Fixed effect estimation of repayment

July 9, 2024
10:19

Seiro Ito

Need: packages lmtest, sandwich.
This is a file whose regression results to be used in read_admin_data.rnw.
Key variables defined in read_admin_data.rnw:

- `adw[, Shortfall := PlannedInstallment - value.repay]`
- `adw[, ShortfallRate := Shortfall/PlannedInstallment]`
- PlannedInstallment := 120, with a grace period, PlannedInstallment := 190
- `EffectiveRepayment := value.repay + value.NetSaving` (same def as value.Paid...)

If I take village*Date fixed effects, mean of Arm*Date becomes zero hence changes by Arm*Year are elimiated. So I will take village fixed effects and date (=year-month) fixed effects (not their interactions).

```
for (i in which(grepl("val|Lag|Shor|Savi|Prof|Miss|Othe|Cum", colnames(X)) &
 !grepl("GroupShortf|LagGroupNetSav", colnames(X)))) {
  X[, colnames(X)[i] := eval(parse(text=colnames(X)[i])) -
    mean(eval(parse(text=colnames(X)[i])), na.rm = T),
    by = groupid]
  X[, colnames(X)[i] := eval(parse(text=colnames(X)[i])) -
    mean(eval(parse(text=colnames(X)[i])), na.rm = T),
    by = Date]
}
```

```
# take only 1st member to form group level data
X[, gnum := 1:.N, by = .(groupid, Date)]
X[, c("LargeSize", "WithGrace", "InKind") := 0L]
X[!grepl("tra", Arm), LargeSize := 1L]
X[grepl("gr|ca", Arm), WithGrace := 1L]
X[grepl("ca", Arm), InKind := 1L]
X[, Attributes := "traditional"]
X[!grepl("tra", Arm), Attributes := "LargeSize"]
X[grepl("gr|ca", Arm), Attributes := "LargeSizeAndWithGrace"]
X[grepl("ca", Arm), Attributes := "LargeSizeAndWithGraceAndInKind"]
X[, Attributes := factor(Attributes, levels = c("traditional", "LargeSize",
  "LargeSizeAndWithGrace", "LargeSizeAndWithGraceAndInKind"))]
qsave(X, paste0(pathsaveEstimationMemo, "ShortFallRegressionData.qs"))
X ← qread(paste0(pathsaveEstimationMemo, "ShortFallRegressionData.qs"))
X1 ← X[gnum == 1, ]
jds ← fread(paste0(pathreceived, "DataForJDS.prn"))
X[, o800 := 0L]
# need to use groupid because some hhid in admin record is missing in jds data
X[groupid %in% jds[grepl("trea", treat), groupid], o800 := 1L]
X2 ← X[o800 == 1L, ]
addmargins(table0(X2[, .(TeeInLY = 1:.N), by = .(groupid, LoanYear)][
  TeeInLY == 1, LoanYear]))
```

```
x
  1   2   3   4 Sum
```

```
69  69  69  69 276
```

```
# group shortfall regressions
vfesg1 ← lm(Shortfall  ~ Arm, data = X1)
vfesg2 ← lm(MeanGroupShortfall  ~ Arm +
  GRSR + LagMeanGroupShortfall + GRSR:LagMeanGroupShortfall, data = X1)
vfesg3 ← lm(MeanGroupShortfall ~
  Arm + Arm:SecondYear + Arm:ThirdYear + Arm:FourthYear,
  data = X1)
vfesg4 ← lm(MeanGroupShortfall ~
  LargeSize + WithGrace + InKind +
  SecondYear +
  I(LargeSize*SecondYear) + WithGrace:SecondYear + InKind:SecondYear +
  ThirdYear +
  I(LargeSize*ThirdYear) + I(WithGrace*ThirdYear) + I(InKind*ThirdYear) +
  FourthYear +
  I(LargeSize*FourthYear) + I(WithGrace*FourthYear) + I(InKind*FourthYear),
  data = X1)
vfesg5 ← lm(MeanGroupShortfall ~
  GRSR + Arm + GRSR:LagMeanGroupShortfall +
  Arm:SecondYear + Arm:ThirdYear  + Arm:FourthYear +
  UltraPoor + UltraPoor:Arm +
  UltraPoor:Arm:SecondYear + UltraPoor:Arm:ThirdYear  + UltraPoor:Arm:FourthYear +
  LagMeanGroupShortfall +
  LagMeanGroupNetSaving + LagMeanCumGroupNetSaving,
  data = X1)
vfesg6 ← lm(MeanGroupShortfall ~
  GRSR + GRSR:LagMeanGroupShortfall +
  SecondYear + LargeSize + WithGrace + InKind +
  I(LargeSize*SecondYear) + I(WithGrace*SecondYear) + I(InKind*SecondYear) +
  ThirdYear +
  I(LargeSize*ThirdYear) + I(WithGrace*ThirdYear) + I(InKind*ThirdYear) +
  UltraPoor +
  I(LargeSize*UltraPoor) + I(WithGrace*UltraPoor) + I(InKind*UltraPoor) +
  I(SecondYear*UltraPoor) +
  FourthYear +
  I(LargeSize*FourthYear) + I(WithGrace*FourthYear) + I(InKind*FourthYear) +
  I(LargeSize*SecondYear*UltraPoor) + I(WithGrace*SecondYear*UltraPoor) +
  I(InKind*SecondYear*UltraPoor) +
  I(ThirdYear*UltraPoor) +
  I(LargeSize*ThirdYear*UltraPoor) + I(WithGrace*ThirdYear*UltraPoor) +
  I(InKind*ThirdYear*UltraPoor) +
  I(FourthYear*UltraPoor) +
  I(LargeSize*FourthYear*UltraPoor) + I(WithGrace*FourthYear*UltraPoor) +
  I(InKind*FourthYear*UltraPoor) +
  LagMeanGroupShortfall +
  LagMeanGroupNetSaving + LagMeanCumGroupNetSaving,
  data = X1)
# individual shortfall regressions
vfes1 ← lm(Shortfall  ~ Arm, data = X)
vfes2 ← lm(Shortfall  ~ Arm +
  GRSR + LagMeanGroupShortfall + GRSR:LagMeanGroupShortfall
  + LagShortfall, data = X)
vfes3 ← lm(Shortfall  ~
  Arm + Arm:SecondYear + Arm:ThirdYear + Arm:FourthYear,
  data = X)
```

```
vfes4 ← lm(MeanGroupShortfall ~
  SecondYear + LargeSize + WithGrace + InKind +
  I(LargeSize*SecondYear) + I(WithGrace*SecondYear) + I(InKind*SecondYear) +
  ThirdYear +
  I(LargeSize*ThirdYear) + I(WithGrace*ThirdYear) + I(InKind*ThirdYear) +
  FourthYear +
  I(LargeSize*FourthYear) + I(WithGrace*FourthYear) + I(InKind*FourthYear),
  data = X)
vfes5 ← lm(Shortfall ~
  GRSR + Arm + GRSR:LagMeanGroupShortfall +
  Arm:SecondYear + Arm:ThirdYear + Arm:FourthYear +
