -7.04 | -0.86 | -2.13 | -1.45 | -1.22 | -5.31 | -1.60 | -3.46 |
| `orig.upb` | -6.53 | -6.91 | 2.62 | -1.17 | -1.37 | -2.83 | -3.61 | -1.79 | -2.70 |
| `fico.score` | -2.90 | -3.75 | -1.90 | -0.32 | -0.26 | -0.55 | -2.85 | -0.38 | -1.61 |
| `dti.r` | -1.03 | -1.60 | 1.39 | -0.29 | -0.22 | -0.46 | -0.41 | -0.32 | -0.37 |
| `ltv.r` | -2.68 | -3.69 | -0.19 | -0.33 | -0.47 | -0.90 | -2.19 | -0.56 | -1.38 |
| `bal.repaid` | -37.92 | -36.51 | -11.62 | -51.22 | -42.57 | -42.88 | -28.68 | -45.56 | -37.12 |
| `t.act.12m` | -7.77 | -11.47 | -3.42 | -7.86 | -7.63 | -9.48 | -7.55 | -8.32 | -7.94 |
| `t.del.30d.12m` | -2.93 | -2.66 | -1.20 | -1.30 | -1.00 | -0.95 | -2.27 | -1.08 | -1.67 |
| `t.del.60d.12m` | -11.75 | -16.07 | -4.69 | -9.28 | -11.76 | -14.38 | -10.84 | -11.81 | -11.32 |
| *No Noise* | | | | | | | | | |
| `int.rate` | 3 | 4 | 6 | 4 | 4 | 5 | 4 | 5 | 4 |
| `orig.upb` | 5 | 5 | 9 | 6 | 5 | 4 | 5 | 4 | 5 |
| `fico.score` | 7 | 6 | 4 | 8 | 8 | 8 | 6 | 8 | 7 |
| `dti.r` | 9 | 9 | 8 | 9 | 9 | 9 | 9 | 9 | 9 |
| `ltv.r` | 8 | 7 | 7 | 7 | 7 | 7 | 8 | 7 | 8 |
| `bal.repaid` | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| `t.act.12m` | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| `t.del.30d.12m` | 6 | 8 | 5 | 5 | 6 | 6 | 7 | 6 | 6 |
| `t.del.60d.12m` | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

*Table 34: Detailed results for Experiment A ($\sigma = 10$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 89.90 | 88.62 | 64.19 | 97.95 | 97.40 | 97.29 | 80.90 | 97.55 | 89.22 |
| `int.rate` | 75.65 | 75.89 | 65.90 | 93.41 | 93.66 | 93.71 | 72.48 | 93.59 | 83.03 |
| `orig.upb` | 75.58 | 73.94 | 66.65 | 95.73 | 94.88 | 92.40 | 72.06 | 94.34 | 83.20 |
| `fico.score` | 81.02 | 78.89 | 62.23 | 94.30 | 94.64 | 94.97 | 74.05 | 94.64 | 84.34 |
| `dti.r` | 86.19 | 82.91 | 65.52 | 96.31 | 95.43 | 94.47 | 78.21 | 95.40 | 86.80 |
| `ltv.r` | 81.18 | 77.25 | 61.47 | 94.20 | 93.82 | 92.76 | 73.30 | 93.59 | 83.45 |
| `bal.repaid` | 52.25 | 52.44 | 52.78 | 51.37 | 54.01 | 53.55 | 52.49 | 52.98 | 52.73 |
| `t.act.12m` | 72.53 | 66.77 | 58.49 | 78.47 | 78.12 | 77.31 | 65.93 | 77.97 | 71.95 |
| `t.del.30d.12m` | 80.80 | 79.05 | 64.47 | 90.46 | 90.41 | 87.31 | 74.78 | 89.39 | 82.09 |
| `t.del.60d.12m` | 71.29 | 66.86 | 58.20 | 82.68 | 79.31 | 76.95 | 65.45 | 79.64 | 72.55 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -14.25 | -12.73 | 1.71 | -4.54 | -3.74 | -3.58 | -8.43 | -3.95 | -6.19 |
| `orig.upb` | -14.32 | -14.67 | 2.46 | -2.22 | -2.52 | -4.89 | -8.85 | -3.21 | -6.03 |
| `fico.score` | -8.87 | -9.73 | -1.96 | -3.66 | -2.76 | -2.31 | -6.86 | -2.91 | -4.88 |
| `dti.r` | -3.71 | -5.71 | 1.33 | -1.64 | -1.97 | -2.82 | -2.70 | -2.14 | -2.42 |
| `ltv.r` | -8.72 | -11.36 | -2.72 | -3.75 | -3.58 | -4.53 | -7.60 | -3.96 | -5.78 |
| `bal.repaid` | -37.65 | -36.18 | -11.41 | -46.59 | -43.39 | -43.73 | -28.41 | -44.57 | -36.49 |
| `t.act.12m` | -17.37 | -21.84 | -5.70 | -19.49 | -19.28 | -19.98 | -14.97 | -19.58 | -17.28 |
| `t.del.30d.12m` | -9.10 | -9.56 | 0.28 | -7.49 | -6.99 | -9.98 | -6.13 | -8.15 | -7.14 |
| `t.del.60d.12m` | -18.61 | -21.76 | -5.99 | -15.28 | -18.09 | -20.34 | -15.46 | -17.90 | -16.68 |
| *No Noise* | | | | | | | | | |
| `int.rate` | 5 | 5 | 8 | 5 | 5 | 7 | 5 | 6 | 5 |
| `orig.upb` | 4 | 4 | 9 | 8 | 8 | 5 | 4 | 7 | 6 |
| `fico.score` | 7 | 7 | 5 | 7 | 7 | 9 | 7 | 8 | 8 |
| `dti.r` | 9 | 9 | 7 | 9 | 9 | 8 | 9 | 9 | 9 |
| `ltv.r` | 8 | 6 | 4 | 6 | 6 | 6 | 6 | 5 | 7 |
| `bal.repaid` | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| `t.act.12m` | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 |
| `t.del.30d.12m` | 6 | 8 | 6 | 4 | 4 | 4 | 8 | 4 | 4 |
| `t.del.60d.12m` | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |

*Table 35: Detailed results for Experiment B ($\sigma = 0.5$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 94.93 | 93.43 | 90.16 | 93.41 | 92.18 | 74.07 | 92.84 | 86.55 | 89.70 |
| hpi.st.d.t.o | 82.50 | 81.57 | 80.10 | 76.68 | 77.22 | 68.73 | 81.39 | 74.21 | 77.80 |
| hpi.zip.o | 92.90 | 91.28 | 88.22 | 92.00 | 91.51 | 75.40 | 90.80 | 86.31 | 88.55 |
| hpi.zip.d.t.o | 91.58 | 90.69 | 88.18 | 91.96 | 91.23 | 73.87 | 90.15 | 85.69 | 87.92 |
| ppi.c.FRMA | 94.81 | 93.32 | 90.07 | 92.56 | 91.41 | 73.08 | 92.73 | 85.68 | 89.21 |
| TB10Y.d.t.o | 94.46 | 92.99 | 89.79 | 93.16 | 91.67 | 73.77 | 92.41 | 86.20 | 89.31 |
| FRMA30Y.d.t.o | 94.70 | 93.22 | 89.94 | 92.67 | 91.70 | 74.94 | 92.62 | 86.43 | 89.53 |
| ppi.o.FRMA | 94.85 | 93.38 | 90.10 | 93.72 | 92.43 | 74.61 | 92.78 | 86.92 | 89.85 |
| equity.est | 94.87 | 93.36 | 90.09 | 93.39 | 92.17 | 73.98 | 92.77 | 86.51 | 89.64 |
| hpi.st.log12m | 91.32 | 89.90 | 86.99 | 90.84 | 90.28 | 72.73 | 89.40 | 84.62 | 87.01 |
| hpi.r.st.us | 93.97 | 92.09 | 88.93 | 94.07 | 92.62 | 73.17 | 91.66 | 86.62 | 89.14 |
| hpi.r.zip.st | 94.64 | 93.12 | 89.90 | 93.20 | 91.45 | 73.42 | 92.55 | 86.02 | 89.29 |
| st.unemp.r12m | 94.88 | 93.37 | 90.14 | 93.12 | 91.99 | 73.94 | 92.80 | 86.35 | 89.57 |
| st.unemp.r3m | 94.90 | 93.41 | 90.16 | 93.47 | 92.24 | 74.04 | 92.82 | 86.59 | 89.71 |
| TB10Y.r12m | 94.67 | 93.14 | 89.88 | 93.49 | 92.32 | 74.79 | 92.57 | 86.87 | 89.72 |
| T10Y3MM | 94.28 | 92.85 | 89.68 | 93.03 | 91.76 | 73.48 | 92.27 | 86.09 | 89.18 |
| T10Y3MM.r12m | 94.86 | 93.27 | 90.00 | 93.24 | 91.83 | 73.74 | 92.71 | 86.27 | 89.49 |
| *No Noise* | | | | | | | | | |
| hpi.st.d.t.o | -12.44 | -11.86 | -10.07 | -16.74 | -14.96 | -5.34 | -11.46 | -12.34 | -11.90 |
| hpi.zip.o | -2.04 | -2.15 | -1.94 | -1.41 | -0.67 | 1.33 | -2.05 | -0.25 | -1.15 |
| hpi.zip.d.t.o | -3.36 | -2.75 | -1.98 | -1.46 | -0.95 | -0.20 | -2.70 | -0.87 | -1.78 |
| ppi.c.FRMA | -0.12 | -0.11 | -0.10 | -0.86 | -0.76 | -0.99 | -0.11 | -0.87 | -0.49 |
| TB10Y.d.t.o | -0.48 | -0.44 | -0.37 | -0.25 | -0.50 | -0.30 | -0.43 | -0.35 | -0.39 |
| FRMA30Y.d.t.o | -0.23 | -0.21 | -0.23 | -0.75 | -0.48 | 0.87 | -0.22 | -0.12 | -0.17 |
| ppi.o.FRMA | -0.08 | -0.06 | -0.06 | 0.30 | 0.25 | 0.54 | -0.07 | 0.36 | 0.15 |
| equity.est | -0.06 | -0.08 | -0.07 | -0.02 | -0.01 | -0.09 | -0.07 | -0.04 | -0.06 |
| hpi.st.log12m | -3.61 | -3.53 | -3.17 | -2.57 | -1.90 | -1.34 | -3.44 | -1.94 | -2.69 |
| hpi.r.st.us | -0.97 | -1.34 | -1.24 | 0.65 | 0.44 | -0.90 | -1.18 | 0.06 | -0.56 |
| hpi.r.zip.st | -0.29 | -0.31 | -0.26 | -0.21 | -0.73 | -0.65 | -0.29 | -0.53 | -0.41 |
| st.unemp.r12m | -0.05 | -0.06 | -0.03 | -0.30 | -0.19 | -0.13 | -0.05 | -0.21 | -0.13 |
| st.unemp.r3m | -0.03 | -0.02 | 0.00 | 0.06 | 0.07 | -0.03 | -0.02 | 0.03 | 0.01 |
| TB10Y.r12m | -0.26 | -0.29 | -0.28 | 0.07 | 0.14 | 0.72 | -0.28 | 0.31 | 0.02 |
| T10Y3MM | -0.66 | -0.59 | -0.48 | -0.39 | -0.42 | -0.60 | -0.58 | -0.47 | -0.52 |
| T10Y3MM.r12m | -0.07 | -0.16 | -0.17 | -0.17 | -0.35 | -0.33 | -0.13 | -0.28 | -0.21 |
| *No Noise* | | | | | | | | | |
| hpi.st.d.t.o | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| hpi.zip.o | 4 | 4 | 4 | 4 | 6 | 16 | 4 | 9 | 4 |
| hpi.zip.d.t.o | 3 | 3 | 3 | 3 | 3 | 9 | 3 | 4 | 3 |
| ppi.c.FRMA | 11 | 12 | 12 | 5 | 4 | 3 | 12 | 3 | 7 |
| TB10Y.d.t.o | 7 | 7 | 7 | 9 | 7 | 8 | 7 | 7 | 9 |
| FRMA30Y.d.t.o | 10 | 10 | 10 | 6 | 8 | 15 | 10 | 11 | 11 |
| ppi.o.FRMA | 12 | 15 | 14 | 15 | 15 | 13 | 14 | 16 | 16 |
| equity.est | 14 | 13 | 13 | 12 | 12 | 11 | 13 | 12 | 13 |
| hpi.st.log12m | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| hpi.r.st.us | 5 | 5 | 5 | 16 | 16 | 4 | 5 | 14 | 5 |
| hpi.r.zip.st | 8 | 8 | 9 | 10 | 5 | 5 | 8 | 5 | 8 |
| st.unemp.r12m | 15 | 14 | 15 | 8 | 11 | 10 | 15 | 10 | 12 |
| st.unemp.r3m | 16 | 16 | 16 | 13 | 13 | 12 | 16 | 13 | 14 |
| TB10Y.r12m | 9 | 9 | 8 | 14 | 14 | 14 | 9 | 15 | 15 |
| T10Y3MM | 6 | 6 | 6 | 7 | 9 | 6 | 6 | 6 | 6 |
| T10Y3MM.r12m | 13 | 11 | 11 | 11 | 10 | 7 | 11 | 8 | 10 |

