

Comparing Models using Kolmogorov-Smirnov Test

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First test: Kolmogorov-Smirnov.

```
install.packages("ks.test", repos="http://R-Forge.R-project.org")
```

Given the data, I want to use the Kolmogorov-Smirnov test to evaluate the maximum distances between each of the 21 models. To do this, I want to create a matrix that shows the K-S test statistic between all of them.

For every one of the weeks 1 to 52 except for weeks 19 to 42 inclusive, the model makes a prediction for each week up to and including 4 weeks from that week. It also tries to predict the week for which the flu season begins, the peak percentage of flu incidence for this season, and the week during which the flu incidence peaks.

What I want to do is take each pair of the 21 models and run Kolmogorov-Smirnov tests between them for their predictions for weeks 1, 2, 3, and 4. I will do this by setting each of the 52 weeks to be the present week and thus derive 28 (skipping weeks 19 to 42) K-S test statistics for each pair. For each pair I shall generate a scatterplot of the test statistics and present them in a grid.

This simplified data will serve as a starting point for future tests.

```
# Stores the names of all the models in a vector.
```

```
modelsVector <- c("CU_EAKFC_SEIRS", "CU_EAKFC_SIRS", "CU_EKF_SEIRS", "CU_EKF_SIRS", "CU_RHF_SEIRS", "CU
```

It looks like we are comparing 22 models. Here I have created a vector to store their names and another vector to store the data.

```
# I create another vector to store the Kolmogorov-Smirnov test statistics for week 1.
```

```
KS Stats Week 1 <- numeric(choose(22, 2))
```

```
sysGlobNames <- numeric(22)
```

```
for (i in 1:22) {
```

```
sysGlobNames[i] <- paste("C:/Users/gladi/Documents/GitHub/cdc-flusight-ensemble/model-forecasts/real-
```

```
CU_EAKFC_SEIRS_Files <- lapply(Sys.glob(sysGlobNames[1]), read.csv)
```

```
CU_EAKFC_SEIRS_Files_Vector <- vector("list", length(CU_EAKFC_SEIRS_Files) )
```

```
for (i in 1:length(CU_EAKFC_SEIRS_Files)) {
```

```
# Removes all entries where Location is not US National
```

```
CU_EAKFC_SEIRS_Files[[i]] <- CU_EAKFC_SEIRS_Files[[i]][!(CU_EAKFC_SEIRS_Files[[i]]$Location != "US Na
```

```
# Removes all entries where Type is not equal to Point
```

```
CU EAKFC SEIRS Files[[i]] <- CU EAKFC SEIRS Files[[i]][!(CU EAKFC SEIRS Files[[i]]$Type != "Point"),]
```

Now that we're removed some data that I have deemed to be extraneous for this demo test, I

```
# will now extract the first four rows that represent the predicted flu incidences for the weeks ahead
```

```
CU_EAKFC_SEIRS_Files_Vector[[i]] <- CU_EAKFC_SEIRS_Files[[i]][1:4,]$Value
```