  UltraPoor:Arm +
  UltraPoor:SecondYear + UltraPoor:ThirdYear + UltraPoor:FourthYear +
  UltraPoor:Arm:SecondYear + UltraPoor:Arm:ThirdYear + UltraPoor:Arm:FourthYear +
  LagShortfall + LagMeanGroupShortfall +
  LagMeanGroupNetSaving + LagMeanCumGroupNetSaving,
  data = X)
vfes6 ← lm(Shortfall ~
  GRSR + GRSR:LagMeanGroupShortfall +
  SecondYear + LargeSize + WithGrace + InKind +
  I(LargeSize*SecondYear) + I(WithGrace*SecondYear) + I(InKind*SecondYear) +
  ThirdYear +
  I(LargeSize*ThirdYear) + I(WithGrace*ThirdYear) + I(InKind*ThirdYear) +
  FourthYear +
  I(LargeSize*FourthYear) + I(WithGrace*FourthYear) + I(InKind*FourthYear) +
  UltraPoor +
  I(LargeSize*UltraPoor) + I(WithGrace*UltraPoor) + I(InKind*UltraPoor) +
  I(SecondYear*UltraPoor) +
  I(LargeSize*SecondYear*UltraPoor) + I(WithGrace*SecondYear*UltraPoor) +
  I(InKind*SecondYear*UltraPoor) +
  I(ThirdYear*UltraPoor) +
  I(LargeSize*ThirdYear*UltraPoor) + I(WithGrace*ThirdYear*UltraPoor) +
  I(InKind*ThirdYear*UltraPoor) +
  I(FourthYear*UltraPoor) +
  I(LargeSize*FourthYear*UltraPoor) + I(WithGrace*FourthYear*UltraPoor) +
  I(InKind*FourthYear*UltraPoor) +
  LagShortfall + LagMeanGroupShortfall +
  LagMeanGroupNetSaving + LagMeanCumGroupNetSaving,
  data = X)
# individual shortfall regressions with o800
vfeso1 ← lm(Shortfall  ~ Arm, data = X2)
vfeso2 ← lm(Shortfall  ~
   Arm + LagMeanGroupShortfall +
  + LagShortfall, data = X2)
vfeso3 ← lm(Shortfall  ~
  Arm + Arm:SecondYear + Arm:ThirdYear + Arm:FourthYear
  + LagShortfall,
  data = X2)
vfeso4 ← lm(MeanGroupShortfall ~
  SecondYear + LargeSize + WithGrace + InKind +
  I(LargeSize*SecondYear) + I(WithGrace*SecondYear) + I(InKind*SecondYear) +
  ThirdYear +
  I(LargeSize*ThirdYear) + I(WithGrace*ThirdYear) + I(InKind*ThirdYear) +
  FourthYear +
  I(LargeSize*FourthYear) + I(WithGrace*FourthYear) + I(InKind*FourthYear)
  + LagShortfall,
```

```
  data = X2)
vfeso5 ← lm(Shortfall ~
  Arm +
  Arm:SecondYear + Arm:ThirdYear + Arm:FourthYear +
  UltraPoor:Arm +
  +I(UltraPoor*SecondYear) + I(UltraPoor*ThirdYear) + I(UltraPoor*FourthYear)+
  UltraPoor*Arm*SecondYear + UltraPoor*Arm*ThirdYear + UltraPoor*Arm*FourthYear +
  LagShortfall + LagMeanGroupShortfall +
  LagMeanGroupNetSaving + LagMeanCumGroupNetSaving,
  data = X2)
# vfeso5 ← update(vfeso5.0,
#   . ~ .
#   +I(UltraPoor*SecondYear) + I(UltraPoor*ThirdYear) + I(UltraPoor*FourthYear)
#   - Armtraditional:SecondYear:UltraPoor - Armtraditional:ThirdYear:UltraPoor
#   - Armtraditional:FourthYear:UltraPoor)
vfeso6 ← lm(Shortfall ~
  SecondYear + LargeSize + WithGrace + InKind +
  I(LargeSize*SecondYear) + I(WithGrace*SecondYear) + I(InKind*SecondYear) +
  ThirdYear +
  I(LargeSize*ThirdYear) + I(WithGrace*ThirdYear) + I(InKind*ThirdYear) +
  FourthYear +
  I(LargeSize*FourthYear) + I(WithGrace*FourthYear) + I(InKind*FourthYear) +
  UltraPoor +
  I(LargeSize*UltraPoor) + I(WithGrace*UltraPoor) + I(InKind*UltraPoor) +
  I(UltraPoor*SecondYear) + I(UltraPoor*ThirdYear) + I(UltraPoor*FourthYear) +
  I(LargeSize*SecondYear*UltraPoor) + I(WithGrace*SecondYear*UltraPoor) +
  I(InKind*SecondYear*UltraPoor) +
  I(LargeSize*ThirdYear*UltraPoor) + I(WithGrace*ThirdYear*UltraPoor) +
  I(InKind*ThirdYear*UltraPoor) +
  I(LargeSize*FourthYear*UltraPoor) + I(WithGrace*FourthYear*UltraPoor) +
  I(InKind*FourthYear*UltraPoor) +
  LagShortfall + LagMeanGroupShortfall +
  LagMeanGroupNetSaving + LagMeanCumGroupNetSaving,
  data = X2)
subst.table ← matrix(
  c("Arm|povertystatus|^se\\$.*|^p\\$.*", "",
    "I\\((.*?)\\)", "\\1",
    "traditional:", "",
    "large g", "LargeG",
    "large", "Large",
    "cattle", "Cattle",
    "Attributes.*And", "",
    "Attributes", "",
    "LargeSize", "Upfront",
    "^SecondYear *\\* *(Ul.*)", "\\1 $\\\\times$ LY2",
    "^ThirdYear *\\* *(Ul.*)", "\\1 $\\\\times$ LY3",
    "^FourthYear *\\* *(Ul.*)", "\\1 $\\\\times$ LY4",
    "(.*):SecondYear:(.*)", "\\1 $\\\\times$ \\2 $\\\\times$ LY2",
    "(.*):ThirdYear:(.*)", "\\1 $\\\\times$ \\2 $\\\\times$ LY3",
    "(.*):FourthYear:(.*)", "\\1 $\\\\times$ \\2 $\\\\times$ LY4",
    "(.*) \\* SecondYear \\* (.*)", "\\1 $\\\\times$ \\2 $\\\\times$ LY2",
    "(.*) \\* ThirdYear \\* (.*)", "\\1 $\\\\times$ \\2 $\\\\times$ LY3",
    "(.*) \\* FourthYear \\* (.*)", "\\1 $\\\\times$ \\2 $\\\\times$ LY4",
    "(.*):SecondYear$", "\\1 $\\\\times$ LY2",
    "(.*):ThirdYear$", "\\1 $\\\\times$ LY3",
    "(.*):FourthYear$", "\\1 $\\\\times$ LY4",
```

```
    "SecondYear", "LY2",
    "ThirdYear", "LY3",
    "FourthYear", "LY4",
    "MonthsE", "Months E",
    "Month([JFMASOND])", "\\1",
    "\\*|:", " $\\\\times$ ",
    "Lag(.*?)-Lag", "\\1$_{t-1}-$Lag",
    "Lag(.*)", "\\1$_{t-1}$",
    "Short", "short",
    "value.repay", "repayment",
    #"MeanGroupS.*l\\$", "per member group shortfall$",
    "MeanGroups.*l\\$", "Group shortfall$", # it is per member, but too long to show
    "^OtherR.*d\\$", "Mean other repayment$",
    "^CumR.*d\\$", "Cumulative repayment$",