*Table 36: Detailed results for Experiment B ($\sigma = 1$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 94.93 | 93.43 | 90.16 | 93.41 | 92.18 | 74.07 | 92.84 | 86.55 | 89.70 |
| `hpi.st.d.t.o` | 71.65 | 71.00 | 70.44 | 65.42 | 67.59 | 62.14 | 71.03 | 65.05 | 68.04 |
| `hpi.zip.o` | 89.35 | 87.53 | 84.87 | 86.89 | 85.44 | 71.02 | 87.25 | 81.12 | 84.18 |
| `hpi.zip.d.t.o` | 87.40 | 87.11 | 85.62 | 88.02 | 87.84 | 74.44 | 86.71 | 83.43 | 85.07 |
| `ppi.c.FRMA` | 94.28 | 92.91 | 89.90 | 91.84 | 91.00 | 73.68 | 92.36 | 85.51 | 88.93 |
| `TB10Y.d.t.o` | 93.59 | 92.06 | 88.93 | 91.90 | 91.37 | 74.62 | 91.53 | 85.96 | 88.75 |
| `FRMA30Y.d.t.o` | 94.28 | 92.88 | 89.75 | 91.43 | 89.56 | 71.06 | 92.30 | 84.02 | 88.16 |
| `ppi.o.FRMA` | 94.67 | 93.24 | 90.07 | 93.25 | 92.14 | 73.30 | 92.66 | 86.23 | 89.45 |
| `equity.est` | 94.70 | 93.20 | 89.94 | 93.52 | 92.43 | 73.89 | 92.61 | 86.61 | 89.61 |
| `hpi.st.log12m` | 85.96 | 84.58 | 82.15 | 86.24 | 86.17 | 74.33 | 84.23 | 82.25 | 83.24 |
| `hpi.r.st.us` | 91.76 | 89.19 | 86.00 | 89.70 | 87.06 | 68.69 | 88.99 | 81.82 | 85.40 |
| `hpi.r.zip.st` | 93.57 | 91.97 | 88.99 | 91.37 | 91.27 | 75.15 | 91.51 | 85.93 | 88.72 |
| `st.unemp.r12m` | 94.80 | 93.30 | 90.05 | 93.53 | 92.45 | 75.10 | 92.72 | 87.03 | 89.87 |
| `st.unemp.r3m` | 94.85 | 93.41 | 90.25 | 93.37 | 92.16 | 74.43 | 92.84 | 86.65 | 89.75 |
| `TB10Y.r12m` | 93.95 | 92.39 | 89.16 | 92.38 | 91.61 | 75.21 | 91.83 | 86.40 | 89.12 |
| `T10Y3MM` | 92.91 | 91.58 | 88.53 | 90.73 | 90.41 | 75.97 | 91.00 | 85.70 | 88.35 |
| `T10Y3MM.r12m` | 94.55 | 92.85 | 89.67 | 93.08 | 92.16 | 76.85 | 92.36 | 87.37 | 89.86 |
| *No Noise* | | | | | | | | | |
| `hpi.st.d.t.o` | -23.28 | -22.43 | -19.72 | -27.99 | -24.59 | -11.93 | -21.81 | -21.50 | -21.66 |
| `hpi.zip.o` | -5.59 | -5.90 | -5.30 | -6.52 | -6.74 | -3.05 | -5.60 | -5.44 | -5.52 |
| `hpi.zip.d.t.o` | -7.53 | -6.32 | -4.55 | -5.39 | -4.34 | 0.37 | -6.13 | -3.12 | -4.63 |
| `ppi.c.FRMA` | -0.65 | -0.52 | -0.27 | -1.57 | -1.18 | -0.39 | -0.48 | -1.05 | -0.76 |
| `TB10Y.d.t.o` | -1.34 | -1.37 | -1.23 | -1.51 | -0.81 | 0.55 | -1.32 | -0.59 | -0.95 |
| `FRMA30Y.d.t.o` | -0.65 | -0.55 | -0.41 | -1.98 | -2.61 | -3.01 | -0.54 | -2.54 | -1.54 |
| `ppi.o.FRMA` | -0.27 | -0.19 | -0.09 | -0.16 | -0.04 | -0.77 | -0.18 | -0.32 | -0.25 |
| `equity.est` | -0.24 | -0.23 | -0.23 | 0.11 | 0.25 | -0.18 | -0.23 | 0.06 | -0.09 |
| `hpi.st.log12m` | -8.98 | -8.86 | -8.02 | -7.18 | -6.00 | 0.26 | -8.62 | -4.31 | -6.46 |
| `hpi.r.st.us` | -3.17 | -4.25 | -4.16 | -3.72 | -5.12 | -5.38 | -3.86 | -4.74 | -4.30 |
| `hpi.r.zip.st` | -1.36 | -1.47 | -1.17 | -2.04 | -0.91 | 1.08 | -1.33 | -0.63 | -0.98 |
| `st.unemp.r12m` | -0.13 | -0.14 | -0.12 | 0.12 | 0.28 | 1.03 | -0.13 | 0.47 | 0.17 |
| `st.unemp.r3m` | -0.08 | -0.02 | 0.09 | -0.05 | -0.02 | 0.36 | 0.00 | 0.10 | 0.05 |
| `TB10Y.r12m` | -0.98 | -1.05 | -1.00 | -1.03 | -0.57 | 1.14 | -1.01 | -0.16 | -0.58 |
| `T10Y3MM` | -2.03 | -1.85 | -1.64 | -2.68 | -1.77 | 1.90 | -1.84 | -0.85 | -1.34 |
| `T10Y3MM.r12m` | -0.38 | -0.58 | -0.50 | -0.33 | -0.02 | 2.78 | -0.49 | 0.81 | 0.16 |
| *No Noise* | | | | | | | | | |
| `hpi.st.d.t.o` | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| `hpi.zip.o` | 4 | 4 | 3 | 3 | 2 | 3 | 4 | 2 | 3 |
| `hpi.zip.d.t.o` | 3 | 3 | 4 | 4 | 5 | 10 | 3 | 5 | 4 |
| `ppi.c.FRMA` | 11 | 12 | 12 | 9 | 8 | 6 | 12 | 7 | 10 |
| `TB10Y.d.t.o` | 8 | 8 | 7 | 10 | 10 | 11 | 8 | 10 | 9 |
| `FRMA30Y.d.t.o` | 10 | 11 | 11 | 8 | 6 | 4 | 10 | 6 | 6 |
| `ppi.o.FRMA` | 13 | 14 | 15 | 13 | 12 | 5 | 14 | 11 | 12 |
| `equity.est` | 14 | 13 | 13 | 15 | 15 | 7 | 13 | 13 | 13 |
| `hpi.st.log12m` | 2 | 2 | 2 | 2 | 3 | 8 | 2 | 4 | 2 |
| `hpi.r.st.us` | 5 | 5 | 5 | 5 | 4 | 2 | 5 | 3 | 5 |
| `hpi.r.zip.st` | 7 | 7 | 8 | 7 | 9 | 13 | 7 | 9 | 8 |
| `st.unemp.r12m` | 15 | 15 | 14 | 16 | 16 | 12 | 15 | 15 | 16 |
| `st.unemp.r3m` | 16 | 16 | 16 | 14 | 13 | 9 | 16 | 14 | 14 |
| `TB10Y.r12m` | 9 | 9 | 9 | 11 | 11 | 14 | 9 | 12 | 11 |
| `T10Y3MM` | 6 | 6 | 6 | 6 | 7 | 15 | 6 | 8 | 7 |
| `T10Y3MM.r12m` | 12 | 10 | 10 | 12 | 14 | 16 | 11 | 16 | 15 |

*Table 37: Detailed results for Experiment B ($\sigma = 2$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 94.93 | 93.43 | 90.16 | 93.41 | 92.18 | 74.07 | 92.84 | 86.55 | 89.70 |
| `hpi.st.d.t.o` | 63.32 | 63.02 | 62.79 | 68.59 | 64.80 | 60.30 | 63.04 | 64.56 | 63.80 |
| `hpi.zip.o` | 81.73 | 80.01 | 78.07 | 87.89 | 85.65 | 67.90 | 79.94 | 80.48 | 80.21 |
| `hpi.zip.d.t.o` | 80.61 | 80.89 | 80.39 | 79.62 | 80.01 | 73.99 | 80.63 | 77.87 | 79.25 |
| `ppi.c.FRMA` | 93.13 | 91.77 | 89.20 | 88.75 | 88.35 | 72.41 | 91.37 | 83.17 | 87.27 |
| `TB10Y.d.t.o` | 91.35 | 90.01 | 87.43 | 89.65 | 89.67 | 72.09 | 89.60 | 83.80 | 86.70 |
| `FRMA30Y.d.t.o` | 93.11 | 91.83 | 89.00 | 88.95 | 88.21 | 77.17 | 91.31 | 84.78 | 88.04 |
| `ppi.o.FRMA` | 94.16 | 92.82 | 89.84 | 93.15 | 92.57 | 76.04 | 92.27 | 87.25 | 89.76 |
| `equity.est` | 94.16 | 92.74 | 89.65 | 94.09 | 92.93 | 73.82 | 92.19 | 86.94 | 89.57 |
| `hpi.st.log12m` | 76.46 | 75.21 | 73.69 | 81.87 | 80.45 | 68.21 | 75.12 | 76.84 | 75.98 |
| `hpi.r.st.us` | 86.28 | 83.20 | 80.29 | 80.26 | 79.28 | 66.38 | 83.26 | 75.31 | 79.28 |
| `hpi.r.zip.st` | 91.30 | 89.69 | 86.84 | 91.89 | 90.05 | 72.00 | 89.28 | 84.65 | 86.96 |
| `st.unemp.r12m` | 94.54 | 93.05 | 89.88 | 93.69 | 92.13 | 74.23 | 92.49 | 86.68 | 89.59 |
| `st.unemp.r3m` | 94.69 | 93.27 | 90.28 | 93.10 | 91.87 | 74.11 | 92.75 | 86.36 | 89.55 |
| `TB10Y.r12m` | 91.73 | 90.12 | 87.06 | 91.26 | 89.47 | 72.02 | 89.64 | 84.25 | 86.95 |
| `T10Y3MM` | 89.82 | 88.77 | 86.28 | 92.03 | 91.13 | 74.05 | 88.29 | 85.74 | 87.01 |
| `T10Y3MM.r12m` | 93.70 | 91.72 | 88.43 | 92.67 | 91.41 | 74.59 | 91.28 | 86.23 | 88.75 |
| *No Noise* | | | | | | | | | |
| `hpi.st.d.t.o` | -31.61 | -30.42 | -27.37 | -24.83 | -27.38 | -13.77 | -29.80 | -21.99 | -25.90 |
| `hpi.zip.o` | -13.20 | -13.42 | -12.09 | -5.53 | -6.53 | -6.17 | -12.90 | -6.07 | -9.49 |
| `hpi.zip.d.t.o` | -14.32 | -12.55 | -9.77 | -13.80 | -12.17 | -0.08 | -12.21 | -8.68 | -10.45 |
| `ppi.c.FRMA` | -1.81 | -1.66 | -0.96 | -4.67 | -3.83 | -1.66 | -1.48 | -3.39 | -2.43 |
| `TB10Y.d.t.o` | -3.59 | -3.42 | -2.73 | -3.76 | -2.51 | -1.98 | -3.25 | -2.75 | -3.00 |
| `FRMA30Y.d.t.o` | -1.82 | -1.61 | -1.17 | -4.46 | -3.97 | 3.10 | -1.53 | -1.78 | -1.65 |
| `ppi.o.FRMA` | -0.78 | -0.62 | -0.32 | -0.26 | 0.39 | 1.97 | -0.57 | 0.70 | 0.06 |
| `equity.est` | -0.77 | -0.69 | -0.51 | 0.67 | 0.75 | -0.26 | -0.66 | 0.39 | -0.13 |
| `hpi.st.log12m` | -18.47 | -18.22 | -16.47 | -11.55 | -11.73 | -5.86 | -17.72 | -9.71 | -13.72 |
| `hpi.r.st.us` | -8.65 | -10.23 | -9.87 | -13.15 | -12.89 | -7.69 | -9.59 | -11.24 | -10.42 |
| `hpi.r.zip.st` | -3.63 | -3.75 | -3.32 | -1.53 | -2.12 | -2.07 | -3.57 | -1.91 | -2.74 |
| `st.unemp.r12m` | -0.39 | -0.38 | -0.28 | 0.27 | -0.05 | 0.16 | -0.35 | 0.13 | -0.11 |
| `st.unemp.r3m` | -0.25 | -0.17 | 0.12 | -0.31 | -0.31 | 0.04 | -0.10 | -0.19 | -0.15 |
| `TB10Y.r12m` | -3.20 | -3.32 | -3.10 | -2.15 | -2.71 | -2.05 | -3.20 | -2.30 | -2.75 |
| `T10Y3MM` | -5.11 | -4.67 | -3.89 | -1.38 | -1.04 | -0.02 | -4.56 | -0.82 | -2.69 |
| `T10Y3MM.r12m` | -1.23 | -1.72 | -1.73 | -0.74 | -0.76 | 0.52 | -1.56 | -0.33 | -0.95 |
| *No Noise* | | | | | | | | | |
| `hpi.st.d.t.o` | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| `hpi.zip.o` | 4 | 3 | 3 | 5 | 5 | 3 | 3 | 5 | 5 |
| `hpi.zip.d.t.o` | 3 | 4 | 5 | 2 | 3 | 10 | 4 | 4 | 3 |
| `ppi.c.FRMA` | 11 | 11 | 12 | 6 | 7 | 8 | 12 | 6 | 10 |
| `TB10Y.d.t.o` | 8 | 8 | 9 | 8 | 9 | 7 | 8 | 7 | 6 |
| `FRMA30Y.d.t.o` | 10 | 12 | 11 | 7 | 6 | 16 | 11 | 10 | 11 |
| `ppi.o.FRMA` | 13 | 14 | 14 | 14 | 15 | 15 | 14 | 16 | 16 |
| `equity.est` | 14 | 13 | 13 | 16 | 16 | 9 | 13 | 15 | 14 |
| `hpi.st.log12m` | 2 | 2 | 2 | 4 | 4 | 4 | 2 | 3 | 2 |
| `hpi.r.st.us` | 5 | 5 | 4 | 3 | 2 | 2 | 5 | 2 | 4 |
| `hpi.r.zip.st` | 7 | 7 | 7 | 10 | 10 | 5 | 7 | 9 | 8 |
| `st.unemp.r12m` | 15 | 15 | 15 | 15 | 14 | 13 | 15 | 14 | 15 |
| `st.unemp.r3m` | 16 | 16 | 16 | 13 | 13 | 12 | 16 | 13 | 13 |
| `TB10Y.r12m` | 9 | 9 | 8 | 9 | 8 | 6 | 9 | 8 | 7 |
| `T10Y3MM` | 6 | 6 | 6 | 11 | 11 | 11 | 6 | 11 | 9 |
| `T10Y3MM.r12m` | 12 | 10 | 10 | 12 | 12 | 14 | 10 | 12 | 12 |

*Table 38: Detailed results for Experiment B ($\sigma = 5$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 94.93 | 93.43 | 90.16 | 93.41 | 92.18 | 74.07 | 92.84 | 86.55 | 89.70 |
| `hpi.st.d.t.o` | 55.60 | 55.57 | 55.51 | 55.19 | 53.54 | 53.61 | 55.56 | 54.11 | 54.84 |
| `hpi.zip.o` | 70.63 | 68.92 | 67.53 | 73.96 | 71.62 | 60.26 | 69.03 | 68.61 | 68.82 |
| `hpi.zip.d.t.o` | 71.13 | 71.67 | 72.02 | 66.16 | 66.02 | 60.74 | 71.61 | 64.31 | 67.96 |
| `ppi.c.FRMA` | 88.62 | 87.43 | 85.07 | 79.31 | 79.45 | 75.50 | 87.04 | 78.09 | 82.56 |
| `TB10Y.d.t.o` | 86.74 | 85.92 | 84.19 | 85.97 | 86.32 | 71.33 | 85.62 | 81.21 | 83.41 |
| `FRMA30Y.d.t.o` | 88.42 | 87.64 | 85.12 | 82.20 | 80.00 | 70.38 | 87.06 | 77.53 | 82.29 |
| `ppi.o.FRMA` | 92.54 | 91.43 | 88.93 | 89.02 | 87.72 | 71.13 | 90.97 | 82.62 | 86.80 |
| `equity.est` | 92.28 | 90.89 | 88.05 | 92.39 | 91.22 | 72.29 | 90.41 | 85.30 | 87.85 |
| `hpi.st.log12m` | 65.48 | 64.70 | 64.10 | 69.95 | 68.10 | 62.07 | 64.76 | 66.71 | 65.73 |
| `hpi.r.st.us` | 72.98 | 70.68 | 68.62 | 72.96 | 73.35 | 57.13 | 70.76 | 67.81 | 69.29 |
| `hpi.r.zip.st` | 84.33 | 82.75 | 80.71 | 82.57 | 82.98 | 68.90 | 82.60 | 78.15 | 80.37 |
| `st.unemp.r12m` | 93.49 | 91.94 | 89.09 | 92.81 | 91.42 | 73.07 | 91.51 | 85.77 | 88.64 |
| `st.unemp.r3m` | 93.33 | 91.92 | 89.25 | 93.90 | 92.43 | 72.66 | 91.50 | 86.33 | 88.91 |
| `TB10Y.r12m` | 85.43 | 82.99 | 79.53 | 87.94 | 86.70 | 74.74 | 82.65 | 83.12 | 82.89 |
| `T10Y3MM` | 81.42 | 81.13 | 80.03 | 83.68 | 83.84 | 77.00 | 80.86 | 81.51 | 81.18 |
| `T10Y3MM.r12m` | 90.22 | 87.67 | 84.39 | 89.96 | 86.83 | 71.39 | 87.43 | 82.72 | 85.08 |
| *No Noise* | | | | | | | | | |
| `hpi.st.d.t.o` | -39.34 | -37.86 | -34.65 | -38.22 | -38.64 | -20.46 | -37.28 | -32.44 | -34.86 |
| `hpi.zip.o` | -24.30 | -24.51 | -22.64 | -19.45 | -20.55 | -13.81 | -23.82 | -17.94 | -20.88 |
| `hpi.zip.d.t.o` | -23.81 | -21.76 | -18.14 | -27.26 | -26.15 | -13.33 | -21.24 | -22.25 | -21.74 |
| `ppi.c.FRMA` | -6.31 | -6.01 | -5.09 | -14.10 | -12.72 | 1.43 | -5.80 | -8.47 | -7.14 |
| `TB10Y.d.t.o` | -8.20 | -7.51 | -5.97 | -7.44 | -5.86 | -2.74 | -7.23 | -5.35 | -6.29 |
| `FRMA30Y.d.t.o` | -6.51 | -5.80 | -5.05 | -11.21 | -12.18 | -3.69 | -5.79 | -9.03 | -7.41 |
| `ppi.o.FRMA` | -2.40 | -2.00 | -1.23 | -4.39 | -4.46 | -2.94 | -1.88 | -3.93 | -2.90 |
| `equity.est` | -2.65 | -2.54 | -2.11 | -1.03 | -0.96 | -1.78 | -2.43 | -1.25 | -1.84 |
| `hpi.st.log12m` | -29.45 | -28.74 | -26.06 | -23.47 | -24.08 | -12.00 | -28.09 | -19.85 | -23.97 |
| `hpi.r.st.us` | -21.95 | -22.75 | -21.54 | -20.45 | -18.83 | -16.94 | -22.08 | -18.74 | -20.41 |
| `hpi.r.zip.st` | -10.60 | -10.69 | -9.46 | -10.84 | -9.20 | -5.17 | -10.25 | -8.40 | -9.33 |
| `st.unemp.r12m` | -1.45 | -1.49 | -1.08 | -0.60 | -0.76 | -1.00 | -1.34 | -0.79 | -1.06 |
| `st.unemp.r3m` | -1.60 | -1.52 | -0.91 | 0.48 | 0.25 | -1.41 | -1.34 | -0.23 | -0.78 |
| `TB10Y.r12m` | -9.50 | -10.44 | -10.63 | -5.47 | -5.48 | 0.67 | -10.19 | -3.43 | -6.81 |
| `T10Y3MM` | -13.51 | -12.31 | -10.13 | -9.73 | -8.33 | 2.93 | -11.98 | -5.05 | -8.51 |
| `T10Y3MM.r12m` | -4.71 | -5.76 | -5.77 | -3.46 | -5.35 | -2.68 | -5.41 | -3.83 | -4.62 |
| *No Noise* | | | | | | | | | |
| `hpi.st.d.t.o` | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| `hpi.zip.o` | 3 | 3 | 3 | 5 | 4 | 3 | 3 | 5 | 4 |
| `hpi.zip.d.t.o` | 4 | 5 | 5 | 2 | 2 | 4 | 5 | 2 | 3 |
| `ppi.c.FRMA` | 11 | 10 | 11 | 6 | 6 | 15 | 10 | 7 | 9 |
| `TB10Y.d.t.o` | 9 | 9 | 9 | 10 | 10 | 9 | 9 | 9 | 11 |
| `FRMA30Y.d.t.o` | 10 | 11 | 12 | 7 | 7 | 7 | 11 | 6 | 8 |
| `ppi.o.FRMA` | 14 | 14 | 14 | 12 | 13 | 8 | 14 | 11 | 13 |
| `equity.est` | 13 | 13 | 13 | 14 | 14 | 11 | 13 | 14 | 14 |
| `hpi.st.log12m` | 2 | 2 | 2 | 3 | 3 | 5 | 2 | 3 | 2 |
| `hpi.r.st.us` | 5 | 4 | 4 | 4 | 5 | 2 | 4 | 4 | 5 |
| `hpi.r.zip.st` | 7 | 7 | 8 | 8 | 8 | 6 | 7 | 8 | 6 |
| `st.unemp.r12m` | 16 | 16 | 15 | 15 | 15 | 13 | 16 | 15 | 15 |
| `st.unemp.r3m` | 15 | 15 | 16 | 16 | 16 | 12 | 15 | 16 | 16 |
| `TB10Y.r12m` | 8 | 8 | 6 | 11 | 11 | 14 | 8 | 13 | 10 |
| `T10Y3MM` | 6 | 6 | 7 | 9 | 9 | 16 | 6 | 10 | 7 |
| `T10Y3MM.r12m` | 12 | 12 | 10 | 13 | 12 | 10 | 12 | 12 | 12 |