}

```
CU_EAKFC_SIRS_Files <- lapply(Sys.glob(sysGlobNames[2]), read.csv)
```

```
CU_EAKFC_SIRS_Files_Vector <- vector("list", length(CU_EAKFC_SIRS_Files))
```

```

for (i in 1:length(CU_EAKFC_SIRS_Files)) {
  CU_EAKFC_SIRS_Files[[i]] <- CU_EAKFC_SIRS_Files[[i]][!(CU_EAKFC_SIRS_Files[[i]]$Location != "US National"),]
  CU_EAKFC_SIRS_Files[[i]] <- CU_EAKFC_SIRS_Files[[i]][!(CU_EAKFC_SIRS_Files[[i]]$Type != "Point"),]
  CU_EAKFC_SIRS_Files_Vector[[i]] <- CU_EAKFC_SIRS_Files[[i]][1:4,]$Value
}

CU_EKF_SEIRS_Files <- lapply(Sys.glob(sysGlobNames[3]), read.csv)
CU_EKF_SEIRS_Files_Vector <- vector("list", length(CU_EKF_SEIRS_Files))
for (i in 1:length(CU_EKF_SEIRS_Files)) {
  CU_EKF_SEIRS_Files[[i]] <- CU_EKF_SEIRS_Files[[i]][!(CU_EKF_SEIRS_Files[[i]]$Location != "US National"),]
  CU_EKF_SEIRS_Files[[i]] <- CU_EKF_SEIRS_Files[[i]][!(CU_EKF_SEIRS_Files[[i]]$Type != "Point"),]
  CU_EKF_SEIRS_Files_Vector[[i]] <- CU_EKF_SEIRS_Files[[i]][1:4,]$Value
}

CU_EKF_SIRS_Files <- lapply(Sys.glob(sysGlobNames[4]), read.csv)
CU_EKF_SIRS_Files_Vector <- vector("list", length(CU_EKF_SIRS_Files))
for (i in 1:length(CU_EKF_SIRS_Files)) {
  CU_EKF_SIRS_Files[[i]] <- CU_EKF_SIRS_Files[[i]][!(CU_EKF_SIRS_Files[[i]]$Location != "US National"),]
  CU_EKF_SIRS_Files[[i]] <- CU_EKF_SIRS_Files[[i]][!(CU_EKF_SIRS_Files[[i]]$Type != "Point"),]
  CU_EKF_SIRS_Files_Vector[[i]] <- CU_EKF_SIRS_Files[[i]][1:4,]$Value
}

CU_RHF_SEIRS_Files <- lapply(Sys.glob(sysGlobNames[5]), read.csv)
CU_RHF_SEIRS_Files_Vector <- vector("list", length(CU_RHF_SEIRS_Files))
for (i in 1:length(CU_RHF_SEIRS_Files)) {
  CU_RHF_SEIRS_Files[[i]] <- CU_RHF_SEIRS_Files[[i]][!(CU_RHF_SEIRS_Files[[i]]$Location != "US National"),]
  CU_RHF_SEIRS_Files[[i]] <- CU_RHF_SEIRS_Files[[i]][!(CU_RHF_SEIRS_Files[[i]]$Type != "Point"),]
  CU_RHF_SEIRS_Files_Vector[[i]] <- CU_RHF_SEIRS_Files[[i]][1:4,]$Value
}

CU_RHF_SIRS_Files <- lapply(Sys.glob(sysGlobNames[6]), read.csv)
CU_RHF_SIRS_Files_Vector <- vector("list", length(CU_RHF_SIRS_Files))
for (i in 1:length(CU_RHF_SIRS_Files)) {
  CU_RHF_SIRS_Files[[i]] <- CU_RHF_SIRS_Files[[i]][!(CU_RHF_SIRS_Files[[i]]$Location != "US National"),]
  CU_RHF_SIRS_Files[[i]] <- CU_RHF_SIRS_Files[[i]][!(CU_RHF_SIRS_Files[[i]]$Type != "Point"),]
  CU_RHF_SIRS_Files_Vector[[i]] <- CU_RHF_SIRS_Files[[i]][1:4,]$Value
}

CUBMA_Files <- lapply(Sys.glob(sysGlobNames[7]), read.csv)
CUBMA_Files_Vector <- vector("list", length(CUBMA_Files))
for (i in 1:length(CUBMA_Files)) {
  CUBMA_Files[[i]] <- CUBMA_Files[[i]][!(CUBMA_Files[[i]]$Location != "US National"),]
  CUBMA_Files[[i]] <- CUBMA_Files[[i]][!(CUBMA_Files[[i]]$Type != "Point"),]
  CUBMA_Files_Vector[[i]] <- CUBMA_Files[[i]][1:4,]$Value
}

Delphi_BasisRegression_PackageDefaults_Files <- lapply(Sys.glob(sysGlobNames[8]), read.csv)
Delphi_BasisRegression_PackageDefaults_Files_Vector <- vector("list", length(Delphi_BasisRegression_Pack
for (i in 1:length(Delphi_BasisRegression_PackageDefaults_Files)) {
  Delphi_BasisRegression_PackageDefaults_Files[[i]] <- Delphi_BasisRegression_PackageDefaults_Files[[i]]
  Delphi_BasisRegression_PackageDefaults_Files[[i]] <- Delphi_BasisRegression_PackageDefaults_Files[[i]]
  Delphi_BasisRegression_PackageDefaults_Files_Vector[[i]] <- Delphi_BasisRegression_PackageDefaults_Fi
}