    "^CumR.*e\\$", "Cumulative repayment rate$",
    "^CumR.*Q\\$", "Cumulative repayment rate$^{2}",
    "^CumN.*g\\$", "Cumulative net saving$",
    "CumOtherO.*d\\$", "Other cumulative repayments$",
    "CumOtherR.*e\\$", "Other cumulative repayment rate$",
    "CumOtherR.*Q\\$", "Other cumulative repayment rate$^{2}",
    "MeanCumGroupNet.*g\\$", "Per member cumulative group net saving (BDT1000)$",
    "value.NetSaving\\$", "Net saving$",
    "MeanG.*g\\$", "Per member group net saving$",
    "\\^2", "$^{2}$"), byrow = T, ncol = 2)
reglists.header ← c("vfesg", "vfes", "vfeso")
# Below is defined in EstimationMemo_OptionSetting.rnw
# ShortfallFileNames← c("Group", "Individual", "o800")
datas ← c("X1", "X", "X2")
for (m in 1:length(reglists.header)) {
  rlist ← eval(parse(text=paste("list(", paste0(reglists.header[m], 1:6, collapse = ","),
  dataX ← get(datas[m])
  ClusterList ← lapply(rlist, function(x)
      if (!is.null(x$na.action)) matrix(dataX[-x$na.action, groupid]) else
      matrix(dataX[, groupid])
    )
  ro ← lapply(1:length(rlist), function(j)
     clx(rlist[[j]], cluster = ClusterList[[j]], returnV = T, deviation = F))
  ro.estlist ← lapply(ro, "[[", 1)
  ro.estlist ← lapply(ro.estlist, function(x) x[, -3, drop = F])
  # unify covariate names so default (traditional) is not duplicated in latextab
  ro.estlist ← lapply(ro.estlist, function(x) {
    rownames(x) ← gsub("Arm", "Attributes", rownames(x))
    x
    })
  ro.estlist ← lapply(ro.estlist, function(x) {
    rownames(x) ← gsub("Armtraditional:|Attributestraditional:", "",
      rownames(x))
    x
    })
  ro.estlist ← lapply(ro.estlist, function(x) {
    rownames(x) ← gsub("^SecondYear:UltraPoor$", "I(SecondYear * UltraPoor)",
      rownames(x))
    x
    })
  ro.estlist ← lapply(ro.estlist, function(x) {
    rownames(x) ← gsub("^ThirdYear:UltraPoor$", "I(ThirdYear * UltraPoor)",
```

```
    rownames(x))
  x
  })
ro.estlist <- lapply(ro.estlist, function(x) {
  rownames(x) <- gsub("^FourthYear:UltraPoor$", "I(FourthYear * UltraPoor)",
    rownames(x))
  x
  })
ro.estlist <- lapply(ro.estlist, function(x) {
  rownames(x) <- gsub("^(.*):(.*)Year$", "I(\\1 * \\2Year)",
    rownames(x))
  x
  })
r.N <- unlist(lapply(ro, "[[", "N"))
r.M <- unlist(lapply(ro, "[[", "clusters.M"))
r.R <- unlist(lapply(rlist, function(x) round(summary(x)$adj, 3)))
r.tab <- tabs2latex3(ro.estlist, digits = 2, use.Pvalue = T, xx.yyy = T)
# reorder rows: rn.new #
rtab <- r.tab
rn <- rownames(r.tab)
rn0 <- rn
for (i in 1:nrow(subst.table))
  rn <- gsub(subst.table[i, 1], subst.table[i, 2], rn)
source(paste0(pathprogram,
  "ReorderingOfRowsInEstimatedResultsRepaymentTable.R"))
rn <- rn[rn.new]
r.tab <- r.tab[rn.new, ]
rn <- paste0("\\makebox[5cm]{\\scriptsize\\hfill ", rn, "}")
r.tb <- rbind(as.matrix(cbind(covariates = rn, r.tab)),
  c("\\makebox[3cm]{\\scriptsize\\hfill number of clusters}", r.M),
  c("\\bar{R}^{2}", r.R),
  c("N", r.N))
r.ltxtb <- latextab(r.tb[1:(grep("fill LY3\\}$", rn)-1), ],
  hleft = "\\scriptsize\\hfil$", hcenter = c(6, rep(1.1, ncol(r.tb)-1)), hright = "$",
  headercolor = "gray90", adjustlineskip = "-.6ex", delimiterline= NULL,
  alternatecolor2 = "gray90")
write.tablev(r.ltxtb,
  paste0(pathsaveHere, "Shortfall", ShortfallFileNames[m], "EstimationResults1.tex")
  , colnamestrue = F)
write.tablev(r.ltxtb,
  paste0(pathsaveEstimationMemo, "Shortfall", ShortfallFileNames[m], "EstimationResults
  , colnamestrue = F)
r.ltxtb <- latextab(r.tb[grep("fill LY3\\}$", rn):(grep("InK.*U.*4\\}$", rn)+1), ],
  hleft = "\\scriptsize\\hfil$", hcenter = c(6, rep(1.1, ncol(r.tb)-1)), hright = "$",
  headercolor = "gray90", adjustlineskip = "-.6ex", delimiterline= NULL,
  alternatecolor2 = "gray90")
write.tablev(r.ltxtb,
  paste0(pathsaveHere, "Shortfall", ShortfallFileNames[m], "EstimationResults2.tex")
  , colnamestrue = F)
write.tablev(r.ltxtb,
  paste0(pathsaveEstimationMemo, "Shortfall", ShortfallFileNames[m], "EstimationResults
  , colnamestrue = F)
r.ltxtb <- latextab(r.tb[
#grep("ll Group s.*1\\}\\$\\}$", rn):nrow(r.tb)
(grep("InK.*U.*4\\}$", rn)+2):nrow(r.tb)
, ],
```

```
    hleft = "\\scriptsize\\hfil$", hcenter = c(6, rep(1.1, ncol(r.tb)-1)), hright = "$",
    headercolor = "gray90", adjustlineskip = "-.6ex", delimiterline= NULL,
    alternatecolor2 = "gray90")
  write.tablev(r.ltxtb,
    paste0(pathsaveHere, "Shortfall", ShortfallFileNames[m], "EstimationResults3.tex")
    , colnamestrue = F)
  write.tablev(r.ltxtb,
    paste0(pathsaveEstimationMemo, "Shortfall", ShortfallFileNames[m], "EstimationResults
    , colnamestrue = F)
  assign(paste0(reglists.header[m], "list"), rlist)
  assign(paste0(reglists.header[m], ".estlist"), ro.estlist)
  assign(paste0(reglists.header[m], ".N"), r.N)
  assign(paste0(reglists.header[m], ".M"), r.M)
  assign(paste0(reglists.header[m], ".R"), r.R)
  assign(paste0(reglists.header[m], "list"), rlist)
  assign(paste0(reglists.header[m], "Xlist"), ClusterList)
}
```

