**pinbasic: Fast and Stable Estimation of the Probability of Informed Trading (PIN)**

The pinbasic package ships utilities for fast and stable estimation of the probability of informed trading in the static PIN framework. The function design is chosen to fit the extended EHO model setup but can also be applied to the simpler EKOP model by equating the intensities of uninformed buys and sells. State-of-the-art factorization of the model likelihood function as well as most recent algorithms for generating initial values for optimization routines are implemented. In total, two likelihood factorizations and three methodologies for starting values are included. Likelihood functions are evaluated with pin\_ll and sets of starting values are returned by initial\_vals. The probability of informed trading can be estimated for arbitrary length of daily buys and sells data with pin\_est which is a wrapper around the workhorse function pin\_est\_core. No information about the time span of the underlying data is required to perform optimizations with pin\_est. However, the recommendation given in the literature is using at least data for 60 trading days to ensure convergence of the likelihood maximization. Quarterly estimates are returned by qpin which can be visualized with ggplot. Datasets of daily aggregated numbers of buys and sells can be simulated with simulateBS. Calculation of confidence intervals for the probability of informed trading can be enabled by confint argument in optimization routines (pin\_est\_core, pin\_est and qpin) or by calling pin\_confint directly. Additionally, posterior probabilities for conditions of trading days can be computed with posterior and plotted with ggplot.

**Examples**

The dataset BSfrequent cover 60 trading days and represent a frequently traded equity. Model parameters and the probability of informed trading can be estimated with pin\_est.

library(pinbasic)

# Loading data

data("BSfrequent")

# Estimation

pin\_freq <- pin\_est(numbuys = BSfrequent[,"Buys"], numsells = BSfrequent[,"Sells"])

pin\_freq

#> $Results

#> Estimate Std. error t value Pr(> t)

#> alpha 0.2000 0.05163873 3.873062 0.0001074766

#> delta 0.5000 0.14433702 3.464115 0.0005319794

#> epsilon\_b 1805.4354 5.67230494 318.289553 0.0000000000

#> epsilon\_s 1700.6753 5.50984189 308.661358 0.0000000000

#> mu 597.6107 14.60600145 40.915421 0.0000000000

#>

#> $ll

#> loglike

#> 1415607

#>

#> $pin

#> PIN

#> 0.03296587

#>

#> $conv

#> Convergence

#> 0

#>

#> $message

#> [1] "relative convergence (4)"

#>

#> $iterations

#> Iterations

#> 1

#>

#> $init\_vals

#> alpha delta epsilon\_b epsilon\_s mu

#> 0.2000 0.5000 1805.4259 1700.6852 597.6111

#>

#> $posterior

#> no good bad

#> [1,] 1.000000e+00 1.054677e-28 8.603585e-38

#> [2,] 1.000000e+00 1.708301e-41 5.437236e-31

#> [3,] 1.000000e+00 7.029207e-40 1.412484e-38

#> [4,] 2.119110e-45 2.484190e-80 1.000000e+00

#> [5,] 4.284377e-34 1.000000e+00 8.485090e-66

#> [6,] 1.000000e+00 2.173042e-38 3.616880e-32

#> [7,] 1.000000e+00 1.657474e-39 2.486257e-44

#> [8,] 6.148468e-35 8.501740e-62 1.000000e+00

#> [9,] 1.000000e+00 1.584055e-36 7.734248e-39

#> [10,] 1.000000e+00 6.617151e-36 9.224399e-43

#> [11,] 3.419344e-38 1.000000e+00 2.743870e-70

#> [12,] 1.000000e+00 1.264228e-40 9.395923e-40

#> [13,] 1.000000e+00 1.785679e-25 3.020421e-45

#> [14,] 1.000000e+00 6.820067e-38 3.359919e-44

#> [15,] 1.000000e+00 3.624041e-34 7.734248e-39

#> [16,] 6.036227e-38 1.015713e-77 1.000000e+00

#> [17,] 1.000000e+00 1.226614e-38 2.922883e-34

#> [18,] 1.000000e+00 5.443069e-42 2.276597e-42

#> [19,] 1.000000e+00 9.928515e-25 6.952753e-40

#> [20,] 3.917168e-47 1.000000e+00 1.103522e-86

#> [21,] 1.435856e-43 1.121835e-89 1.000000e+00

#> [22,] 1.000000e+00 1.632631e-38 1.908825e-38

#> [23,] 1.000000e+00 2.076785e-35 2.486257e-44

#> [24,] 1.540415e-42 1.000000e+00 1.148294e-86

#> [25,] 1.000000e+00 6.324039e-33 1.908825e-38

#> [26,] 1.000000e+00 2.892333e-38 3.737577e-43

#> [27,] 1.000000e+00 7.029207e-40 4.023421e-31

#> [28,] 1.000000e+00 9.642821e-42 2.627545e-35

#> [29,] 1.000000e+00 9.498287e-41 4.540581e-44

#> [30,] 1.000000e+00 1.560312e-35 2.235037e-45

#> [31,] 1.789734e-33 1.000000e+00 5.903585e-80

#> [32,] 1.472181e-39 1.000000e+00 7.064422e-74

#> [33,] 1.000000e+00 1.322823e-43 2.405970e-33

#> [34,] 1.000000e+00 2.764215e-35 3.192063e-36

#> [35,] 1.000000e+00 1.024329e-45 4.313742e-36

#> [36,] 1.000000e+00 2.045657e-34 9.395923e-40

#> [37,] 1.000000e+00 3.463511e-31 5.144867e-40

#> [38,] 1.000000e+00 1.632631e-38 1.412484e-38

#> [39,] 1.000000e+00 5.201964e-39 8.446526e-41

#> [40,] 1.000000e+00 4.472796e-29 1.520508e-26

#> [41,] 1.000000e+00 1.632631e-38 1.944319e-35

#> [42,] 1.000000e+00 3.072441e-42 3.550854e-35

#> [43,] 1.000000e+00 2.848980e-37 7.734248e-39

#> [44,] 1.000000e+00 2.108388e-36 6.825829e-43

#> [45,] 1.000000e+00 2.108388e-36 2.154180e-51

#> [46,] 1.000000e+00 1.513888e-33 8.024552e-33

#> [47,] 1.000000e+00 6.617151e-36 1.600465e-34

#> [48,] 1.000000e+00 2.108388e-36 3.020421e-45

#> [49,] 1.000000e+00 1.120353e-32 7.213723e-34

#> [50,] 2.401133e-41 4.101858e-82 1.000000e+00

#> [51,] 1.000000e+00 1.103560e-31 7.734248e-39

#> [52,] 1.000000e+00 7.355002e-43 1.684626e-42

#> [53,] 1.000000e+00 5.695348e-45 8.446526e-41

#> [54,] 1.000000e+00 5.201964e-39 1.514405e-43

#> [55,] 1.000000e+00 4.897022e-35 1.571248e-37

#> [56,] 1.000000e+00 6.923847e-39 1.293372e-36

#> [57,] 1.000000e+00 6.617151e-36 1.341919e-30

#> [58,] 1.000000e+00 1.172280e-35 3.877866e-37

#> [59,] 5.426305e-39 3.757091e-77 1.000000e+00

#> [60,] 1.000000e+00 2.486910e-28 2.084616e-40

#> attr(,"class")

#> [1] "matrix" "posterior"