```

```

Delphi_DeltaDensity_PackageDefaults_Files <- lapply(Sys.glob(sysGlobNames[9]), read.csv)
Delphi_DeltaDensity_PackageDefaults_Files_Vector <- vector("list", length(Delphi_DeltaDensity_PackageDe
for (i in 1:length(Delphi_DeltaDensity_PackageDefaults_Files)) {
  Delphi_DeltaDensity_PackageDefaults_Files[[i]] <- Delphi_DeltaDensity_PackageDefaults_Files[[i]][!(De
  Delphi_DeltaDensity_PackageDefaults_Files[[i]] <- Delphi_DeltaDensity_PackageDefaults_Files[[i]][!(De
  Delphi_DeltaDensity_PackageDefaults_Files_Vector[[i]] <- Delphi_DeltaDensity_PackageDefaults_Files[[i]
}

Delphi_EmpiricalBayes_Cond4_Files <- lapply(Sys.glob(sysGlobNames[10]), read.csv)
Delphi_EmpiricalBayes_Cond4_Files_Vector <- vector("list", length(Delphi_EmpiricalBayes_Cond4_Files))
for (i in 1:length(Delphi_EmpiricalBayes_Cond4_Files)) {
  Delphi_EmpiricalBayes_Cond4_Files[[i]] <- Delphi_EmpiricalBayes_Cond4_Files[[i]][!(Delphi_EmpiricalBa
  Delphi_EmpiricalBayes_Cond4_Files[[i]] <- Delphi_EmpiricalBayes_Cond4_Files[[i]][!(Delphi_EmpiricalBa
  Delphi_EmpiricalBayes_Cond4_Files_Vector[[i]] <- Delphi_EmpiricalBayes_Cond4_Files[[i]][1:4,]$Value
}

Delphi_EmpiricalBayes_PackageDefaults_Files <- lapply(Sys.glob(sysGlobNames[11]), read.csv)
Delphi_EmpiricalBayes_PackageDefaults_Files_Vector <- vector("list", length(Delphi_EmpiricalBayes_Packa
for (i in 1:length(Delphi_EmpiricalBayes_PackageDefaults_Files)) {
  Delphi_EmpiricalBayes_PackageDefaults_Files[[i]] <- Delphi_EmpiricalBayes_PackageDefaults_Files[[i]][
  Delphi_EmpiricalBayes_PackageDefaults_Files[[i]] <- Delphi_EmpiricalBayes_PackageDefaults_Files[[i]][
  Delphi_EmpiricalBayes_PackageDefaults_Files_Vector[[i]] <- Delphi_EmpiricalBayes_PackageDefaults_Files
}

Delphi_EmpiricalFutures_PackageDefaults_Files <- lapply(Sys.glob(sysGlobNames[12]), read.csv)
Delphi_EmpiricalFutures_PackageDefaults_Files_Vector <- vector("list", length(Delphi_EmpiricalFutures_P
for (i in 1:length(Delphi_EmpiricalFutures_PackageDefaults_Files)) {
  Delphi_EmpiricalFutures_PackageDefaults_Files[[i]] <- Delphi_EmpiricalFutures_PackageDefaults_Files[[
  Delphi_EmpiricalFutures_PackageDefaults_Files[[i]] <- Delphi_EmpiricalFutures_PackageDefaults_Files[[
  Delphi_EmpiricalFutures_PackageDefaults_Files_Vector[[i]] <- Delphi_EmpiricalFutures_PackageDefaults_F
}

Delphi_EmpiricalTrajectories_PackageDefaults_Files <- lapply(Sys.glob(sysGlobNames[13]), read.csv)
Delphi_EmpiricalTrajectories_PackageDefaults_Files_Vector <- vector("list", length(Delphi_EmpiricalTraj
for (i in 1:length(Delphi_EmpiricalTrajectories_PackageDefaults_Files)) {
  Delphi_EmpiricalTrajectories_PackageDefaults_Files[[i]] <- Delphi_EmpiricalTrajectories_PackageDefaul
  Delphi_EmpiricalTrajectories_PackageDefaults_Files[[i]] <- Delphi_EmpiricalTrajectories_PackageDefaul
  Delphi_EmpiricalTrajectories_PackageDefaults_Files_Vector[[i]] <- Delphi_EmpiricalTrajectories_Packag
}

Delphi_MarkovianDeltaDensity_PackageDefaults_Files <- lapply(Sys.glob(sysGlobNames[14]), read.csv)
Delphi_MarkovianDeltaDensity_PackageDefaults_Files_Vector <- vector("list", length(Delphi_MarkovianDelt
for (i in 1:length(Delphi_MarkovianDeltaDensity_PackageDefaults_Files)) {
  Delphi_MarkovianDeltaDensity_PackageDefaults_Files[[i]] <- Delphi_MarkovianDeltaDensity_PackageDefaul
  Delphi_MarkovianDeltaDensity_PackageDefaults_Files[[i]] <- Delphi_MarkovianDeltaDensity_PackageDefaul
  Delphi_MarkovianDeltaDensity_PackageDefaults_Files_Vector[[i]] <- Delphi_MarkovianDeltaDensity_Packag
}

Delphi_Stat_FewerComponentsNoBackcastNoNowcast_Files <- lapply(Sys.glob(sysGlobNames[15]), read.csv)
Delphi_Stat_FewerComponentsNoBackcastNoNowcast_Files_Vector <- vector("list", length(Delphi_Stat_FewerC
for (i in 1:length(Delphi_Stat_FewerComponentsNoBackcastNoNowcast_Files)) {
  Delphi_Stat_FewerComponentsNoBackcastNoNowcast_Files[[i]] <- Delphi_Stat_FewerComponentsNoBackcastNoN
  Delphi_Stat_FewerComponentsNoBackcastNoNowcast_Files[[i]] <- Delphi_Stat_FewerComponentsNoBackcastNoN