Table 1: Group level effects of repayment shortfall

covariates	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	14.11 (34.8)	28.77 (2.3)	126.04 (0.0)	126.04 (0.0)	71.38 (0.0)	71.38 (0.0)
Large	−19.20 (27.1)	−35.30 (0.0)	−40.93 (3.6)		−24.53 (6.1)	
LargeGrace	−7.65 (72.9)	−19.06 (2.0)	−106.17 (0.0)		−77.62 (0.0)	
Cattle	−18.82 (35.8)	−28.63 (0.1)	−95.74 (0.0)		−59.78 (0.1)	
Upfront				−40.93 (3.6)		−24.53 (6.1)
WithGrace				−65.24 (0.0)		−53.08 (0.0)
InKind				10.43 (44.2)		17.84 (20.0)
UltraPoor					−26.72 (4.8)	−26.72 (4.8)
Large × UltraPoor					11.59 (43.2)	
LargeGrace × UltraPoor					29.31 (8.2)	
Cattle × UltraPoor					5.51 (77.0)	
Upfront × UltraPoor						11.59 (43.2)
WithGrace × UltraPoor						17.72 (12.4)
InKind × UltraPoor						−23.79 (17.0)
LY2			125.57 (0.0)	125.57 (0.0)	38.02 (0.3)	38.02 (0.3)
Large × LY2			114.68 (0.0)		18.76 (0.3)	
LargeGrace × LY2			161.27 (0.0)		96.77 (0.0)	
Cattle × LY2			124.81 (0.0)		65.59 (0.4)	
Upfront × LY2				−10.89 (60.4)		−19.26 (13.9)
WithGrace × LY2				46.59 (3.5)		78.01 (0.2)
InKind × LY2				−36.46 (5.0)		−31.18 (28.4)
UltraPoor × LY2					0.47 (97.0)	0.47 (97.0)
Large × UltraPoor × LY2					22.12 (5.7)	
LargeGrace × UltraPoor × LY2					−20.37 (36.7)	
Cattle × UltraPoor × LY2					8.77 (69.4)	
Upfront × UltraPoor × LY2						21.65 (18.6)
WithGrace × UltraPoor × LY2						−42.49 (8.8)
InKind × UltraPoor × LY2						29.13 (35.5)