*Table 39: Detailed results for Experiment B ($\sigma = 10$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 94.93 | 93.43 | 90.16 | 93.41 | 92.18 | 74.07 | 92.84 | 86.55 | 89.70 |
| hpi.st.d.t.o | 54.20 | 53.86 | 53.82 | 51.29 | 52.23 | 52.18 | 53.96 | 51.90 | 52.93 |
| hpi.zip.o | 62.14 | 61.53 | 60.80 | 72.74 | 70.33 | 66.17 | 61.49 | 69.74 | 65.62 |
| hpi.zip.d.t.o | 64.37 | 64.91 | 64.91 | 62.43 | 62.55 | 61.08 | 64.73 | 62.02 | 63.38 |
| ppi.c.FRMA | 82.07 | 80.55 | 76.63 | 76.34 | 74.61 | 71.47 | 79.75 | 74.14 | 76.94 |
| TB10Y.d.t.o | 81.95 | 81.13 | 79.39 | 78.76 | 78.98 | 71.27 | 80.82 | 76.34 | 78.58 |
| FRMA30Y.d.t.o | 81.91 | 81.83 | 79.24 | 76.58 | 76.08 | 71.09 | 80.99 | 74.58 | 77.79 |
| ppi.o.FRMA | 89.54 | 89.11 | 87.63 | 85.14 | 84.02 | 73.26 | 88.76 | 80.81 | 84.78 |
| equity.est | 88.44 | 86.39 | 82.90 | 90.92 | 89.83 | 80.53 | 85.91 | 87.09 | 86.50 |
| hpi.st.log12m | 58.35 | 57.65 | 57.42 | 52.64 | 51.90 | 49.47 | 57.81 | 51.33 | 54.57 |
| hpi.r.st.us | 65.42 | 64.16 | 63.26 | 69.82 | 68.16 | 62.80 | 64.28 | 66.93 | 65.60 |
| hpi.r.zip.st | 75.71 | 74.55 | 73.14 | 73.38 | 72.86 | 66.08 | 74.47 | 70.78 | 72.62 |
| st.unemp.r12m | 92.26 | 90.34 | 86.86 | 90.94 | 90.20 | 79.56 | 89.82 | 86.90 | 88.36 |
| st.unemp.r3m | 91.24 | 89.48 | 86.60 | 90.38 | 88.53 | 74.25 | 89.11 | 84.38 | 86.75 |
| TB10Y.r12m | 77.35 | 73.58 | 70.73 | 83.67 | 82.84 | 69.38 | 73.88 | 78.63 | 76.26 |
| T10Y3MM | 74.38 | 74.44 | 73.59 | 70.76 | 70.67 | 67.06 | 74.14 | 69.50 | 71.82 |
| T10Y3MM.r12m | 85.01 | 81.94 | 78.89 | 90.51 | 88.01 | 72.63 | 81.95 | 83.72 | 82.83 |
| *No Noise* | | | | | | | | | |
| hpi.st.d.t.o | -40.73 | -39.57 | -36.34 | -42.13 | -39.95 | -21.89 | -38.88 | -34.66 | -36.77 |
| hpi.zip.o | -32.79 | -31.90 | -29.36 | -20.68 | -21.85 | -7.91 | -31.35 | -16.81 | -24.08 |
| hpi.zip.d.t.o | -30.56 | -28.52 | -25.25 | -30.98 | -29.63 | -12.99 | -28.11 | -24.53 | -26.32 |
| ppi.c.FRMA | -12.86 | -12.88 | -13.54 | -17.08 | -17.56 | -2.60 | -13.09 | -12.41 | -12.75 |
| TB10Y.d.t.o | -12.99 | -12.30 | -10.77 | -14.65 | -13.20 | -2.80 | -12.02 | -10.22 | -11.12 |
| FRMA30Y.d.t.o | -13.03 | -11.61 | -10.92 | -16.84 | -16.10 | -2.98 | -11.85 | -11.97 | -11.91 |
| ppi.o.FRMA | -5.40 | -4.32 | -2.54 | -8.27 | -8.16 | -0.81 | -4.09 | -5.75 | -4.92 |
| equity.est | -6.49 | -7.04 | -7.26 | -2.49 | -2.35 | 6.46 | -6.93 | 0.54 | -3.20 |
| hpi.st.log12m | -36.59 | -35.78 | -32.74 | -40.78 | -40.28 | -24.60 | -35.04 | -35.22 | -35.13 |
| hpi.r.st.us | -29.52 | -29.27 | -26.90 | -23.60 | -24.02 | -11.27 | -28.56 | -19.63 | -24.10 |
| hpi.r.zip.st | -19.22 | -18.89 | -17.02 | -20.03 | -19.32 | -7.99 | -18.38 | -15.78 | -17.08 |
| st.unemp.r12m | -2.67 | -3.09 | -3.30 | -2.47 | -1.98 | 5.49 | -3.02 | 0.35 | -1.34 |
| st.unemp.r3m | -3.70 | -3.95 | -3.56 | -3.04 | -3.65 | 0.18 | -3.74 | -2.17 | -2.95 |
| TB10Y.r12m | -17.58 | -19.86 | -19.44 | -9.75 | -9.34 | -4.69 | -18.96 | -7.93 | -13.44 |
| T10Y3MM | -20.55 | -18.99 | -16.57 | -22.66 | -21.51 | -7.01 | -18.70 | -17.06 | -17.88 |
| T10Y3MM.r12m | -9.93 | -11.49 | -11.28 | -2.90 | -4.17 | -1.44 | -10.90 | -2.84 | -6.87 |
| *No Noise* | | | | | | | | | |
| hpi.st.d.t.o | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| hpi.zip.o | 3 | 3 | 3 | 6 | 5 | 6 | 3 | 6 | 5 |
| hpi.zip.d.t.o | 4 | 5 | 5 | 3 | 3 | 3 | 5 | 3 | 3 |
| ppi.c.FRMA | 11 | 9 | 9 | 8 | 8 | 11 | 9 | 8 | 9 |
| TB10Y.d.t.o | 10 | 10 | 12 | 10 | 10 | 10 | 10 | 10 | 11 |
| FRMA30Y.d.t.o | 9 | 11 | 11 | 9 | 9 | 9 | 11 | 9 | 10 |
| ppi.o.FRMA | 14 | 14 | 16 | 12 | 12 | 13 | 14 | 12 | 13 |
| equity.est | 13 | 13 | 13 | 15 | 15 | 16 | 13 | 16 | 14 |
| hpi.st.log12m | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 2 |
| hpi.r.st.us | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| hpi.r.zip.st | 7 | 8 | 7 | 7 | 7 | 5 | 8 | 7 | 7 |
| st.unemp.r12m | 16 | 16 | 15 | 16 | 16 | 15 | 16 | 15 | 16 |
| st.unemp.r3m | 15 | 15 | 14 | 13 | 14 | 14 | 15 | 14 | 15 |
| TB10Y.r12m | 8 | 6 | 6 | 11 | 11 | 8 | 6 | 11 | 8 |
| T10Y3MM | 6 | 7 | 8 | 5 | 6 | 7 | 7 | 5 | 6 |
| T10Y3MM.r12m | 12 | 12 | 10 | 14 | 13 | 12 | 12 | 13 | 12 |

*Table 40: Detailed results for Experiment C ($\sigma = 0.5$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 95.61 | 94.87 | 94.29 | 98.27 | 97.72 | 92.54 | 94.92 | 96.17 | 95.55 |
| `int.rate` | 95.47 | 94.73 | 94.19 | 98.27 | 97.70 | 92.51 | 94.80 | 96.16 | 95.48 |
| `orig.upb` | 95.57 | 94.81 | 94.22 | 98.28 | 97.73 | 92.54 | 94.87 | 96.18 | 95.52 |
| `fico.score` | 95.62 | 94.87 | 94.28 | 98.33 | 97.77 | 92.57 | 94.92 | 96.23 | 95.57 |
| `dti.r` | 95.60 | 94.86 | 94.27 | 98.25 | 97.69 | 92.53 | 94.91 | 96.16 | 95.53 |
| `ltv.r` | 95.50 | 94.77 | 94.19 | 98.26 | 97.75 | 92.56 | 94.82 | 96.19 | 95.50 |
| `bal.repaid` | 92.53 | 91.93 | 91.44 | 98.00 | 97.55 | 92.44 | 91.97 | 96.00 | 93.98 |
| `t.act.12m` | 95.61 | 94.88 | 94.31 | 98.31 | 97.74 | 92.52 | 94.93 | 96.19 | 95.56 |
| `t.del.30d.12m` | 95.59 | 94.85 | 94.27 | 98.32 | 97.80 | 92.55 | 94.91 | 96.22 | 95.57 |
| `t.del.60d.12m` | 95.49 | 94.71 | 93.96 | 98.31 | 97.72 | 92.46 | 94.72 | 96.16 | 95.44 |
| `hpi.st.d.t.o` | 86.25 | 85.72 | 85.25 | 96.63 | 96.41 | 92.32 | 85.74 | 95.12 | 90.43 |
| `hpi.zip.o` | 94.40 | 93.61 | 93.08 | 98.26 | 97.68 | 92.51 | 93.70 | 96.15 | 94.92 |
| `hpi.zip.d.t.o` | 92.71 | 92.18 | 91.82 | 98.12 | 97.69 | 92.54 | 92.24 | 96.12 | 94.18 |
| `ppi.c.FRMA` | 95.50 | 94.77 | 94.17 | 98.32 | 97.77 | 92.53 | 94.81 | 96.21 | 95.51 |
| `TB10Y.d.t.o` | 95.38 | 94.65 | 94.08 | 98.29 | 97.80 | 92.55 | 94.70 | 96.21 | 95.46 |
| `FRMA30Y.d.t.o` | 95.30 | 94.59 | 94.06 | 98.25 | 97.71 | 92.54 | 94.65 | 96.17 | 95.41 |
| `ppi.o.FRMA` | 95.54 | 94.79 | 94.22 | 98.25 | 97.70 | 92.49 | 94.85 | 96.15 | 95.50 |
| `equity.est` | 95.42 | 94.69 | 94.08 | 98.05 | 97.51 | 92.53 | 94.73 | 96.03 | 95.38 |
| `hpi.st.log12m` | 92.82 | 91.98 | 91.18 | 98.33 | 97.68 | 92.31 | 91.99 | 96.10 | 94.05 |
| `hpi.r.st.us` | 94.80 | 93.79 | 93.11 | 98.25 | 97.58 | 92.52 | 93.90 | 96.12 | 95.01 |
| `hpi.r.zip.st` | 95.39 | 94.65 | 94.07 | 98.25 | 97.71 | 92.53 | 94.70 | 96.16 | 95.43 |
| `st.unemp.r12m` | 95.59 | 94.85 | 94.25 | 98.27 | 97.70 | 92.52 | 94.89 | 96.17 | 95.53 |
| `st.unemp.r3m` | 95.55 | 94.81 | 94.22 | 98.28 | 97.71 | 92.53 | 94.86 | 96.17 | 95.52 |
| `TB10Y.r12m` | 95.44 | 94.66 | 94.07 | 98.32 | 97.82 | 92.59 | 94.73 | 96.24 | 95.49 |
| `T10Y3MM` | 95.24 | 94.53 | 94.00 | 98.25 | 97.74 | 92.59 | 94.59 | 96.19 | 95.39 |
| `T10Y3MM.r12m` | 95.49 | 94.70 | 94.15 | 98.30 | 97.63 | 92.41 | 94.78 | 96.11 | 95.45 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -0.14 | -0.14 | -0.09 | 0.00 | -0.01 | -0.03 | -0.12 | -0.01 | -0.07 |
| `orig.upb` | -0.04 | -0.05 | -0.07 | 0.01 | 0.01 | 0.00 | -0.06 | 0.01 | -0.02 |
| `fico.score` | 0.01 | 0.01 | -0.01 | 0.06 | 0.06 | 0.03 | 0.00 | 0.05 | 0.03 |
| `dti.r` | -0.02 | -0.01 | -0.01 | -0.02 | -0.02 | -0.01 | -0.01 | -0.02 | -0.01 |
| `ltv.r` | -0.11 | -0.10 | -0.10 | -0.01 | 0.03 | 0.02 | -0.10 | 0.01 | -0.04 |
| `bal.repaid` | -3.08 | -2.94 | -2.85 | -0.27 | -0.17 | -0.10 | -2.96 | -0.18 | -1.57 |
| `t.act.12m` | 0.00 | 0.02 | 0.03 | 0.04 | 0.03 | -0.02 | 0.01 | 0.01 | 0.01 |
| `t.del.30d.12m` | -0.02 | -0.01 | -0.02 | 0.05 | 0.09 | 0.01 | -0.02 | 0.05 | 0.02 |
| `t.del.60d.12m` | -0.12 | -0.15 | -0.33 | 0.04 | 0.00 | -0.08 | -0.20 | -0.01 | -0.11 |
| `hpi.st.d.t.o` | -9.37 | -9.15 | -9.03 | -1.63 | -1.30 | -0.22 | -9.18 | -1.05 | -5.12 |
| `hpi.zip.o` | -1.21 | -1.25 | -1.21 | -0.01 | -0.03 | -0.03 | -1.22 | -0.02 | -0.62 |
| `hpi.zip.d.t.o` | -2.90 | -2.68 | -2.47 | -0.15 | -0.03 | 0.00 | -2.68 | -0.06 | -1.37 |
| `ppi.c.FRMA` | -0.12 | -0.10 | -0.11 | 0.05 | 0.05 | -0.01 | -0.11 | 0.03 | -0.04 |
| `TB10Y.d.t.o` | -0.23 | -0.22 | -0.20 | 0.02 | 0.08 | 0.01 | -0.22 | 0.04 | -0.09 |
| `FRMA30Y.d.t.o` | -0.31 | -0.27 | -0.23 | -0.02 | 0.00 | 0.00 | -0.27 | -0.01 | -0.14 |
| `ppi.o.FRMA` | -0.08 | -0.08 | -0.07 | -0.02 | -0.02 | -0.05 | -0.07 | -0.03 | -0.05 |
| `equity.est` | -0.19 | -0.18 | -0.20 | -0.22 | -0.20 | -0.01 | -0.19 | -0.14 | -0.17 |
| `hpi.st.log12m` | -2.80 | -2.88 | -3.11 | 0.06 | -0.04 | -0.23 | -2.93 | -0.07 | -1.50 |
| `hpi.r.st.us` | -0.81 | -1.08 | -1.18 | -0.02 | -0.14 | -0.02 | -1.02 | -0.06 | -0.54 |
| `hpi.r.zip.st` | -0.22 | -0.22 | -0.22 | -0.02 | -0.01 | -0.01 | -0.22 | -0.01 | -0.11 |
| `st.unemp.r12m` | -0.02 | -0.02 | -0.04 | 0.00 | -0.01 | -0.01 | -0.03 | -0.01 | -0.02 |
| `st.unemp.r3m` | -0.06 | -0.06 | -0.07 | 0.01 | -0.01 | -0.01 | -0.06 | 0.00 | -0.03 |
| `TB10Y.r12m` | -0.17 | -0.20 | -0.21 | 0.05 | 0.10 | 0.06 | -0.20 | 0.07 | -0.06 |
| `T10Y3MM` | -0.38 | -0.33 | -0.29 | -0.02 | 0.02 | 0.05 | -0.33 | 0.02 | -0.16 |
| `T10Y3MM.r12m` | -0.13 | -0.16 | -0.14 | 0.03 | -0.08 | -0.13 | -0.14 | -0.06 | -0.10 |
| *No Noise* | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| int.rate | 13 | 15 | 17 | 13 | 11 | 7 | 15 | 11 | 14 |
| orig.upb | 20 | 20 | 18 | 15 | 17 | 18 | 20 | 17 | 20 |
| fico.score | 25 | 24 | 24 | 25 | 22 | 23 | 24 | 24 | 25 |
| dti.r | 23 | 23 | 23 | 5 | 9 | 13 | 23 | 10 | 22 |
| ltv.r | 17 | 17 | 16 | 11 | 20 | 22 | 17 | 18 | 17 |
| bal.repaid | 2 | 2 | 3 | 2 | 3 | 4 | 2 | 2 | 2 |
| t.act.12m | 24 | 25 | 25 | 19 | 19 | 9 | 25 | 19 | 23 |
| t.del.30d.12m | 22 | 22 | 22 | 22 | 24 | 20 | 22 | 23 | 24 |
| t.del.60d.12m | 15 | 14 | 7 | 20 | 16 | 5 | 11 | 13 | 11 |
| hpi.st.d.t.o | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| hpi.zip.o | 5 | 5 | 5 | 11 | 7 | 8 | 5 | 9 | 5 |
| hpi.zip.d.t.o | 3 | 4 | 4 | 4 | 8 | 18 | 4 | 6 | 4 |
| ppi.c.FRMA | 16 | 16 | 15 | 22 | 21 | 15 | 16 | 21 | 18 |
| TB10Y.d.t.o | 9 | 9 | 13 | 17 | 23 | 21 | 10 | 22 | 13 |
| FRMA30Y.d.t.o | 8 | 8 | 9 | 6 | 15 | 17 | 8 | 15 | 9 |
| ppi.o.FRMA | 18 | 18 | 20 | 6 | 10 | 6 | 18 | 8 | 16 |
| equity.est | 11 | 12 | 12 | 3 | 2 | 15 | 13 | 3 | 7 |
| hpi.st.log12m | 4 | 3 | 2 | 24 | 6 | 1 | 3 | 4 | 3 |
| hpi.r.st.us | 6 | 6 | 6 | 6 | 4 | 10 | 6 | 7 | 6 |
| hpi.r.zip.st | 10 | 10 | 10 | 6 | 13 | 13 | 9 | 12 | 10 |
| st.unemp.r12m | 21 | 21 | 21 | 13 | 11 | 11 | 21 | 14 | 21 |
| st.unemp.r3m | 19 | 19 | 19 | 16 | 13 | 12 | 19 | 16 | 19 |
| TB10Y.r12m | 12 | 11 | 11 | 21 | 25 | 25 | 12 | 25 | 15 |
| T10Y3MM | 7 | 7 | 8 | 10 | 18 | 24 | 7 | 20 | 8 |
| T10Y3MM.r12m | 14 | 13 | 14 | 18 | 5 | 3 | 14 | 5 | 12 |