```

```

Delphi_Stat_FewerComponentsNoBackcastNoNowcast_Files_Vector[[i]] <- Delphi_Stat_FewerComponentsNoBackcastNoNowcast_Files_Vector[[i]]
}

Delphi_Uniform_Files <- lapply(Sys.glob(sysGlobNames[16]), read.csv)
Delphi_Uniform_Files_Vector <- vector("list", length(Delphi_Uniform_Files))
for (i in 1:length(Delphi_Uniform_Files)) {
  Delphi_Uniform_Files[[i]] <- Delphi_Uniform_Files[[i]][!(Delphi_Uniform_Files[[i]]$Location != "US National"),]
  Delphi_Uniform_Files[[i]] <- Delphi_Uniform_Files[[i]][!(Delphi_Uniform_Files[[i]]$Type != "Point"),]
  Delphi_Uniform_Files_Vector[[i]] <- Delphi_Uniform_Files[[i]][1:4,]$Value
}

LANL_DBM_Files <- lapply(Sys.glob(sysGlobNames[17]), read.csv)
LANL_DBM_Files_Vector <- vector("list", length(LANL_DBM_Files))
for (i in 1:length(LANL_DBM_Files)) {
  LANL_DBM_Files[[i]] <- LANL_DBM_Files[[i]][!(LANL_DBM_Files[[i]]$Location != "US National"),]
  LANL_DBM_Files[[i]] <- LANL_DBM_Files[[i]][!(LANL_DBM_Files[[i]]$Type != "Point"),]
  LANL_DBM_Files_Vector[[i]] <- LANL_DBM_Files[[i]][1:4,]$Value
}

ReichLab_kcde_Files <- lapply(Sys.glob(sysGlobNames[18]), read.csv)
ReichLab_kcde_Files_Vector <- vector("list", length(ReichLab_kcde_Files))
for (i in 1:length(ReichLab_kcde_Files)) {
  ReichLab_kcde_Files[[i]] <- ReichLab_kcde_Files[[i]][!(ReichLab_kcde_Files[[i]]$Location != "US National"),]
  ReichLab_kcde_Files[[i]] <- ReichLab_kcde_Files[[i]][!(ReichLab_kcde_Files[[i]]$Type != "Point"),]
  ReichLab_kcde_Files_Vector[[i]] <- ReichLab_kcde_Files[[i]][1:4,]$Value
}

ReichLab_kde_Files <- lapply(Sys.glob(sysGlobNames[19]), read.csv)
ReichLab_kde_Files_Vector <- vector("list", length(ReichLab_kde_Files))
for (i in 1:length(ReichLab_kde_Files)) {
  ReichLab_kde_Files[[i]] <- ReichLab_kde_Files[[i]][!(ReichLab_kde_Files[[i]]$Location != "US National"),]
  ReichLab_kde_Files[[i]] <- ReichLab_kde_Files[[i]][!(ReichLab_kde_Files[[i]]$Type != "Point"),]
  ReichLab_kde_Files_Vector[[i]] <- ReichLab_kde_Files[[i]][1:4,]$Value
}

ReichLab_sarima_seasonal_difference_FALSE_Files <- lapply(Sys.glob(sysGlobNames[20]), read.csv)