Table 1: Group level effects of repayment shortfall (continued)

covariates	(1)	(2)	(3)	(4)	(5)	(6)
LY3			84.95 (0.9)	84.95 (0.9)	1.23 (96.6)	1.23 (96.6)
Large × LY3			−21.59 (68.4)		−270.76 (11.7)	
LargeGrace × LY3			167.79 (0.0)		129.51 (3.7)	
Cattle × LY3			103.72 (0.2)		13.32 (78.2)	
Upfront × LY3				−106.54 (8.7)		−271.99 (11.9)
WithGrace × LY3				189.39 (0.2)		400.28 (2.8)
InKind × LY3				−64.07 (15.5)		−116.20 (15.8)
UltraPoor × LY3					11.59 (73.8)	11.59 (73.8)
Large × UltraPoor × LY3					251.93 (14.9)	
LargeGrace × UltraPoor × LY3					−72.38 (22.8)	
Cattle × UltraPoor × LY3					38.06 (49.3)	
Upfront × UltraPoor × LY3						240.34 (17.7)
WithGrace × UltraPoor × LY3						−324.31 (8.0)
InKind × UltraPoor × LY3						110.44 (19.7)
LY4			−191.71 (0.0)	−191.71 (0.0)	−190.52 (0.0)	−190.52 (0.0)
Large × LY4			−231.88 (0.0)		−176.62 (0.0)	
LargeGrace × LY4			−54.82 (13.3)		−128.57 (0.0)	
Cattle × LY4			−33.07 (51.4)		−60.28 (0.5)	
Upfront × LY4				−40.18 (45.4)		13.90 (76.6)
WithGrace × LY4				177.06 (0.0)		48.06 (23.4)
InKind × LY4				21.76 (72.8)		68.29 (0.1)
UltraPoor × LY4					44.08 (41.6)	44.08 (41.6)
Large × UltraPoor × LY4					5.54 (89.8)	
LargeGrace × UltraPoor × LY4					59.74 (14.0)	
Cattle × UltraPoor × LY4					−17.01 (77.9)	
Upfront × UltraPoor × LY4						−38.54 (58.2)
WithGrace × UltraPoor × LY4						54.20 (34.3)
InKind × UltraPoor × LY4						−76.76 (31.0)

Source: Estimated with GUK administrative data.

Notes: 1. Estimates of repayment shortfall controlling for group/village and year-month fixed effects using 48 month administrative records. The estimated model is $\tilde{y}_{it} = b_1 + \boldsymbol{b}_1'\mathbf{d}_i + b_2\mathsf{LY2} + \boldsymbol{b}_2'\mathbf{d}_i\mathsf{LY2} + b_3\mathsf{LY3} + \boldsymbol{b}_3'\mathbf{d}_i\mathsf{LY3} + b_4\mathsf{LY4} + \boldsymbol{b}_4'\mathbf{d}_i\mathsf{LY4} + \tilde{e}_{it}$, where $\tilde{x}_{it}$ is group and time demeaned value of variable x, $t = 1, \ldots, 48$ is an ellapsed month index, $\mathbf{d}_i$ is a three element vector of arms or functional attributes, $\mathsf{LY2}, \mathsf{LY3}, \mathsf{LY4}$ are indicator variables of loan years 2, 3, 4. Loan years are defined with the ellapsed months since the first disbursement date, 13-24 for LY2, 25-36 for LY3, and 37-48 for LY4. Fixed effects are controlled by differencing out respecive means from the data matrix. Shortfall y_{it} is (planned installment) - (actual repayment). Group shortfall$_{t-1}$ indicates a one month lagged mean shortfall amount of a group. Per member group net saving$_{t-1}$ and Per member cumulative group net saving (BDT1000)$_{t-1}$ give one month lagged average net saving in a group and their accumulated sums, respectively. Median group repayent shortfall rate is -1.42. 69 groups participated in the lending program.

2. Standard errors are clustered at group (village) level.

Table 1: Group level effects of repayment shortfall (continued)

covariates	(1)	(2)	(3)	(4)	(5)	(6)
GRSRhigh		31.16 (7.4)			25.37 (12.9)	25.37 (12.9)
Group shortfall$_{t-1}$		0.78 (0.0)			0.67 (0.0)	0.67 (0.0)
GRSRhigh × Group shortfall$_{t-1}$		−0.18 (12.6)			−0.17 (12.2)	−0.17 (12.2)
Per member group net saving$_{t-1}$					−0.02 (0.0)	−0.02 (0.0)
Per member cumulative group net saving (BDT1000)$_{t-1}$					−0.01 (74.9)	−0.01 (74.9)
number of clusters	92	92	92	92	92	92
$\bar{R}^2$	0	0.211	0.128	0.128	0.256	0.256
N	4204	4178	4204	4204	4178	4178

Source: Estimated with GUK administrative data.

Notes: 1. Estimates of repayment shortfall controlling for group/village and year-month fixed effects using 48 month administrative records. The estimated model is $\tilde{y}_{it} = b_1 + \boldsymbol{b}_1'\mathbf{d}_i + b_2\mathsf{LY2} + \boldsymbol{b}_2'\mathbf{d}_i\mathsf{LY2} + b_3\mathsf{LY3} + \boldsymbol{b}_3'\mathbf{d}_i\mathsf{LY3} + b_4\mathsf{LY4} + \boldsymbol{b}_4'\mathbf{d}_i\mathsf{LY4} + \tilde{e}_{it}$, where $\tilde{x}_{it}$ is group and time demeaned value of variable x, $t = 1, \ldots, 48$ is an ellapsed month index, $\mathbf{d}_i$ is a three element vector of arms or functional attributes, $\mathsf{LY2}, \mathsf{LY3}, \mathsf{LY4}$ are indicator variables of loan years 2, 3, 4. Loan years are defined with the ellapsed months since the first disbursement date, 13-24 for LY2, 25-36 for LY3, and 37-48 for LY4. Fixed effects are controlled by differencing out respecive means from the data matrix. Shortfall y_{it} is (planned installment) - (actual repayment). Group shortfall$_{t-1}$ indicates a one month lagged mean shortfall amount of a group. Per member group net saving$_{t-1}$ and Per member cumulative group net saving (BDT1000)$_{t-1}$ give one month lagged average net saving in a group and their accumulated sums, respectively. Median group repayent shortfall rate is -1.42. 69 groups participated in the lending program.