*Table 41: Detailed results for Experiment C ($\sigma = 1$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 95.61 | 94.87 | 94.29 | 98.27 | 97.72 | 92.54 | 94.92 | 96.17 | 95.55 |
| `int.rate` | 95.04 | 94.32 | 93.79 | 98.29 | 97.72 | 92.41 | 94.38 | 96.14 | 95.26 |
| `orig.upb` | 95.34 | 94.59 | 93.95 | 98.35 | 97.81 | 92.55 | 94.63 | 96.24 | 95.43 |
| `fico.score` | 95.56 | 94.80 | 94.20 | 98.26 | 97.75 | 92.48 | 94.85 | 96.16 | 95.51 |
| `dti.r` | 95.56 | 94.81 | 94.22 | 98.32 | 97.74 | 92.53 | 94.86 | 96.19 | 95.53 |
| `ltv.r` | 95.28 | 94.56 | 93.96 | 98.31 | 97.78 | 92.54 | 94.60 | 96.21 | 95.41 |
| `bal.repaid` | 88.50 | 88.13 | 87.73 | 97.00 | 96.88 | 92.19 | 88.12 | 95.35 | 91.74 |
| `t.act.12m` | 95.57 | 94.81 | 94.11 | 98.30 | 97.78 | 92.59 | 94.83 | 96.22 | 95.53 |
| `t.del.30d.12m` | 95.53 | 94.77 | 94.12 | 98.27 | 97.67 | 92.37 | 94.81 | 96.10 | 95.46 |
| `t.del.60d.12m` | 95.03 | 94.10 | 92.86 | 97.85 | 97.36 | 92.13 | 94.00 | 95.78 | 94.89 |
| `hpi.st.d.t.o` | 76.33 | 76.12 | 75.95 | 92.99 | 93.29 | 92.94 | 76.13 | 93.08 | 84.60 |
| `hpi.zip.o` | 91.98 | 91.05 | 90.66 | 97.98 | 97.54 | 92.55 | 91.23 | 96.02 | 93.62 |
| `hpi.zip.d.t.o` | 88.18 | 87.97 | 87.89 | 96.39 | 96.97 | 92.41 | 88.01 | 95.25 | 91.63 |
| `ppi.c.FRMA` | 95.04 | 94.36 | 93.81 | 98.30 | 97.77 | 92.54 | 94.40 | 96.20 | 95.30 |
| `TB10Y.d.t.o` | 94.87 | 94.18 | 93.58 | 98.27 | 97.76 | 92.55 | 94.21 | 96.19 | 95.20 |
| `FRMA30Y.d.t.o` | 94.44 | 93.79 | 93.29 | 98.16 | 97.65 | 92.65 | 93.84 | 96.15 | 95.00 |
| `ppi.o.FRMA` | 95.38 | 94.66 | 94.10 | 98.24 | 97.67 | 92.44 | 94.71 | 96.12 | 95.42 |
| `equity.est` | 95.05 | 94.34 | 93.79 | 97.96 | 97.48 | 92.50 | 94.39 | 95.98 | 95.19 |
| `hpi.st.log12m` | 88.21 | 87.44 | 86.51 | 97.78 | 97.52 | 92.87 | 87.39 | 96.05 | 91.72 |
| `hpi.r.st.us` | 93.54 | 91.98 | 91.20 | 97.75 | 96.43 | 91.95 | 92.24 | 95.38 | 93.81 |
| `hpi.r.zip.st` | 95.13 | 94.41 | 93.84 | 98.31 | 97.78 | 92.51 | 94.46 | 96.20 | 95.33 |
| `st.unemp.r12m` | 95.50 | 94.76 | 94.19 | 98.22 | 97.64 | 92.45 | 94.82 | 96.10 | 95.46 |
| `st.unemp.r3m` | 95.49 | 94.75 | 94.18 | 98.32 | 97.75 | 92.48 | 94.81 | 96.18 | 95.50 |
| `TB10Y.r12m` | 94.93 | 94.04 | 93.42 | 98.22 | 97.58 | 92.38 | 94.13 | 96.06 | 95.10 |
| `T10Y3MM` | 94.31 | 93.65 | 93.23 | 98.27 | 97.75 | 92.57 | 93.73 | 96.20 | 94.96 |
| `T10Y3MM.r12m` | 95.22 | 94.17 | 93.62 | 98.23 | 97.72 | 92.43 | 94.34 | 96.13 | 95.23 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -0.57 | -0.55 | -0.50 | 0.02 | 0.00 | -0.13 | -0.54 | -0.04 | -0.29 |
| `orig.upb` | -0.27 | -0.28 | -0.34 | 0.08 | 0.09 | 0.01 | -0.30 | 0.06 | -0.12 |
| `fico.score` | -0.06 | -0.07 | -0.09 | -0.01 | 0.04 | -0.06 | -0.07 | -0.01 | -0.04 |
| `dti.r` | -0.05 | -0.06 | -0.06 | 0.05 | 0.02 | -0.01 | -0.06 | 0.02 | -0.02 |
| `ltv.r` | -0.33 | -0.30 | -0.33 | 0.04 | 0.07 | 0.00 | -0.32 | 0.04 | -0.14 |
| `bal.repaid` | -7.11 | -6.73 | -6.55 | -1.27 | -0.84 | -0.35 | -6.80 | -0.82 | -3.81 |
| `t.act.12m` | -0.04 | -0.06 | -0.18 | 0.03 | 0.07 | 0.05 | -0.09 | 0.05 | -0.02 |
| `t.del.30d.12m` | -0.08 | -0.09 | -0.17 | 0.00 | -0.05 | -0.17 | -0.11 | -0.07 | -0.09 |
| `t.del.60d.12m` | -0.58 | -0.77 | -1.42 | -0.42 | -0.35 | -0.41 | -0.92 | -0.39 | -0.66 |
| `hpi.st.d.t.o` | -19.28 | -18.74 | -18.34 | -5.28 | -4.42 | 0.40 | -18.79 | -3.10 | -10.94 |
| `hpi.zip.o` | -3.64 | -3.82 | -3.63 | -0.29 | -0.17 | 0.01 | -3.70 | -0.15 | -1.92 |
| `hpi.zip.d.t.o` | -7.43 | -6.90 | -6.40 | -1.88 | -0.74 | -0.13 | -6.91 | -0.92 | -3.92 |
| `ppi.c.FRMA` | -0.57 | -0.51 | -0.48 | 0.03 | 0.05 | 0.00 | -0.52 | 0.03 | -0.25 |
| `TB10Y.d.t.o` | -0.74 | -0.69 | -0.71 | 0.01 | 0.04 | 0.01 | -0.72 | 0.02 | -0.35 |
| `FRMA30Y.d.t.o` | -1.18 | -1.08 | -0.99 | -0.11 | -0.07 | 0.11 | -1.08 | -0.02 | -0.55 |
| `ppi.o.FRMA` | -0.23 | -0.20 | -0.19 | -0.03 | -0.04 | -0.10 | -0.21 | -0.05 | -0.13 |
| `equity.est` | -0.57 | -0.53 | -0.49 | -0.31 | -0.24 | -0.04 | -0.53 | -0.20 | -0.36 |
| `hpi.st.log12m` | -7.40 | -7.43 | -7.78 | -0.49 | -0.20 | 0.33 | -7.53 | -0.12 | -3.83 |
| `hpi.r.st.us` | -2.07 | -2.88 | -3.09 | -0.52 | -1.29 | -0.59 | -2.68 | -0.80 | -1.74 |
| `hpi.r.zip.st` | -0.49 | -0.46 | -0.44 | 0.04 | 0.06 | -0.03 | -0.46 | 0.02 | -0.22 |
| `st.unemp.r12m` | -0.11 | -0.11 | -0.10 | -0.05 | -0.08 | -0.09 | -0.11 | -0.07 | -0.09 |
| `st.unemp.r3m` | -0.12 | -0.11 | -0.11 | 0.05 | 0.04 | -0.06 | -0.11 | 0.01 | -0.05 |
| `TB10Y.r12m` | -0.68 | -0.82 | -0.86 | -0.05 | -0.14 | -0.16 | -0.79 | -0.12 | -0.45 |
| `T10Y3MM` | -1.31 | -1.22 | -1.06 | 0.00 | 0.04 | 0.03 | -1.20 | 0.02 | -0.59 |
| `T10Y3MM.r12m` | -0.40 | -0.69 | -0.66 | -0.04 | 0.00 | -0.11 | -0.59 | -0.05 | -0.32 |
| *No Noise* | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| int.rate | 13 | 13 | 13 | 18 | 14 | 7 | 13 | 14 | 14 |
| orig.upb | 18 | 18 | 17 | 25 | 25 | 20 | 18 | 25 | 19 |
| fico.score | 23 | 23 | 24 | 14 | 18 | 11 | 24 | 16 | 23 |
| dti.r | 24 | 24 | 25 | 23 | 16 | 15 | 25 | 18 | 25 |
| ltv.r | 17 | 17 | 18 | 21 | 24 | 17 | 17 | 23 | 17 |
| bal.repaid | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 4 |
| t.act.12m | 25 | 25 | 20 | 19 | 23 | 22 | 23 | 24 | 24 |
| t.del.30d.12m | 22 | 22 | 21 | 16 | 12 | 4 | 21 | 10 | 20 |
| t.del.60d.12m | 11 | 10 | 7 | 6 | 5 | 2 | 9 | 5 | 7 |
| hpi.st.d.t.o | 1 | 1 | 1 | 1 | 1 | 25 | 1 | 1 | 1 |
| hpi.zip.o | 5 | 5 | 5 | 8 | 8 | 18 | 5 | 7 | 5 |
| hpi.zip.d.t.o | 2 | 3 | 4 | 2 | 4 | 6 | 3 | 2 | 2 |
| ppi.c.FRMA | 12 | 15 | 15 | 20 | 21 | 16 | 15 | 22 | 15 |
| TB10Y.d.t.o | 9 | 12 | 11 | 17 | 20 | 18 | 11 | 19 | 12 |
| FRMA30Y.d.t.o | 8 | 8 | 9 | 9 | 11 | 23 | 8 | 15 | 9 |
| ppi.o.FRMA | 19 | 19 | 19 | 13 | 13 | 9 | 19 | 12 | 18 |
| equity.est | 14 | 14 | 14 | 7 | 6 | 13 | 14 | 6 | 11 |
| hpi.st.log12m | 3 | 2 | 2 | 5 | 7 | 24 | 2 | 8 | 3 |
| hpi.r.st.us | 6 | 6 | 6 | 4 | 2 | 1 | 6 | 4 | 6 |
| hpi.r.zip.st | 15 | 16 | 16 | 22 | 22 | 14 | 16 | 21 | 16 |
| st.unemp.r12m | 21 | 21 | 23 | 10 | 10 | 10 | 22 | 11 | 21 |
| st.unemp.r3m | 20 | 20 | 22 | 24 | 17 | 12 | 20 | 17 | 22 |
| TB10Y.r12m | 10 | 9 | 10 | 11 | 9 | 5 | 10 | 9 | 10 |
| T10Y3MM | 7 | 7 | 8 | 15 | 18 | 21 | 7 | 20 | 8 |
| T10Y3MM.r12m | 16 | 11 | 12 | 12 | 14 | 8 | 12 | 13 | 13 |