2. Standard errors are clustered at group (village) level.

Table 2: Individual level effects of repayment shortfall, all individuals

covariates	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	−0.80 (56.2)	2.77 (74.0)	0.06 (99.7)	144.89 (0.0)	20.49 (14.4)	20.49 (14.4)
Large	1.19 (49.5)	−3.80 (25.6)	57.64 (0.1)		40.69 (0.6)	
LargeGrace	0.73 (69.8)	−5.07 (14.7)	−146.35 (0.0)		−142.43 (0.0)	
Cattle	1.31 (47.9)	−6.20 (16.6)	−140.97 (0.0)		−143.24 (0.0)	
Upfront				−37.79 (0.1)		40.69 (0.6)
WithGrace				−60.86 (0.0)		−183.12 (0.0)
InKind				−0.32 (96.4)		−0.81 (95.6)
UltraPoor					3.91 (57.7)	3.91 (57.7)
Large × UltraPoor					−4.71 (50.9)	
LargeGrace × UltraPoor					5.93 (3.6)	
Cattle × UltraPoor					9.43 (1.4)	
Upfront × UltraPoor						−8.62 (38.9)
WithGrace × UltraPoor						10.64 (16.6)
InKind × UltraPoor						3.51 (44.9)
LY2			49.49 (0.2)	103.10 (0.0)	56.96 (0.0)	56.96 (0.0)
Large × LY2			−17.02 (12.5)		−0.81 (94.4)	
LargeGrace × LY2			248.71 (0.0)		223.19 (0.0)	
Cattle × LY2			263.69 (0.0)		234.96 (0.0)	
Upfront × LY2				−10.22 (44.5)		−57.78 (0.2)
WithGrace × LY2				45.66 (0.0)		224.00 (0.0)
InKind × LY2				−25.07 (10.5)		11.77 (57.5)
UltraPoor × LY2					−14.18 (11.9)	−14.18 (11.9)
Large × UltraPoor × LY2					13.55 (29.4)	
LargeGrace × UltraPoor × LY2					13.23 (29.1)	
Cattle × UltraPoor × LY2					9.15 (47.4)	
Upfront × UltraPoor × LY2						13.55 (29.4)
WithGrace × UltraPoor × LY2						−0.32 (97.9)
InKind × UltraPoor × LY2						−4.08 (74.2)

Table 2: Individual level effects of repayment shortfall, all individuals (continued)

covariates	(1)	(2)	(3)	(4)	(5)	(6)
LY3			98.17	87.29	102.95	102.95
			(0.0)	(0.0)	(0.0)	(0.0)
Large × LY3			−11.29		−17.20	
			(39.0)		(31.5)	
LargeGrace × LY3			346.60		288.53	
			(0.0)		(0.0)	
Cattle × LY3			344.54		308.25	
			(0.0)		(0.0)	
Upfront × LY3				−101.72		−120.15
				(0.0)		(0.0)
WithGrace × LY3				144.31		305.73
				(0.0)		(0.0)
InKind × LY3				−22.12		19.72
				(30.2)		(53.8)
UltraPoor × LY3					−19.87	−19.87
					(1.0)	(1.0)
Large × UltraPoor × LY3					33.15	
					(6.1)	
LargeGrace × UltraPoor × LY3					27.82	
					(1.8)	
Cattle × UltraPoor × LY3					−7.45	
					(72.6)	
Upfront × UltraPoor × LY3						33.15
						(6.1)
WithGrace × UltraPoor × LY3						−5.33
						(77.1)
InKind × UltraPoor × LY3						−35.27
						(10.7)
LY4			−307.26	−179.04	−239.19	−239.19
			(0.0)	(0.0)	(0.0)	(0.0)
Large × LY4			−330.16		−265.83	
			(0.0)		(0.0)	
LargeGrace × LY4			−119.24		−98.42	
			(0.0)		(0.4)	
Cattle × LY4			−172.15		−116.65	
			(0.0)		(1.8)	
Upfront × LY4				−120.51		−26.64
				(0.5)		(54.4)
WithGrace × LY4				238.31		167.41
				(0.0)		(0.0)
InKind × LY4				−12.25		−18.23
				(82.1)		(75.7)
UltraPoor × LY4					−20.33	−20.33
					(45.0)	(45.0)
Large × UltraPoor × LY4					10.32	
					(76.9)	
LargeGrace × UltraPoor × LY4					39.79	
					(24.6)	
Cattle × UltraPoor × LY4					13.85	
					(69.5)	
Upfront × UltraPoor × LY4						10.32
						(76.9)
WithGrace × UltraPoor × LY4						29.47
						(34.3)
InKind × UltraPoor × LY4						−25.94
						(41.4)

Source: Estimated with GUK administrative data.

Notes: 1. Estimates of repayment shortfall controlling for group/village and year-month fixed effects using 48 month administrative records. The estimated model is $\tilde{y}_{it} = b_1 + \boldsymbol{b}_1'\mathbf{d}_i + b_2\mathsf{LY2} + \boldsymbol{b}_2'\mathbf{d}_i\mathsf{LY2} + b_3\mathsf{LY3} + \boldsymbol{b}_3'\mathbf{d}_i\mathsf{LY3} + b_4\mathsf{LY4} + \boldsymbol{b}_4'\mathbf{d}_i\mathsf{LY4} + \tilde{e}_{it}$, where $\tilde{x}_{it}$ is group and time demeaned value of variable x, $t = 1, \ldots, 48$ is an ellapsed month index, $\mathbf{d}_i$ is a three element vector of arms or functional attributes, $\mathsf{LY2}, \mathsf{LY3}, \mathsf{LY4}$ are indicator variables of loan years 2, 3, 4. Loan years are defined with the ellapsed months since the first disbursement date, 13-24 for LY2, 25-36 for LY3, and 37-48 for LY4. Fixed effects are controlled by differencing out respecive means from the data matrix. Shortfall y_{it} is (planned installment) - (actual repayment). Group shortfall$_{t-1}$ indicates a one month lagged mean shortfall amount of a group. Per member group net saving$_{t-1}$ and Per member cumulative group net saving (BDT1000)$_{t-1}$ give one month lagged average net saving in a group and their accumulated sums, respectively. Median group repayent shortfall rate is -1.42. 69 groups participated in the lending program.

2. Standard errors are clustered at group (village) level.

TABLE 2: INDIVIDUAL LEVEL EFFECTS OF REPAYMENT SHORTFALL, ALL INDIVIDUALS (CONTINUED)

covariates	(1)	(2)	(3)	(4)	(5)	(6)
GRSRhigh		15.89 (13.9)			20.85 (5.2)	20.85 (5.2)
Group shortfall$_{t-1}$		0.01 (88.6)			−0.12 (1.9)	−0.12 (1.9)
GRSRhigh × Group shortfall$_{t-1}$		−0.11 (14.4)			−0.14 (6.9)	−0.14 (6.9)
shortfall$_{t-1}$		0.44 (0.0)			0.30 (0.0)	0.30 (0.0)
Per member group net saving$_{t-1}$					−0.04 (13.5)	−0.04 (13.5)
Per member cumulative group net saving (BDT1000)$_{t-1}$					−0.04 (29.0)	−0.04 (29.0)
number of clusters	92	92	92	92	92	92
$\bar{R}^2$	0	0.097	0.133	0.136	0.173	0.173
N	55352	55170	55352	55352	55170	55170

Source: Estimated with GUK administrative data.

Notes: 1. Estimates of repayment shortfall controlling for group/village and year-month fixed effects using 48 month administrative records. The estimated model is $\tilde{y}_{it} = b_1 + \boldsymbol{b}_1'\mathbf{d}_i + b_2\mathsf{LY2} + \boldsymbol{b}_2'\mathbf{d}_i\mathsf{LY2} + b_3\mathsf{LY3} + \boldsymbol{b}_3'\mathbf{d}_i\mathsf{LY3} + b_4\mathsf{LY4} + \boldsymbol{b}_4'\mathbf{d}_i\mathsf{LY4} + \tilde{e}_{it}$, where $\tilde{x}_{it}$ is group and time demeaned value of variable x, $t = 1, \ldots, 48$ is an ellapsed month index, $\mathbf{d}_i$ is a three element vector of arms or functional attributes, $\mathsf{LY2}, \mathsf{LY3}, \mathsf{LY4}$ are indicator variables of loan years 2, 3, 4. Loan years are defined with the ellapsed months since the first disbursement date, 13-24 for LY2, 25-36 for LY3, and 37-48 for LY4. Fixed effects are controlled by differencing out respecive means from the data matrix. Shortfall y_{it} is (planned installment) - (actual repayment). Group shortfall$_{t-1}$ indicates a one month lagged mean shortfall amount of a group. Per member group net saving$_{t-1}$ and Per member cumulative group net saving (BDT1000)$_{t-1}$ give one month lagged average net saving in a group and their accumulated sums, respectively. Median group repayent shortfall rate is -1.42. 69 groups participated in the lending program.

2. Standard errors are clustered at group (village) level.

Table 3: Individual level effects of repayment shortfall

covariates	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	3.11 (3.9)	14.20 (12.6)	31.23 (0.8)	131.82 (0.0)	51.21 (0.0)	51.21 (0.0)
Large	−1.13 (53.2)	−4.99 (9.9)	23.71 (9.6)		21.65 (18.2)	
LargeGrace	−1.21 (53.5)	−6.71 (3.6)	−138.02 (0.0)		−148.27 (0.0)	
Cattle	−1.37 (46.8)	−6.65 (5.0)	−140.01 (0.0)		−152.05 (0.0)	
Upfront				−16.99 (9.6)		21.65 (18.2)
WithGrace				−75.48 (0.0)		−169.92 (0.0)
InKind				2.08 (75.4)		−3.78 (80.0)
UltraPoor					−0.07 (99.5)	−0.07 (99.5)
Large × UltraPoor					−4.07 (75.7)	
LargeGrace × UltraPoor					7.80 (49.0)	
Cattle × UltraPoor					10.38 (37.3)	
Upfront × UltraPoor						−4.07 (75.7)
WithGrace × UltraPoor						11.87 (14.1)
InKind × UltraPoor						2.57 (64.3)
LY2			21.94 (7.6)	86.56 (0.0)	53.91 (0.2)	53.91 (0.2)
Large × LY2			−20.54 (1.5)		−47.15 (1.7)	
LargeGrace × LY2			202.85 (0.0)		166.12 (0.0)	
Cattle × LY2			216.04 (0.0)		182.78 (0.0)	
Upfront × LY2				−1.51 (91.5)		−47.15 (1.7)
WithGrace × LY2				54.29 (0.1)		213.27 (0.0)
InKind × LY2				−15.18 (36.8)		16.65 (46.7)
UltraPoor × LY2					−7.27 (54.8)	−7.27 (54.8)
Large × UltraPoor × LY2					5.27 (70.3)	
LargeGrace × UltraPoor × LY2					6.76 (63.9)	
Cattle × UltraPoor × LY2					−1.32 (93.3)	
Upfront × UltraPoor × LY2						5.27 (70.3)
WithGrace × UltraPoor × LY2						1.49 (88.5)
InKind × UltraPoor × LY2						−8.09 (53.6)

TABLE 3: INDIVIDUAL LEVEL EFFECTS OF REPAYMENT SHORTFALL (CONTINUED)

covariates	(1)	(2)	(3)	(4)	(5)	(6)
LY3			43.46	70.77	76.73	76.73
			(0.4)	(0.0)	(0.0)	(0.0)
Large × LY3			−17.04		−83.16	
			(17.2)		(0.1)	
LargeGrace × LY3			242.61		184.25	
			(0.0)		(0.0)	
Cattle × LY3			260.48		225.16	
			(0.0)		(0.0)	
Upfront × LY3				−89.08		−83.16
				(0.0)		(0.1)
WithGrace × LY3				140.00		267.41
				(0.0)		(0.0)
InKind × LY3				−9.03		40.91
				(68.9)		(23.6)
UltraPoor × LY3					−10.02	−10.02
					(26.8)	(26.8)
Large × UltraPoor × LY3					17.87	
					(33.4)	
LargeGrace × UltraPoor × LY3					7.12	
					(60.8)	
Cattle × UltraPoor × LY3					−29.52	
					(20.0)	
Upfront × UltraPoor × LY3						17.87
						(33.4)
WithGrace × UltraPoor × LY3						−10.75
						(58.1)
InKind × UltraPoor × LY3						−36.64
						(12.3)
LY4			−283.74	−168.44	−269.18	−269.18
			(0.0)	(0.0)	(0.0)	(0.0)
Large × LY4			−264.49		−7.66	
			(0.0)		(87.4)	
LargeGrace × LY4			−91.78		155.19	
			(0.2)		(0.1)	
Cattle × LY4			−136.17		141.55	
			(0.1)		(2.3)	
Upfront × LY4				−125.24		−7.66
				(0.8)		(87.4)
WithGrace × LY4				227.68		162.85
				(0.0)		(0.2)
InKind × LY4				−13.03		−13.63
				(83.0)		(83.2)
UltraPoor × LY4					−13.10	−13.10
					(69.5)	(69.5)
Large × UltraPoor × LY4					17.81	
					(67.1)	
LargeGrace × UltraPoor × LY4					43.79	
					(27.6)	
Cattle × UltraPoor × LY4					13.61	
					(73.8)	
Upfront × UltraPoor × LY4						17.81
						(67.1)
WithGrace × UltraPoor × LY4						25.98
						(44.8)
InKind × UltraPoor × LY4						−30.18
						(36.6)