*Table 42: Detailed results for Experiment C ($\sigma = 2$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 95.61 | 94.87 | 94.29 | 98.27 | 97.72 | 92.54 | 94.92 | 96.17 | 95.55 |
| `int.rate` | 93.71 | 92.96 | 92.50 | 97.96 | 97.44 | 92.39 | 93.06 | 95.93 | 94.49 |
| `orig.upb` | 94.54 | 93.72 | 93.02 | 98.32 | 97.82 | 92.63 | 93.76 | 96.25 | 95.01 |
| `fico.score` | 95.41 | 94.65 | 94.00 | 98.42 | 97.90 | 92.72 | 94.69 | 96.34 | 95.52 |
| `dti.r` | 95.38 | 94.59 | 93.96 | 98.37 | 97.72 | 92.42 | 94.64 | 96.17 | 95.41 |
| `ltv.r` | 94.57 | 93.84 | 93.11 | 98.36 | 97.71 | 92.36 | 93.84 | 96.14 | 94.99 |
| `bal.repaid` | 83.25 | 83.00 | 82.82 | 94.26 | 95.07 | 88.87 | 83.03 | 92.73 | 87.88 |
| `t.act.12m` | 95.23 | 94.31 | 93.29 | 98.13 | 97.67 | 92.21 | 94.28 | 96.00 | 95.14 |
| `t.del.30d.12m` | 95.27 | 94.51 | 93.85 | 98.23 | 97.49 | 92.17 | 94.54 | 95.96 | 95.25 |
| `t.del.60d.12m` | 93.70 | 92.35 | 89.59 | 97.34 | 96.97 | 92.24 | 91.88 | 95.52 | 93.70 |
| `hpi.st.d.t.o` | 67.88 | 67.80 | 67.72 | 87.88 | 87.85 | 85.19 | 67.80 | 86.97 | 77.39 |
| `hpi.zip.o` | 85.72 | 84.69 | 84.37 | 94.17 | 92.26 | 89.12 | 84.93 | 91.85 | 88.39 |
| `hpi.zip.d.t.o` | 80.37 | 80.42 | 80.42 | 92.57 | 93.58 | 90.27 | 80.40 | 92.14 | 86.27 |
| `ppi.c.FRMA` | 94.04 | 93.39 | 92.76 | 97.62 | 97.21 | 92.57 | 93.40 | 95.80 | 94.60 |
| `TB10Y.d.t.o` | 93.84 | 93.15 | 92.58 | 97.61 | 97.06 | 92.58 | 93.19 | 95.75 | 94.47 |
| `FRMA30Y.d.t.o` | 92.51 | 91.80 | 91.50 | 98.00 | 97.48 | 92.41 | 91.93 | 95.96 | 93.95 |
| `ppi.o.FRMA` | 94.76 | 94.02 | 93.47 | 98.16 | 97.66 | 92.43 | 94.08 | 96.08 | 95.08 |
| `equity.est` | 93.13 | 92.47 | 91.88 | 97.90 | 97.30 | 92.32 | 92.49 | 95.84 | 94.17 |
| `hpi.st.log12m` | 79.90 | 79.19 | 78.37 | 94.82 | 94.32 | 90.49 | 79.15 | 93.21 | 86.18 |
| `hpi.r.st.us` | 87.62 | 85.72 | 84.24 | 98.08 | 95.87 | 92.09 | 85.86 | 95.35 | 90.60 |
| `hpi.r.zip.st` | 93.69 | 93.05 | 92.55 | 98.18 | 97.76 | 92.64 | 93.10 | 96.19 | 94.65 |
| `st.unemp.r12m` | 95.23 | 94.46 | 93.84 | 98.16 | 97.58 | 92.40 | 94.51 | 96.05 | 95.28 |
| `st.unemp.r3m` | 95.28 | 94.55 | 93.98 | 98.16 | 97.77 | 92.78 | 94.60 | 96.24 | 95.42 |
| `TB10Y.r12m` | 93.13 | 92.14 | 91.47 | 98.24 | 97.66 | 92.54 | 92.25 | 96.15 | 94.20 |
| `T10Y3MM` | 91.93 | 91.42 | 91.27 | 97.80 | 97.22 | 92.19 | 91.54 | 95.74 | 93.64 |
| `T10Y3MM.r12m` | 94.13 | 92.87 | 92.37 | 98.18 | 97.48 | 92.32 | 93.12 | 95.99 | 94.56 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -1.90 | -1.91 | -1.79 | -0.31 | -0.27 | -0.15 | -1.87 | -0.24 | -1.06 |
| `orig.upb` | -1.08 | -1.14 | -1.27 | 0.05 | 0.10 | 0.09 | -1.16 | 0.08 | -0.54 |
| `fico.score` | -0.20 | -0.22 | -0.28 | 0.15 | 0.18 | 0.18 | -0.23 | 0.17 | -0.03 |
| `dti.r` | -0.24 | -0.28 | -0.32 | 0.10 | 0.00 | -0.11 | -0.28 | 0.00 | -0.14 |
| `ltv.r` | -1.04 | -1.03 | -1.17 | 0.09 | 0.00 | -0.18 | -1.08 | -0.03 | -0.56 |
| `bal.repaid` | -12.36 | -11.87 | -11.46 | -4.01 | -2.65 | -3.67 | -11.90 | -3.44 | -7.67 |
| `t.act.12m` | -0.38 | -0.56 | -1.00 | -0.14 | -0.04 | -0.33 | -0.65 | -0.17 | -0.41 |
| `t.del.30d.12m` | -0.35 | -0.35 | -0.44 | -0.04 | -0.23 | -0.37 | -0.38 | -0.21 | -0.29 |
| `t.del.60d.12m` | -1.91 | -2.52 | -4.70 | -0.93 | -0.74 | -0.30 | -3.04 | -0.66 | -1.85 |
| `hpi.st.d.t.o` | -27.73 | -27.06 | -26.57 | -10.39 | -9.87 | -7.35 | -27.12 | -9.20 | -18.16 |
| `hpi.zip.o` | -9.89 | -10.18 | -9.92 | -4.10 | -5.45 | -3.42 | -10.00 | -4.32 | -7.16 |
| `hpi.zip.d.t.o` | -15.25 | -14.44 | -13.87 | -5.70 | -4.13 | -2.27 | -14.52 | -4.04 | -9.28 |
| `ppi.c.FRMA` | -1.57 | -1.47 | -1.53 | -0.65 | -0.51 | 0.03 | -1.52 | -0.38 | -0.95 |
| `TB10Y.d.t.o` | -1.77 | -1.72 | -1.71 | -0.66 | -0.65 | 0.04 | -1.73 | -0.43 | -1.08 |
| `FRMA30Y.d.t.o` | -3.10 | -3.07 | -2.79 | -0.27 | -0.23 | -0.13 | -2.99 | -0.21 | -1.60 |
| `ppi.o.FRMA` | -0.86 | -0.85 | -0.82 | -0.11 | -0.06 | -0.11 | -0.84 | -0.09 | -0.47 |
| `equity.est` | -2.48 | -2.40 | -2.41 | -0.37 | -0.42 | -0.22 | -2.43 | -0.34 | -1.38 |
| `hpi.st.log12m` | -15.72 | -15.68 | -15.92 | -3.45 | -3.39 | -2.05 | -15.77 | -2.97 | -9.37 |
| `hpi.r.st.us` | -7.99 | -9.14 | -10.04 | -0.19 | -1.85 | -0.45 | -9.06 | -0.83 | -4.94 |
| `hpi.r.zip.st` | -1.92 | -1.81 | -1.74 | -0.08 | 0.04 | 0.10 | -1.83 | 0.02 | -0.90 |
| `st.unemp.r12m` | -0.38 | -0.41 | -0.45 | -0.11 | -0.13 | -0.14 | -0.41 | -0.13 | -0.27 |
| `st.unemp.r3m` | -0.33 | -0.32 | -0.30 | -0.11 | 0.05 | 0.24 | -0.32 | 0.06 | -0.13 |
| `TB10Y.r12m` | -2.49 | -2.72 | -2.82 | -0.03 | -0.06 | 0.00 | -2.68 | -0.03 | -1.35 |
| `T10Y3MM` | -3.69 | -3.44 | -3.02 | -0.47 | -0.49 | -0.35 | -3.38 | -0.44 | -1.91 |
| `T10Y3MM.r12m` | -1.48 | -2.00 | -1.91 | -0.08 | -0.24 | -0.22 | -1.80 | -0.18 | -0.99 |
| *No Noise* | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| int.rate | 13 | 13 | 13 | 11 | 12 | 14 | 12 | 12 | 13 |
| orig.upb | 17 | 17 | 17 | 22 | 24 | 22 | 17 | 24 | 18 |
| fico.score | 25 | 25 | 25 | 25 | 25 | 24 | 25 | 25 | 25 |
| dti.r | 24 | 24 | 23 | 24 | 21 | 17 | 24 | 21 | 23 |
| ltv.r | 18 | 18 | 18 | 23 | 20 | 13 | 18 | 19 | 17 |
| bal.repaid | 4 | 4 | 4 | 4 | 5 | 2 | 4 | 4 | 4 |
| t.act.12m | 20 | 20 | 19 | 14 | 19 | 9 | 20 | 16 | 20 |
| t.del.30d.12m | 22 | 22 | 22 | 20 | 15 | 7 | 22 | 14 | 21 |
| t.del.60d.12m | 12 | 10 | 7 | 6 | 7 | 10 | 8 | 7 | 8 |
| hpi.st.d.t.o | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| hpi.zip.o | 5 | 5 | 6 | 3 | 2 | 3 | 5 | 2 | 5 |
| hpi.zip.d.t.o | 3 | 3 | 3 | 2 | 3 | 4 | 3 | 3 | 3 |
| ppi.c.FRMA | 15 | 16 | 16 | 8 | 9 | 20 | 16 | 10 | 15 |
| TB10Y.d.t.o | 14 | 15 | 15 | 7 | 8 | 21 | 15 | 9 | 12 |
| FRMA30Y.d.t.o | 8 | 8 | 10 | 12 | 14 | 16 | 9 | 13 | 9 |
| ppi.o.FRMA | 19 | 19 | 20 | 16 | 17 | 18 | 19 | 18 | 19 |
| equity.est | 10 | 11 | 11 | 10 | 11 | 11 | 11 | 11 | 10 |
| hpi.st.log12m | 2 | 2 | 2 | 5 | 4 | 5 | 2 | 5 | 2 |
| hpi.r.st.us | 6 | 6 | 5 | 13 | 6 | 6 | 6 | 6 | 6 |
| hpi.r.zip.st | 11 | 14 | 14 | 18 | 22 | 23 | 13 | 22 | 16 |
| st.unemp.r12m | 21 | 21 | 21 | 15 | 16 | 15 | 21 | 17 | 22 |
| st.unemp.r3m | 23 | 23 | 24 | 16 | 23 | 25 | 23 | 23 | 24 |
| TB10Y.r12m | 9 | 9 | 9 | 21 | 18 | 19 | 10 | 20 | 11 |
| T10Y3MM | 7 | 7 | 8 | 9 | 10 | 8 | 7 | 8 | 7 |
| T10Y3MM.r12m | 16 | 12 | 12 | 18 | 13 | 11 | 14 | 15 | 14 |

*Table 43: Detailed results for Experiment C ($\sigma = 5$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 95.61 | 94.87 | 94.29 | 98.27 | 97.72 | 92.54 | 94.92 | 96.17 | 95.55 |
| `int.rate` | 89.94 | 89.30 | 89.34 | 96.45 | 95.25 | 91.21 | 89.52 | 94.30 | 91.91 |
| `orig.upb` | 91.17 | 90.26 | 89.06 | 98.34 | 97.71 | 91.58 | 90.16 | 95.88 | 93.02 |
| `fico.score` | 94.67 | 93.91 | 92.74 | 96.89 | 96.10 | 91.60 | 93.77 | 94.86 | 94.32 |
| `dti.r` | 94.80 | 93.94 | 93.15 | 98.32 | 97.70 | 92.33 | 93.96 | 96.12 | 95.04 |
| `ltv.r` | 91.84 | 91.26 | 90.16 | 98.01 | 97.39 | 91.71 | 91.09 | 95.70 | 93.40 |
| `bal.repaid` | 73.15 | 72.91 | 72.93 | 91.07 | 88.68 | 83.07 | 72.99 | 87.60 | 80.30 |
| `t.act.12m` | 93.20 | 91.32 | 88.35 | 96.44 | 95.36 | 87.61 | 90.96 | 93.14 | 92.05 |
| `t.del.30d.12m` | 94.26 | 93.23 | 91.74 | 97.89 | 97.42 | 93.23 | 93.08 | 96.18 | 94.63 |
| `t.del.60d.12m` | 87.64 | 83.40 | 78.30 | 93.30 | 92.05 | 84.68 | 83.11 | 90.01 | 86.56 |
| `hpi.st.d.t.o` | 58.21 | 58.00 | 58.03 | 63.92 | 65.66 | 68.43 | 58.08 | 66.00 | 62.04 |
| `hpi.zip.o` | 75.32 | 74.49 | 74.67 | 92.76 | 90.57 | 87.22 | 74.83 | 90.18 | 82.50 |
| `hpi.zip.d.t.o` | 69.89 | 69.81 | 69.75 | 78.65 | 80.51 | 83.12 | 69.82 | 80.76 | 75.29 |
| `ppi.c.FRMA` | 89.80 | 89.29 | 88.01 | 96.41 | 95.77 | 91.56 | 89.03 | 94.58 | 91.81 |
| `TB10Y.d.t.o` | 90.12 | 89.28 | 87.41 | 96.52 | 95.10 | 90.33 | 88.93 | 93.98 | 91.46 |
| `FRMA30Y.d.t.o` | 85.96 | 85.37 | 85.48 | 95.43 | 94.65 | 91.20 | 85.60 | 93.76 | 89.68 |
| `ppi.o.FRMA` | 91.44 | 90.68 | 89.75 | 97.64 | 97.03 | 92.40 | 90.62 | 95.69 | 93.16 |
| `equity.est` | 88.66 | 88.05 | 87.19 | 97.50 | 96.80 | 91.90 | 87.97 | 95.40 | 91.68 |
| `hpi.st.log12m` | 67.52 | 67.10 | 66.75 | 79.53 | 77.96 | 75.70 | 67.12 | 77.73 | 72.43 |
| `hpi.r.st.us` | 74.43 | 72.70 | 71.38 | 91.91 | 90.30 | 81.68 | 72.84 | 87.97 | 80.40 |
| `hpi.r.zip.st` | 88.87 | 88.37 | 87.88 | 97.63 | 97.05 | 92.36 | 88.37 | 95.68 | 92.03 |
| `st.unemp.r12m` | 93.83 | 93.04 | 92.24 | 97.61 | 96.80 | 92.05 | 93.04 | 95.49 | 94.26 |
| `st.unemp.r3m` | 94.27 | 93.49 | 92.65 | 98.03 | 97.22 | 92.04 | 93.47 | 95.77 | 94.62 |
| `TB10Y.r12m` | 86.05 | 84.74 | 83.59 | 95.77 | 94.66 | 93.03 | 84.79 | 94.49 | 89.64 |
| `T10Y3MM` | 85.57 | 85.64 | 85.92 | 94.47 | 93.93 | 90.68 | 85.71 | 93.03 | 89.37 |
| `T10Y3MM.r12m` | 88.40 | 86.89 | 86.44 | 96.27 | 95.35 | 91.39 | 87.24 | 94.34 | 90.79 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -5.68 | -5.57 | -4.95 | -1.82 | -2.47 | -1.33 | -5.40 | -1.87 | -3.64 |
| `orig.upb` | -4.45 | -4.61 | -5.22 | 0.07 | 0.00 | -0.96 | -4.76 | -0.30 | -2.53 |
| `fico.score` | -0.94 | -0.96 | -1.54 | -1.38 | -1.61 | -0.94 | -1.15 | -1.31 | -1.23 |
| `dti.r` | -0.82 | -0.93 | -1.14 | 0.05 | -0.01 | -0.21 | -0.96 | -0.06 | -0.51 |
| `ltv.r` | -3.77 | -3.61 | -4.12 | -0.26 | -0.33 | -0.83 | -3.83 | -0.47 | -2.15 |
| `bal.repaid` | -22.47 | -21.96 | -21.36 | -7.20 | -9.03 | -9.47 | -21.93 | -8.57 | -15.25 |
| `t.act.12m` | -2.42 | -3.54 | -5.94 | -1.83 | -2.35 | -4.93 | -3.96 | -3.04 | -3.50 |
| `t.del.30d.12m` | -1.35 | -1.63 | -2.55 | -0.38 | -0.30 | 0.69 | -1.84 | 0.00 | -0.92 |
| `t.del.60d.12m` | -7.98 | -11.46 | -15.99 | -4.97 | -5.66 | -7.86 | -11.81 | -6.17 | -8.99 |
| `hpi.st.d.t.o` | -37.41 | -36.86 | -36.25 | -34.35 | -32.06 | -24.11 | -36.84 | -30.17 | -33.51 |
| `hpi.zip.o` | -20.30 | -20.38 | -19.61 | -5.51 | -7.15 | -5.32 | -20.10 | -5.99 | -13.04 |
| `hpi.zip.d.t.o` | -25.73 | -25.05 | -24.54 | -19.62 | -17.21 | -9.42 | -25.11 | -15.41 | -20.26 |
| `ppi.c.FRMA` | -5.81 | -5.58 | -6.28 | -1.86 | -1.94 | -0.98 | -5.89 | -1.60 | -3.74 |
| `TB10Y.d.t.o` | -5.50 | -5.59 | -6.88 | -1.75 | -2.62 | -2.21 | -5.99 | -2.19 | -4.09 |
| `FRMA30Y.d.t.o` | -9.65 | -9.50 | -8.81 | -2.84 | -3.07 | -1.34 | -9.32 | -2.41 | -5.87 |
| `ppi.o.FRMA` | -4.17 | -4.19 | -4.53 | -0.63 | -0.68 | -0.14 | -4.30 | -0.49 | -2.39 |
| `equity.est` | -6.95 | -6.82 | -7.09 | -0.77 | -0.92 | -0.64 | -6.96 | -0.78 | -3.87 |
| `hpi.st.log12m` | -28.09 | -27.77 | -27.53 | -18.74 | -19.75 | -16.84 | -27.80 | -18.44 | -23.12 |
| `hpi.r.st.us` | -21.19 | -22.16 | -22.90 | -6.36 | -7.41 | -10.85 | -22.08 | -8.21 | -15.15 |
| `hpi.r.zip.st` | -6.74 | -6.50 | -6.41 | -0.64 | -0.67 | -0.18 | -6.55 | -0.49 | -3.52 |
| `st.unemp.r12m` | -1.79 | -1.83 | -2.05 | -0.66 | -0.92 | -0.49 | -1.89 | -0.69 | -1.29 |
| `st.unemp.r3m` | -1.35 | -1.38 | -1.64 | -0.24 | -0.50 | -0.50 | -1.46 | -0.41 | -0.93 |
| `TB10Y.r12m` | -9.56 | -10.13 | -10.70 | -2.50 | -3.06 | 0.50 | -10.13 | -1.69 | -5.91 |
| `T10Y3MM` | -10.04 | -9.23 | -8.37 | -3.80 | -3.78 | -1.86 | -9.21 | -3.15 | -6.18 |
| `T10Y3MM.r12m` | -7.21 | -7.97 | -7.85 | -2.00 | -2.37 | -1.15 | -7.68 | -1.84 | -4.76 |
| *No Noise* | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| int.rate | 15 | 16 | 18 | 14 | 12 | 12 | 16 | 12 | 15 |
| orig.upb | 17 | 17 | 17 | 25 | 25 | 15 | 17 | 23 | 18 |
| fico.score | 24 | 24 | 24 | 16 | 16 | 16 | 24 | 16 | 22 |
| dti.r | 25 | 25 | 25 | 24 | 24 | 21 | 25 | 24 | 25 |
| ltv.r | 19 | 19 | 20 | 22 | 22 | 17 | 20 | 21 | 20 |
| bal.repaid | 4 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 4 |
| t.act.12m | 20 | 20 | 16 | 13 | 14 | 8 | 19 | 9 | 17 |
| t.del.30d.12m | 22 | 22 | 21 | 21 | 23 | 25 | 22 | 25 | 24 |
| t.del.60d.12m | 10 | 7 | 7 | 7 | 7 | 6 | 7 | 6 | 7 |
| hpi.st.d.t.o | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| hpi.zip.o | 6 | 6 | 6 | 6 | 6 | 7 | 6 | 7 | 6 |
| hpi.zip.d.t.o | 3 | 3 | 3 | 2 | 3 | 5 | 3 | 3 | 3 |
| ppi.c.FRMA | 14 | 15 | 15 | 12 | 15 | 14 | 15 | 15 | 14 |
| TB10Y.d.t.o | 16 | 14 | 13 | 15 | 11 | 9 | 14 | 11 | 12 |
| FRMA30Y.d.t.o | 8 | 9 | 9 | 9 | 9 | 11 | 9 | 10 | 10 |
| ppi.o.FRMA | 18 | 18 | 19 | 20 | 19 | 23 | 18 | 20 | 19 |
| equity.est | 12 | 12 | 12 | 17 | 17 | 18 | 12 | 17 | 13 |
| hpi.st.log12m | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 |
| hpi.r.st.us | 5 | 4 | 4 | 5 | 5 | 3 | 4 | 5 | 5 |
| hpi.r.zip.st | 13 | 13 | 14 | 19 | 20 | 22 | 13 | 19 | 16 |
| st.unemp.r12m | 21 | 21 | 22 | 18 | 17 | 20 | 21 | 18 | 21 |
| st.unemp.r3m | 23 | 23 | 23 | 23 | 21 | 19 | 23 | 22 | 23 |
| TB10Y.r12m | 9 | 8 | 8 | 10 | 10 | 24 | 8 | 14 | 9 |
| T10Y3MM | 7 | 10 | 10 | 8 | 8 | 10 | 10 | 8 | 8 |
| T10Y3MM.r12m | 11 | 11 | 11 | 11 | 13 | 13 | 11 | 13 | 11 |

*Table 44: Detailed results for Experiment C ($\sigma = 10$)*

| Variable | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| *No Noise* | 95.61 | 94.87 | 94.29 | 98.27 | 97.72 | 92.54 | 94.92 | 96.17 | 95.55 |
| `int.rate` | 85.08 | 84.57 | 84.99 | 94.33 | 93.83 | 88.92 | 84.88 | 92.36 | 88.62 |
| `orig.upb` | 85.62 | 84.24 | 81.97 | 97.40 | 97.14 | 90.25 | 83.94 | 94.93 | 89.44 |
| `fico.score` | 93.26 | 91.76 | 88.22 | 96.44 | 95.65 | 91.82 | 91.08 | 94.64 | 92.86 |
| `dti.r` | 93.43 | 92.32 | 90.50 | 97.85 | 96.79 | 91.49 | 92.08 | 95.38 | 93.73 |
| `ltv.r` | 87.61 | 86.55 | 83.82 | 98.32 | 97.87 | 92.93 | 85.99 | 96.38 | 91.19 |
| `bal.repaid` | 68.24 | 68.09 | 68.18 | 71.93 | 72.11 | 65.98 | 68.17 | 70.01 | 69.09 |
| `t.act.12m` | 88.44 | 83.63 | 79.38 | 93.06 | 92.12 | 84.68 | 83.82 | 89.96 | 86.89 |
| `t.del.30d.12m` | 91.79 | 89.60 | 85.44 | 95.70 | 94.64 | 89.43 | 88.94 | 93.26 | 91.10 |
| `t.del.60d.12m` | 77.07 | 70.91 | 67.21 | 84.59 | 82.84 | 71.30 | 71.73 | 79.57 | 75.65 |
| `hpi.st.d.t.o` | 54.94 | 54.63 | 54.62 | 55.19 | 51.96 | 47.70 | 54.73 | 51.62 | 53.17 |
| `hpi.zip.o` | 65.80 | 65.18 | 65.58 | 78.98 | 78.33 | 78.89 | 65.52 | 78.73 | 72.13 |
| `hpi.zip.d.t.o` | 61.12 | 61.45 | 61.38 | 58.69 | 59.67 | 64.36 | 61.32 | 60.91 | 61.11 |
| `ppi.c.FRMA` | 83.62 | 82.87 | 79.86 | 94.49 | 92.42 | 88.44 | 82.12 | 91.78 | 86.95 |
| `TB10Y.d.t.o` | 85.22 | 82.45 | 77.89 | 92.79 | 91.39 | 88.77 | 81.85 | 90.98 | 86.42 |
| `FRMA30Y.d.t.o` | 78.23 | 77.78 | 77.92 | 90.78 | 91.93 | 89.48 | 77.98 | 90.73 | 84.35 |
| `ppi.o.FRMA` | 86.49 | 85.28 | 82.71 | 95.93 | 95.49 | 90.74 | 84.82 | 94.05 | 89.44 |
| `equity.est` | 81.84 | 80.85 | 78.98 | 96.24 | 94.98 | 88.01 | 80.56 | 93.08 | 86.82 |
| `hpi.st.log12m` | 60.78 | 60.62 | 60.46 | 72.72 | 70.47 | 68.43 | 60.62 | 70.54 | 65.58 |
| `hpi.r.st.us` | 64.97 | 63.77 | 63.15 | 82.49 | 81.46 | 76.84 | 63.96 | 80.26 | 72.11 |
| `hpi.r.zip.st` | 83.08 | 82.55 | 81.71 | 95.47 | 94.20 | 89.86 | 82.45 | 93.18 | 87.81 |
| `st.unemp.r12m` | 91.67 | 90.57 | 88.08 | 94.58 | 92.63 | 90.09 | 90.11 | 92.44 | 91.27 |
| `st.unemp.r3m` | 93.38 | 92.27 | 90.34 | 96.14 | 95.16 | 90.72 | 92.00 | 94.01 | 93.00 |
| `TB10Y.r12m` | 76.18 | 74.79 | 73.73 | 95.08 | 94.12 | 93.59 | 74.90 | 94.27 | 84.58 |
| `T10Y3MM` | 77.43 | 78.58 | 79.61 | 86.48 | 86.25 | 86.82 | 78.54 | 86.52 | 82.53 |
| `T10Y3MM.r12m` | 81.15 | 79.63 | 79.44 | 94.28 | 92.52 | 90.86 | 80.07 | 92.55 | 86.31 |
| *No Noise* | | | | | | | | | |
| `int.rate` | -10.53 | -10.29 | -9.29 | -3.94 | -3.89 | -3.62 | -10.04 | -3.82 | -6.93 |
| `orig.upb` | -10.00 | -10.63 | -12.32 | -0.87 | -0.57 | -2.29 | -10.98 | -1.24 | -6.11 |
| `fico.score` | -2.35 | -3.10 | -6.07 | -1.83 | -2.07 | -0.71 | -3.84 | -1.54 | -2.69 |
| `dti.r` | -2.18 | -2.55 | -3.79 | -0.42 | -0.93 | -1.05 | -2.84 | -0.80 | -1.82 |
| `ltv.r` | -8.00 | -8.31 | -10.47 | 0.05 | 0.16 | 0.40 | -8.93 | 0.20 | -4.36 |
| `bal.repaid` | -27.37 | -26.77 | -26.10 | -26.34 | -25.61 | -26.56 | -26.75 | -26.17 | -26.46 |
| `t.act.12m` | -7.17 | -11.24 | -14.90 | -5.21 | -5.59 | -7.85 | -11.11 | -6.22 | -8.66 |
| `t.del.30d.12m` | -3.82 | -5.27 | -8.85 | -2.57 | -3.08 | -3.11 | -5.98 | -2.92 | -4.45 |
| `t.del.60d.12m` | -18.55 | -23.95 | -27.08 | -13.68 | -14.88 | -21.24 | -23.19 | -16.60 | -19.90 |
| `hpi.st.d.t.o` | -40.67 | -40.23 | -39.66 | -43.08 | -45.75 | -44.84 | -40.19 | -44.56 | -42.37 |
| `hpi.zip.o` | -29.81 | -29.68 | -28.71 | -19.29 | -19.38 | -13.65 | -29.40 | -17.44 | -23.42 |
| `hpi.zip.d.t.o` | -34.50 | -33.42 | -32.91 | -39.58 | -38.04 | -28.18 | -33.61 | -35.27 | -34.44 |
| `ppi.c.FRMA` | -11.99 | -12.00 | -14.42 | -3.78 | -5.30 | -4.10 | -12.80 | -4.39 | -8.60 |
| `TB10Y.d.t.o` | -10.39 | -12.42 | -16.39 | -5.48 | -6.33 | -3.77 | -13.07 | -5.19 | -9.13 |
| `FRMA30Y.d.t.o` | -17.38 | -17.09 | -16.37 | -7.49 | -5.79 | -3.06 | -16.95 | -5.45 | -11.20 |
| `ppi.o.FRMA` | -9.13 | -9.59 | -11.58 | -2.34 | -2.23 | -1.80 | -10.10 | -2.12 | -6.11 |
| `equity.est` | -13.77 | -14.02 | -15.31 | -2.03 | -2.74 | -4.53 | -14.37 | -3.10 | -8.73 |
| `hpi.st.log12m` | -34.83 | -34.24 | -33.83 | -25.55 | -27.25 | -24.10 | -34.30 | -25.63 | -29.97 |
| `hpi.r.st.us` | -30.64 | -31.09 | -31.14 | -15.78 | -16.26 | -15.70 | -30.96 | -15.91 | -23.44 |
| `hpi.r.zip.st` | -12.53 | -12.32 | -12.58 | -2.80 | -3.52 | -2.68 | -12.47 | -3.00 | -7.74 |
| `st.unemp.r12m` | -3.94 | -4.30 | -6.21 | -3.69 | -5.09 | -2.45 | -4.82 | -3.74 | -4.28 |
| `st.unemp.r3m` | -2.23 | -2.59 | -3.95 | -2.13 | -2.55 | -1.82 | -2.93 | -2.17 | -2.55 |
| `TB10Y.r12m` | -19.43 | -20.08 | -20.55 | -3.19 | -3.59 | 1.05 | -20.02 | -1.91 | -10.96 |
| `T10Y3MM` | -18.19 | -16.28 | -14.68 | -11.79 | -11.46 | -5.72 | -16.38 | -9.66 | -13.02 |
| `T10Y3MM.r12m` | -14.46 | -15.24 | -14.85 | -3.99 | -5.20 | -1.67 | -14.85 | -3.62 | -9.24 |
| *No Noise* | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| int.rate | 15 | 18 | 20 | 13 | 15 | 13 | 19 | 13 | 17 |
| orig.upb | 17 | 17 | 17 | 23 | 24 | 18 | 17 | 23 | 18 |
| fico.score | 23 | 23 | 23 | 22 | 22 | 23 | 23 | 22 | 23 |
| dti.r | 25 | 25 | 25 | 24 | 23 | 22 | 25 | 24 | 25 |
| ltv.r | 19 | 20 | 19 | 25 | 25 | 24 | 20 | 25 | 21 |
| bal.repaid | 6 | 6 | 7 | 3 | 4 | 3 | 6 | 3 | 4 |
| t.act.12m | 20 | 16 | 12 | 11 | 11 | 8 | 16 | 9 | 14 |
| t.del.30d.12m | 22 | 21 | 21 | 18 | 18 | 14 | 21 | 18 | 20 |
| t.del.60d.12m | 8 | 7 | 6 | 7 | 7 | 5 | 7 | 6 | 7 |
| hpi.st.d.t.o | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| hpi.zip.o | 5 | 5 | 5 | 5 | 5 | 7 | 5 | 5 | 6 |
| hpi.zip.d.t.o | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| ppi.c.FRMA | 14 | 15 | 15 | 14 | 12 | 11 | 14 | 12 | 15 |
| TB10Y.d.t.o | 16 | 13 | 9 | 10 | 9 | 12 | 13 | 11 | 12 |
| FRMA30Y.d.t.o | 10 | 9 | 10 | 9 | 10 | 15 | 9 | 10 | 9 |
| ppi.o.FRMA | 18 | 19 | 18 | 19 | 21 | 20 | 18 | 20 | 19 |
| equity.est | 12 | 12 | 11 | 21 | 19 | 10 | 12 | 16 | 13 |
| hpi.st.log12m | 2 | 2 | 2 | 4 | 3 | 4 | 2 | 4 | 3 |
| hpi.r.st.us | 4 | 4 | 4 | 6 | 6 | 6 | 4 | 7 | 5 |
| hpi.r.zip.st | 13 | 14 | 16 | 17 | 17 | 16 | 15 | 17 | 16 |
| st.unemp.r12m | 21 | 22 | 22 | 15 | 14 | 17 | 22 | 14 | 22 |
| st.unemp.r3m | 24 | 24 | 24 | 20 | 20 | 19 | 24 | 19 | 24 |
| TB10Y.r12m | 7 | 8 | 8 | 16 | 16 | 25 | 8 | 21 | 10 |
| T10Y3MM | 9 | 10 | 14 | 8 | 8 | 9 | 10 | 8 | 8 |
| T10Y3MM.r12m | 11 | 11 | 13 | 12 | 13 | 21 | 11 | 15 | 11 |

The previous analysis examines the robustness of the proposed approach to calculate feature importance by comparing different configurations (e.g., noise intensities). In addition to such an internal perspective, we also compare the extracted feature importance rankings between DeepHit and RSF, focussing on the experiments A to C because the corresponding dataset incorporates more features than the more recent data for Experiment D to F. Detailed results of the DeepHit versus RSF comparison for prepayment and default prediction are available in Table 45 and Table 46, respectively.