Source: Estimated with GUK administrative data.

Notes: 1. Estimates of repayment shortfall controlling for group/village and year-month fixed effects using 48 month administrative records. The estimated model is $\tilde{y}_{it} = b_1 + \boldsymbol{b}_1'\mathbf{d}_i + b_2\mathsf{LY2} + \boldsymbol{b}_2'\mathbf{d}_i\mathsf{LY2} + b_3\mathsf{LY3} + \boldsymbol{b}_3'\mathbf{d}_i\mathsf{LY3} + b_4\mathsf{LY4} + \boldsymbol{b}_4'\mathbf{d}_i\mathsf{LY4} + \tilde{e}_{it}$, where $\tilde{x}_{it}$ is group and time demeaned value of variable x, $t = 1, \ldots, 48$ is an ellapsed month index, $\mathbf{d}_i$ is a three element vector of arms or functional attributes, $\mathsf{LY2}, \mathsf{LY3}, \mathsf{LY4}$ are indicator variables of loan years 2, 3, 4. Loan years are defined with the ellapsed months since the first disbursement date, 13-24 for LY2, 25-36 for LY3, and 37-48 for LY4. Fixed effects are controlled by differencing out respecive means from the data matrix. Shortfall y_{it} is (planned installment) - (actual repayment). Group shortfall$_{t-1}$ indicates a one month lagged mean shortfall amount of a group. Per member group net saving$_{t-1}$ and Per member cumulative group net saving (BDT1000)$_{t-1}$ give one month lagged average net saving in a group and their accumulated sums, respectively. Median group repayent shortfall rate is -1.42. 69 groups participated in the lending program.

2. Standard errors are clustered at group (village) level.

TABLE 3: INDIVIDUAL LEVEL EFFECTS OF REPAYMENT SHORTFALL (CONTINUED)

covariates	(1)	(2)	(3)	(4)	(5)	(6)
Group shortfall$_{t-1}$		−0.07 (23.6)			−0.22 (0.0)	−0.22 (0.0)
shortfall$_{t-1}$		0.45 (0.0)	0.27 (0.0)	−0.05 (0.0)	0.30 (0.0)	0.30 (0.0)
Per member group net saving$_{t-1}$					−0.11 (0.0)	−0.11 (0.0)
Per member cumulative group net saving (BDT1000)$_{t-1}$					−0.03 (41.0)	−0.03 (41.0)
number of clusters	69	69	69	69	69	69
$\bar{R}^2$	0	0.102	0.172	0.121	0.179	0.179
N	41901	41722	41722	41722	41722	41722

Source: Estimated with GUK administrative data.

Notes: 1. Estimates of repayment shortfall controlling for group/village and year-month fixed effects using 48 month administrative records. The estimated model is $\tilde{y}_{it} = b_1 + \boldsymbol{b}_1'\mathbf{d}_i + b_2\mathsf{LY2} + \boldsymbol{b}_2'\mathbf{d}_i\mathsf{LY2} + b_3\mathsf{LY3} + \boldsymbol{b}_3'\mathbf{d}_i\mathsf{LY3} + b_4\mathsf{LY4} + \boldsymbol{b}_4'\mathbf{d}_i\mathsf{LY4} + \tilde{e}_{it}$, where $\tilde{x}_{it}$ is group and time demeaned value of variable x, $t = 1, \ldots, 48$ is an ellapsed month index, $\mathbf{d}_i$ is a three element vector of arms or functional attributes, LY2, LY3, LY4 are indicator variables of loan years 2, 3, 4. Loan years are defined with the ellapsed months since the first disbursement date, 13-24 for LY2, 25-36 for LY3, and 37-48 for LY4. Fixed effects are controlled by differencing out respecive means from the data matrix. Shortfall y_{it} is (planned installment) - (actual repayment). Group shortfall$_{t-1}$ indicates a one month lagged mean shortfall amount of a group. Per member group net saving$_{t-1}$ and Per member cumulative group net saving (BDT1000)$_{t-1}$ give one month lagged average net saving in a group and their accumulated sums, respectively. Median group repayent shortfall rate is -1.42. 69 groups participated in the lending program.

2. Standard errors are clustered at group (village) level.

Finding .1 TABLE 1 shows group level repayment shortfall has a positive autocorrelation hence is persistent. In (1), the coefficient is smaller in groups with high shortfall rates, hinting loan repayment discipline as a group at some intermediate level. In (2) and (3), group level shortfall gets smaller in the third year than in the second year for all arms, indicating stronger efforts in repayment in the final loan year. In (4) and (5), the UltraPoor is found to have no larger repayment shortfall than the moderately poor, except for the Large arm or Upfront attribute in the second loan year. TABLE 2 (1), (4) and (5) also show persistence for individuals, although the magnitude is much smaller. In (1), lagged shortfall of others decreases with own shortfall only in high GRSR group. This confirms the group level repayment discipline that is consistent with a steady state short fall rate at an intermediate level as a group. In (2), shortfall is larger in the second and third year for the arms with a grace period. This reflects that a grace period does not necessarily help the borrowers to prepare repayments, which is against the intention to match the repayment with the cash flow. The ultra poor has smaller shortfall in all arms in year 2 except in the large grace arm in year 3. The results on the ultra poor may indicate the difference with the moderately poor is nominal.