When comparing cause-specific variable importance estimates of DHT and RSF in Table 45 and Table 46, we observe positive correlations across experiments and event types. For loan-level variables (Experiment A), the correlations are especially high and show that two survival models agree on which variables are most important. For example, the group of the top four most important variables is the same. In Experiment B, we observe a similar trend for the macro-economic variables. The only notable exception from this trend is Experiment C, where the importance of variables for default prediction differs more substantially between DHT and RF. Overall, DHT favours macro-economic variables related to the house price index whereas the RF ranking includes more loan-related variables in the top ranks. The corresponding ranking for the prepayment event does not display this pattern. Interestingly, the DHT ranking is more consistent across events in Experiment C compared to RF, suggesting that RF has identified specific patterns in the feature-target relationship when predicting default. Considering Table 3 shows both models predict default accurately whereby RF has an edge over DHT in the particular setting ($\emptyset C_2$ RF: 99.34 c.f. DHT: 96.73). In this regard, a difference in the ranking, which we observe in Table 6, is desirable as it reveals the different valuation of variables across RF and DHT, which causes differences in predictive performance.

*Table 45: Comparisons of feature importance between DeepHit and RSF – Prepayment*

***Experiment A – Prepayment***

| Variable | DHT | RSF |
|---|---|---|
| **int.rate** | 4 | 2 |
| **orig.upb** | 6 | 5 |
| **fico.score** | 7 | 8 |
| **dti.r** | 9 | 9 |
| **ltv.r** | 8 | 7 |
| **bal.repaid** | 1 | 1 |
| **t.act.12m** | 3 | 4 |
| **t.del.30d.12m** | 5 | 6 |
| **t.del.60d.12m** | 2 | 3 |
| Spearman's $\rho$ | **0.92** | |

***Experiment B – Prepayment***

| Variable | DHT | RSF |
|---|---|---|
| **hpi.st.d.t.o** | 1 | 1 |
| **hpi.zip.o** | 4 | 4 |
| **hpi.zip.d.t.o** | 3 | 2 |
| **ppi.c.FRMA** | 10 | 9 |
| **TB10Y.d.t.o** | 12 | 7 |
| **FRMA30Y.d.t.o** | 8 | 3 |
| **ppi.o.FRMA** | 13 | 14 |
| **equity.est** | 14 | 16 |
| **hpi.st.log12m** | 2 | 8 |
| **hpi.r.st.us** | 5 | 6 |
| **hpi.r.zip.st** | 7 | 15 |
| **st.unemp.r12m** | 16 | 12 |
| **st.unemp.r3m** | 15 | 13 |
| **TB10Y.r12m** | 6 | 5 |
| **T10Y3MM** | 9 | 10 |
| **T10Y3MM.r12m** | 11 | 11 |
| Spearman's $\rho$ | **0.74** | |

***Experiment C – Prepayment***

| Variable | DHT | RSF |
|---|---|---|
| **int.rate** | 19 | 10 |
| **orig.upb** | 17 | 20 |
| **fico.score** | 23 | 24 |
| **dti.r** | 25 | 25 |
| **ltv.r** | 20 | 23 |
| **bal.repaid** | 6 | 1 |
| **t.act.12m** | 13 | 15 |
| **t.del.30d.12m** | 21 | 18 |
| **t.del.60d.12m** | 8 | 13 |
| **hpi.st.d.t.o** | 1 | 2 |
| **hpi.zip.o** | 4 | 5 |
| **hpi.zip.d.t.o** | 3 | 3 |
| **ppi.c.FRMA** | 9 | 9 |
| **TB10Y.d.t.o** | 14 | 7 |
| **FRMA30Y.d.t.o** | 12 | 4 |
| **ppi.o.FRMA** | 18 | 19 |
| **equity.est** | 15 | 21 |
| **hpi.st.log12m** | 2 | 14 |
| **hpi.r.st.us** | 5 | 8 |
| **hpi.r.zip.st** | 11 | 22 |
| **st.unemp.r12m** | 22 | 16 |
| **st.unemp.r3m** | 24 | 17 |
| **TB10Y.r12m** | 7 | 6 |
| **T10Y3MM** | 10 | 11 |
| **T10Y3MM.r12m** | 16 | 12 |
| Spearman's $\rho$ | **0.73** | |

*Table 46: Comparisons of feature importance between DeepHit and RSF – Default*

***Experiment A – Default***

| Variable | DHT | RSF |
|---|---|---|
| int.rate | 4 | 6 |
| orig.upb | 6 | 8 |
| fico.score | 7 | 5 |
| dti.r | 9 | 9 |
| ltv.r | 8 | 7 |
| bal.repaid | 1 | 2 |
| t.act.12m | 3 | 3 |
| t.del.30d.12m | 5 | 4 |
| t.del.60d.12m | 2 | 1 |
| Spearman's $\rho$ | **0.87** | |

***Experiment B – Default***

| Variable | DHT | RSF |
|---|---|---|
| hpi.st.d.t.o | 2 | 1 |
| hpi.zip.o | 6 | 5 |
| hpi.zip.d.t.o | 3 | 2 |
| ppi.c.FRMA | 8 | 10 |
| TB10Y.d.t.o | 10 | 13 |
| FRMA30Y.d.t.o | 9 | 7 |
| ppi.o.FRMA | 12 | 11 |
| equity.est | 16 | 14 |
| hpi.st.log12m | 1 | 4 |
| hpi.r.st.us | 4 | 3 |
| hpi.r.zip.st | 7 | 8 |
| st.unemp.r12m | 15 | 16 |
| st.unemp.r3m | 14 | 15 |
| TB10Y.r12m | 11 | 9 |
| T10Y3MM | 5 | 6 |
| T10Y3MM.r12m | 13 | 12 |
| Spearman's $\rho$ | **0.93** | |

***Experiment C – Default***

| Variable | DHT | RSF |
|---|---|---|
| int.rate | 15 | 15 |
| orig.upb | 25 | 25 |
| fico.score | 20 | 18 |
| dti.r | 22 | 22 |
| ltv.r | 19 | 24 |
| bal.repaid | 6 | 4 |
| t.act.12m | 18 | 1 |
| t.del.30d.12m | 21 | 3 |
| t.del.60d.12m | 9 | 2 |
| hpi.st.d.t.o | 1 | 6 |
| hpi.zip.o | 3 | 8 |
| hpi.zip.d.t.o | 4 | 5 |
| ppi.c.FRMA | 10 | 16 |
| TB10Y.d.t.o | 13 | 11 |
| FRMA30Y.d.t.o | 12 | 7 |
| ppi.o.FRMA | 16 | 12 |
| equity.est | 17 | 17 |
| hpi.st.log12m | 2 | 20 |
| hpi.r.st.us | 5 | 13 |
| hpi.r.zip.st | 11 | 23 |
| st.unemp.r12m | 24 | 10 |
| st.unemp.r3m | 23 | 19 |
| TB10Y.r12m | 7 | 9 |
| T10Y3MM | 14 | 14 |
| T10Y3MM.r12m | 8 | 21 |
| Spearman's $\rho$ | **0.33** | |

## Appendix F: Class imbalance

Table 1 reveals that the distribution of events exhibits imbalance. Default events, in particular, occur infrequently and are especially scarce later periods of the data when relevant legislation was changed in the aftermath of the 2008/2009 financial crisis. Class imbalance is a known impediment to predictive modeling and may have hindered the survival techniques that we consider in the paper to unfold their full potential. To verify the robustness of our findings concerning class imbalance, this part of the online companion reports the results of additional experiments using the SMOTE algorithm (Chawla, et al., 2002), which oversamples the minority class by creating synthetic examples. To that end, we have rerun experiments 4.1, 4.2, and 4.3. Recall that these experiments employ post-crisis data, which, according to Table 1, exhibits the smallest number of events and thus the highest imbalance between events and censored observations. This suggests that remedying class imbalance by SMOTE should be most valuable.

The SMOTE algorithm allows the user to control the amount of rebalancing. We chose to use a ratio of 1:10 for the test. For example, when predicting default, we create a data set with 1000 default events (100 factual and 900 synthetic cases) and 9000 non-default events. This way, we keep the size of the data set the same as in experiments 4.1 to 4.3. Furthermore, we select the 9000 non-default cases among those 9,900 non-default cases that were used for Experiment 4.1 to 4.3 (see Figure 1) to maximize the comparability of results before and after applying SMOTE.

Detailed results, comparable to those of Appendix D above, on how individual survival models perform with SMOTE are available in Tables 48, 49, and 50 below. Table 47 summarizes these results and depicts the event-specific and overall Concordance indices across survival models before and after applying SMOTE, as well as the difference in model performance. Positive values in the last three columns indicate that a model performed better without SMOTE, whereas negative values indicate that SMOTE has increased performance.

Out of the 4 (models) x 3 (performance indices) x 3 (experiments) = 36 comparisons, we observe a beneficial effect of SMOTE in 21 cases. In 15 cases, the survival models performed better without SMOTE. Considering the magnitude of observed performance differences, we suggest that the effect of balancing classes via SMOTE is relatively small. In most cases, the values of the concordance index differ no more than 2 points. The only exception is Experiment 4.2 in which we observe a substantial positive effect of SMOTE for RSF. Overall, however, Table 45 does not make a strong case for SMOTE. First and foremost, we observe no evidence against the superiority of the ML-based survival models and DHT in particular. The degree to which models benefit or suffer from SMOTE is relatively stable across models. This facilitates concluding that the results reported in the main paper are robust toward class imbalance. Second, the strong imbalance in Experiments 4.1, 4.2, and 4.3 together with typically small and mixed effects of SMOTE support the conclusion that it is not essential to use SMOTE for the data employed here. With this result, we refrain from testing SMOTE in other and leave a comprehensive analysis of class imbalance and resampling methods in survival modelling settings to future research.

*Table 47: Summary of the predictive performance comparison when using SMOTE*

| | ***Original*** | | | ***With SMOTE*** | | | ***Difference Original - SMOTE*** | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Experiment 4.1*** | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset \boldsymbol{C}$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset \boldsymbol{C}$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset \boldsymbol{C}$ |
| CSC | 76.88 | 97.54 | 87.21 | 75.26 | 96.72 | 85.99 | 1.62 | 0.82 | 1.22 |
| FGR | 76.76 | 98.39 | 87.57 | 74.52 | 96.10 | 85.31 | 2.24 | 2.29 | 2.26 |
| RSF | 82.50 | *99.20* | 90.85 | 83.15 | *98.54* | 90.84 | -0.65 | 0.66 | 0.01 |
| DHT | *85.84* | 98.54 | **92.19** | *87.79* | 93.98 | **90.88** | -1.95 | 4.56 | 1.31 |
| ***Experiment 4.2*** | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset \boldsymbol{C}$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset \boldsymbol{C}$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset \boldsymbol{C}$ |
| CSC | 79.37 | 72.22 | 75.79 | 79.19 | 76.86 | 78.02 | 0.18 | -4.64 | -2.23 |
| FGR | 79.67 | 68.38 | 74.02 | 79.60 | 72.00 | 75.8 | 0.07 | -3.62 | -1.78 |
| RSF | 82.64 | 72.26 | 77.45 | 84.35 | *92.97* | **88.66** | -1.71 | -20.71 | -11.21 |
| DHT | *86.17* | *77.71* | **81.94** | *85.90* | 86.58 | 86.24 | 0.27 | -8.87 | -4.3 |
| ***Experiment 4.3*** | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset \boldsymbol{C}$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset \boldsymbol{C}$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset \boldsymbol{C}$ |
| CSC | 81.09 | 98.60 | 89.85 | 81.44 | 96.48 | 88.96 | -0.35 | 2.12 | 0.89 |
| FGR | 82.09 | 98.39 | 90.24 | 81.82 | 96.22 | 89.02 | 0.27 | 2.17 | 1.22 |
| RSF | 84.96 | *99.34* | 92.15 | 85.97 | *98.42* | 92.20 | -1.01 | 0.92 | -0.05 |
| DHT | *92.13* | 97.67 | **94.90** | *92.81* | 96.10 | **94.46** | -0.68 | 1.57 | 0.44 |

*Table 48: Detailed results after re-running Experiment 4.1 using SMOTE*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 76.59 | 75.96 | 71.19 | 96.62 | 96.87 | 97.38 | 74.58 | 96.95 | 85.77 |
| 2 | 78.25 | 76.45 | 72.44 | 96.55 | 97.36 | 97.55 | 75.71 | 97.15 | 86.43 |
| 3 | 81.04 | 79.78 | 69.57 | 95.43 | 97.6 | 98.3 | 76.8 | 97.11 | 86.95 |
| 4 | 80.67 | 78.92 | 68.58 | 95.56 | 96.32 | 96.57 | 76.06 | 96.15 | 86.1 |
| 5 | 76.33 | 75.93 | 67 | 95.69 | 96.54 | 97.86 | 73.09 | 96.7 | 84.89 |
| 6 | 75.15 | 75.1 | 69.61 | 92.96 | 97.46 | 98.36 | 73.29 | 96.26 | 84.77 |
| 7 | 79.69 | 77.4 | 61.14 | 95.69 | 97.27 | 98.1 | 72.74 | 97.02 | 84.88 |
| 8 | 79.29 | 78.31 | 74.57 | 96 | 97.18 | 97.98 | 77.39 | 97.05 | 87.22 |
| 9 | 79.34 | 76.73 | 72.29 | 96.08 | 96.57 | 96.84 | 76.12 | 96.5 | 86.31 |
| 10 | 79.98 | 77.89 | 72.68 | 94.74 | 97.19 | 97 | 76.85 | 96.31 | 86.58 |
| Mean | 78.63 | 77.25 | 69.91 | 95.53 | 97.04 | 97.59 | 75.26 | 96.72 | 85.99 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 74.99 | 75.2 | 71.33 | 95.59 | 95.92 | 96.42 | 73.84 | 95.98 | 84.91 |
| 2 | 75.25 | 74.79 | 72.32 | 97.36 | 97.21 | 97.02 | 74.12 | 97.2 | 85.66 |
| 3 | 79.04 | 78.77 | 70.02 | 95.05 | 97.44 | 98.46 | 75.94 | 96.98 | 86.46 |
| 4 | 78.53 | 77.63 | 68.67 | 94.39 | 96.24 | 96.74 | 74.94 | 95.79 | 85.37 |
| 5 | 74.96 | 75.38 | 67.35 | 94.86 | 95.12 | 97.01 | 72.56 | 95.67 | 84.12 |
| 6 | 72.14 | 73.64 | 70.22 | 92.94 | 96.93 | 98.33 | 72 | 96.06 | 84.03 |
| 7 | 78.07 | 76.96 | 62 | 94.58 | 96.24 | 97.83 | 72.34 | 96.22 | 84.28 |
| 8 | 77.83 | 77.69 | 75.42 | 93.73 | 95.53 | 96.98 | 76.98 | 95.42 | 86.2 |
| 9 | 77.79 | 77.24 | 75.42 | 94.1 | 95.92 | 97.34 | 76.82 | 95.79 | 86.3 |
| 10 | 77.27 | 76.52 | 73.07 | 93.73 | 96.96 | 96.99 | 75.62 | 95.9 | 85.76 |
| Mean | 76.59 | 76.38 | 70.58 | 94.63 | 96.35 | 97.31 | 74.52 | 96.1 | 85.31 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 89.35 | 84.24 | 78.24 | 99.46 | 98.55 | 97.7 | 83.94 | 98.57 | 91.26 |
| 2 | 89.69 | 82.35 | 77.46 | 99.89 | 98.28 | 98.29 | 83.16 | 98.82 | 90.99 |
| 3 | 89.91 | 84.72 | 80.28 | 99.34 | 98.55 | 98.35 | 84.97 | 98.75 | 91.86 |
| 4 | 89.69 | 84.9 | 73.15 | 99.14 | 97.67 | 97.25 | 82.58 | 98.02 | 90.3 |
| 5 | 88.95 | 84.18 | 76.82 | 99.59 | 98.54 | 97.98 | 83.32 | 98.7 | 91.01 |
| 6 | 89.25 | 84.55 | 80.06 | 98.73 | 98.18 | 98.54 | 84.62 | 98.49 | 91.55 |
| 7 | 89.45 | 83.07 | 63.96 | 99.37 | 98.65 | 98.34 | 78.83 | 98.79 | 88.81 |
| 8 | 89.72 | 84.74 | 71.05 | 99.83 | 98.42 | 97.66 | 81.84 | 98.64 | 90.24 |
| 9 | 89.67 | 85 | 79.1 | 99.05 | 97.77 | 98.17 | 84.59 | 98.33 | 91.46 |
| 10 | 89.44 | 84.57 | 76.81 | 99.22 | 98.22 | 97.52 | 83.61 | 98.32 | 90.96 |
| Mean | 89.51 | 84.23 | 75.69 | 99.36 | 98.28 | 97.98 | 83.15 | 98.54 | 90.84 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 89.37 | 87.5 | 86.18 | 95.7 | 93.52 | 92.1 | 87.68 | 93.77 | 90.73 |
| 2 | 90.22 | 87.43 | 86.02 | 96.24 | 94.51 | 95.06 | 87.89 | 95.27 | 91.58 |
| 3 | 90.57 | 88.36 | 86.82 | 94.73 | 95.51 | 95.29 | 88.58 | 95.18 | 91.88 |
| 4 | 89.49 | 86.77 | 85.25 | 93.5 | 92.13 | 92.35 | 87.17 | 92.66 | 89.91 |
| 5 | 89.22 | 86.76 | 84.88 | 97.76 | 92.34 | 91.75 | 86.95 | 93.95 | 90.45 |
| 6 | 89.28 | 87.58 | 85.62 | 93.42 | 94.36 | 94.15 | 87.49 | 93.97 | 90.73 |
| 7 | 90.5 | 87.1 | 85.32 | 97.79 | 95.07 | 93.28 | 87.64 | 95.38 | 91.51 |
| 8 | 90.21 | 88.17 | 86.39 | 94.38 | 93.75 | 93.15 | 88.26 | 93.76 | 91.01 |
| 9 | 90.89 | 88.31 | 87.21 | 92.74 | 93.41 | 92.01 | 88.81 | 92.72 | 90.76 |
| 10 | 90.04 | 86.88 | 85.25 | 91.31 | 93.98 | 94.12 | 87.39 | 93.14 | 90.26 |
| Mean | 89.98 | 87.49 | 85.89 | 94.76 | 93.86 | 93.33 | 87.79 | 93.98 | 90.88 |

*Table 49: Detailed results after re-running Experiment 4.2 using SMOTE*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 83.34 | 80.25 | 74.73 | 72.38 | 77.76 | 78.9 | 79.44 | 76.35 | 77.89 |
| 2 | 83.56 | 80.13 | 74.61 | 49 | 80.12 | 70.94 | 79.43 | 66.69 | 73.06 |
| 3 | 84.21 | 79.93 | 75.15 | 86.95 | 71.43 | 73.53 | 79.76 | 77.3 | 78.53 |
| 4 | 84.13 | 80.36 | 71.8 | 84.63 | 80.91 | 80.89 | 78.76 | 82.14 | 80.45 |
| 5 | 84.36 | 81.51 | 75.76 | 72.54 | 81.91 | 60.6 | 80.54 | 71.68 | 76.11 |
| 6 | 83.99 | 80.92 | 68.69 | 72.16 | 79.07 | 72.53 | 77.86 | 74.59 | 76.22 |
| 7 | 84.54 | 81.29 | 65.58 | 84.66 | 79.72 | 89.09 | 77.14 | 84.49 | 80.81 |
| 8 | 84.25 | 80.96 | 73 | 67.19 | 82.05 | 80.26 | 79.4 | 76.5 | 77.95 |
| 9 | 82.85 | 79.4 | 75.54 | 80.44 | 73.86 | 80.11 | 79.26 | 78.14 | 78.7 |
| 10 | 84.61 | 80.86 | 75.31 | 70.83 | 86.19 | 85.12 | 80.26 | 80.71 | 80.49 |
| Mean | 83.98 | 80.56 | 73.02 | 74.08 | 79.3 | 77.2 | 79.19 | 76.86 | 78.02 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 83.41 | 80.59 | 75.98 | 70.45 | 74.16 | 75.97 | 80 | 73.53 | 76.76 |
| 2 | 83.53 | 80.43 | 75.41 | 40.19 | 73.96 | 71.87 | 79.79 | 62.01 | 70.9 |
| 3 | 84.04 | 80.34 | 75.93 | 73.42 | 65.76 | 71.74 | 80.1 | 70.31 | 75.21 |
| 4 | 83.4 | 80.76 | 73.07 | 79.65 | 75.74 | 76.95 | 79.08 | 77.45 | 78.26 |
| 5 | 84.5 | 81.75 | 76.64 | 71.98 | 76.97 | 62.86 | 80.96 | 70.6 | 75.78 |
| 6 | 83.83 | 81.27 | 69.63 | 60.6 | 75.15 | 74.77 | 78.25 | 70.18 | 74.21 |
| 7 | 84.42 | 81.73 | 66.55 | 77.5 | 73.03 | 86.22 | 77.57 | 78.92 | 78.24 |
| 8 | 84.47 | 81.41 | 73.7 | 60.73 | 73.36 | 73.53 | 79.86 | 69.21 | 74.53 |
| 9 | 82.62 | 79.4 | 76.65 | 72.78 | 66.07 | 74.95 | 79.55 | 71.27 | 75.41 |
| 10 | 84.55 | 81.31 | 76.56 | 71.89 | 78.86 | 78.85 | 80.81 | 76.53 | 78.67 |
| Mean | 83.88 | 80.9 | 74.01 | 67.92 | 73.31 | 74.77 | 79.6 | 72 | 75.8 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 89.84 | 85.46 | 79.31 | 97.36 | 89.91 | 91.21 | 84.87 | 92.82 | 88.85 |
| 2 | 89.99 | 84.64 | 79.19 | 98.32 | 91.74 | 91.03 | 84.61 | 93.7 | 89.15 |
| 3 | 90.38 | 84.83 | 77.2 | 96.99 | 93.88 | 94.73 | 84.14 | 95.2 | 89.67 |
| 4 | 90.42 | 84.95 | 72.15 | 94.73 | 91.8 | 91.96 | 82.51 | 92.83 | 87.67 |
| 5 | 90.71 | 85.84 | 80.67 | 85.61 | 91.1 | 94.05 | 85.74 | 90.25 | 88 |
| 6 | 90.56 | 86.16 | 76.28 | 89.68 | 92.46 | 92.02 | 84.33 | 91.39 | 87.86 |
| 7 | 90.24 | 85.9 | 68.23 | 97.88 | 93.04 | 96.4 | 81.46 | 95.77 | 88.61 |
| 8 | 90.47 | 86.07 | 77.82 | 93.58 | 92.76 | 92.01 | 84.79 | 92.79 | 88.79 |
| 9 | 90.47 | 85.23 | 79.68 | 92.86 | 90.6 | 93.08 | 85.13 | 92.18 | 88.66 |
| 10 | 90.82 | 85.9 | 81.02 | 94.73 | 92.07 | 91.48 | 85.91 | 92.76 | 89.34 |
| Mean | 90.39 | 85.5 | 77.16 | 94.17 | 91.94 | 92.8 | 84.35 | 92.97 | 88.66 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 89.97 | 85.66 | 74.06 | 89.89 | 86.97 | 84.55 | 83.23 | 87.14 | 85.18 |
| 2 | 89.52 | 86.49 | 84.3 | 89.51 | 87.05 | 82.59 | 86.77 | 86.38 | 86.58 |
| 3 | 90.24 | 86.88 | 82.38 | 89.07 | 89.06 | 84.52 | 86.5 | 87.55 | 87.02 |
| 4 | 89.81 | 86.76 | 76.53 | 89.36 | 88.96 | 89.11 | 84.37 | 89.15 | 86.76 |
| 5 | 89.86 | 86.34 | 77.76 | 84.49 | 90.21 | 85.85 | 84.65 | 86.85 | 85.75 |
| 6 | 89.39 | 86.83 | 85.32 | 79.17 | 85.36 | 84.1 | 87.18 | 82.88 | 85.03 |
| 7 | 89.5 | 86.45 | 81.49 | 88.38 | 87.93 | 86.5 | 85.81 | 87.6 | 86.71 |
| 8 | 90.41 | 86.72 | 82.56 | 78.65 | 87.68 | 85.25 | 86.56 | 83.86 | 85.21 |
| 9 | 89.66 | 87.03 | 81.27 | 87.73 | 87.94 | 86.66 | 85.98 | 87.44 | 86.71 |
| 10 | 90.71 | 87.92 | 85.21 | 83.35 | 89.5 | 88.08 | 87.95 | 86.98 | 87.46 |
| Mean | 89.91 | 86.71 | 81.09 | 85.96 | 88.07 | 85.72 | 85.9 | 86.58 | 86.24 |

*Table 50: Detailed results after re-running Experiment 4.3 using SMOTE*

CSC

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 84.18 | 82.78 | 77.31 | 92.71 | 97.5 | 96.67 | 81.42 | 95.62 | 88.52 |
| 2 | 85.08 | 82.86 | 77.37 | 94.98 | 97.47 | 96.63 | 81.77 | 96.36 | 89.07 |
| 3 | 86.6 | 83.3 | 76.78 | 97.13 | 98.25 | 98.3 | 82.23 | 97.89 | 90.06 |
| 4 | 87.02 | 84.19 | 75.16 | 96.91 | 96.78 | 96.66 | 82.12 | 96.78 | 89.45 |
| 5 | 85.34 | 83.84 | 77.33 | 93.03 | 97.15 | 94.74 | 82.17 | 94.97 | 88.57 |
| 6 | 85.15 | 82.7 | 69.75 | 92.71 | 97.63 | 98.13 | 79.2 | 96.16 | 87.68 |
| 7 | 86.67 | 83.71 | 66.49 | 97.05 | 97.82 | 98.13 | 78.95 | 97.67 | 88.31 |
| 8 | 85.83 | 83.9 | 76.09 | 95.51 | 97.88 | 95.48 | 81.94 | 96.29 | 89.11 |
| 9 | 85.83 | 81.91 | 77.07 | 96.89 | 97.48 | 97.23 | 81.6 | 97.2 | 89.4 |
| 10 | 86.76 | 84.09 | 78 | 92.84 | 97.82 | 96.82 | 82.95 | 95.83 | 89.39 |
| Mean | 85.85 | 83.33 | 75.13 | 94.98 | 97.58 | 96.88 | 81.44 | 96.48 | 88.96 |

FGR

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 83.05 | 82.88 | 79.4 | 93.5 | 96.48 | 96.82 | 81.77 | 95.6 | 88.69 |
| 2 | 83.13 | 82.49 | 78.43 | 93.85 | 97.28 | 97.74 | 81.35 | 96.29 | 88.82 |
| 3 | 85.22 | 83.93 | 79.26 | 95.25 | 97.93 | 98.7 | 82.8 | 97.29 | 90.05 |
| 4 | 85.4 | 84.55 | 77.09 | 95.78 | 96.87 | 97.23 | 82.35 | 96.63 | 89.49 |
| 5 | 84.22 | 83.98 | 78.86 | 94.24 | 96.22 | 97.42 | 82.35 | 95.96 | 89.16 |
| 6 | 83.26 | 82.94 | 71.64 | 92.33 | 97.13 | 98.44 | 79.28 | 95.97 | 87.62 |
| 7 | 85.42 | 84.6 | 68.76 | 95.26 | 96.53 | 98.12 | 79.59 | 96.64 | 88.12 |
| 8 | 84.74 | 84.28 | 78.24 | 93.23 | 96.77 | 97.67 | 82.42 | 95.89 | 89.15 |
| 9 | 84.49 | 83.67 | 82.3 | 94.79 | 96.25 | 97.48 | 83.48 | 96.17 | 89.83 |
| 10 | 84.81 | 83.86 | 79.61 | 92.82 | 97.19 | 97.12 | 82.76 | 95.71 | 89.23 |
| Mean | 84.37 | 83.72 | 77.36 | 94.1 | 96.87 | 97.68 | 81.82 | 96.22 | 89.02 |

RSF

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 92.96 | 87.81 | 79.83 | 99.52 | 98.21 | 97.18 | 86.87 | 98.31 | 92.59 |
| 2 | 93.23 | 86.88 | 79.13 | 99.91 | 97.99 | 98.15 | 86.41 | 98.68 | 92.55 |
| 3 | 92.94 | 87.83 | 78.53 | 99.6 | 98.53 | 98.13 | 86.43 | 98.75 | 92.59 |
| 4 | 93.35 | 87.63 | 73.59 | 98.97 | 97.63 | 97.42 | 84.86 | 98.01 | 91.43 |
| 5 | 93.05 | 87.56 | 79.82 | 99.1 | 98.35 | 97.55 | 86.81 | 98.33 | 92.57 |
| 6 | 93.34 | 87.9 | 77.17 | 98.5 | 97.91 | 98.47 | 86.14 | 98.29 | 92.21 |
| 7 | 93.2 | 88.2 | 66.08 | 99.4 | 98.39 | 98.15 | 82.5 | 98.65 | 90.57 |
| 8 | 92.94 | 88.14 | 73.77 | 99.84 | 98.32 | 97.59 | 84.95 | 98.58 | 91.76 |
| 9 | 93.42 | 87.96 | 81.24 | 99.05 | 97.67 | 98.09 | 87.54 | 98.27 | 92.9 |
| 10 | 93.3 | 87.33 | 81.11 | 99.32 | 98.21 | 97.42 | 87.25 | 98.32 | 92.78 |
| Mean | 93.17 | 87.72 | 77.03 | 99.32 | 98.12 | 97.82 | 85.97 | 98.42 | 92.2 |

DHT

| Sample | $C_1(24)$ | $C_1(48)$ | $C_1(72)$ | $C_2(24)$ | $C_2(48)$ | $C_2(72)$ | $\emptyset C_1$ | $\emptyset C_2$ | $\emptyset C$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 94.21 | 92.45 | 90.57 | 95.77 | 94.69 | 93.27 | 92.41 | 94.58 | 93.49 |
| 2 | 95.5 | 93.11 | 91.65 | 98.6 | 95.85 | 95.93 | 93.42 | 96.79 | 95.11 |
| 3 | 94.23 | 92.31 | 91.05 | 98.16 | 97.51 | 97.22 | 92.53 | 97.63 | 95.08 |
| 4 | 94.55 | 93.11 | 92.09 | 97.44 | 96.46 | 96.04 | 93.25 | 96.65 | 94.95 |
| 5 | 94.1 | 92.39 | 91.13 | 97.22 | 96.88 | 93.06 | 92.54 | 95.72 | 94.13 |
| 6 | 94.69 | 92.07 | 90 | 94.94 | 95.55 | 95.32 | 92.25 | 95.27 | 93.76 |
| 7 | 95.69 | 93.76 | 91.66 | 98.5 | 97.11 | 95.91 | 93.7 | 97.17 | 95.44 |
| 8 | 93.39 | 91.76 | 90.7 | 95.06 | 95.01 | 93.57 | 91.95 | 94.55 | 93.25 |
| 9 | 94.51 | 92.44 | 91.3 | 96.96 | 95.62 | 95.07 | 92.75 | 95.89 | 94.32 |
| 10 | 95.71 | 93.08 | 91.15 | 97.13 | 96.62 | 96.54 | 93.31 | 96.76 | 95.04 |
| Mean | 94.66 | 92.65 | 91.13 | 96.98 | 96.13 | 95.19 | 92.81 | 96.1 | 94.46 |

# References

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