ReichLab_sarima_seasonal_difference_FALSE_Files_Vector <- vector("list", length(ReichLab_sarima_seasonal_difference_FALSE_Files))
for (i in 1:length(ReichLab_sarima_seasonal_difference_FALSE_Files)) {
  ReichLab_sarima_seasonal_difference_FALSE_Files[[i]] <- ReichLab_sarima_seasonal_difference_FALSE_Files[[i]]
  ReichLab_sarima_seasonal_difference_FALSE_Files[[i]] <- ReichLab_sarima_seasonal_difference_FALSE_Files[[i]]
  ReichLab_sarima_seasonal_difference_FALSE_Files_Vector[[i]] <- ReichLab_sarima_seasonal_difference_FALSE_Files[[i]]
}

ReichLab_sarima_seasonal_difference_TRUE_Files <- lapply(Sys.glob(sysGlobNames[21]), read.csv)
ReichLab_sarima_seasonal_difference_TRUE_Files_Vector <- vector("list", length(ReichLab_sarima_seasonal_difference_TRUE_Files))
for (i in 1:length(ReichLab_sarima_seasonal_difference_TRUE_Files)) {
  ReichLab_sarima_seasonal_difference_TRUE_Files[[i]] <- ReichLab_sarima_seasonal_difference_TRUE_Files[[i]]
  ReichLab_sarima_seasonal_difference_TRUE_Files[[i]] <- ReichLab_sarima_seasonal_difference_TRUE_Files[[i]]
  ReichLab_sarima_seasonal_difference_TRUE_Files_Vector[[i]] <- ReichLab_sarima_seasonal_difference_TRUE_Files[[i]]
}

UTAustin_edm_Files <- lapply(Sys.glob(sysGlobNames[22]), read.csv)
UTAustin_edm_Files_Vector <- vector("list", length(UTAustin_edm_Files))

```

```

for (i in 1:length(UTAustin_edm_Files)) {
  UTAustin_edm_Files[[i]] <- UTAustin_edm_Files[[i]][!(UTAustin_edm_Files[[i]]$Location != "US National
  UTAustin_edm_Files[[i]] <- UTAustin_edm_Files[[i]][!(UTAustin_edm_Files[[i]]$Type != "Point"),]
  UTAustin_edm_Files_Vector[[i]] <- UTAustin_edm_Files[[i]][1:4,]$Value
}

# Since I first want to look at the K-S test statistic instead of the p-values,
# I will not use the ks.test() function for now.

choose(21, 2)

## [1] 210

# There are 210 possible combinations excluding the last model, UTAustin (which has fewer sets of predi

vectorNames <- c("CU_EAKFC_SEIRS_Files_Vector", "CU_EAKFC_SIRS_Files_Vector", "CU_EKF_SEIRS_Files_Vector")

listofVectors <- vector("list", 210)
for (i in 1:length(listofVectors)) {
  listofVectors[[i]] <- numeric(28)
  # We could append more things into each vector (the titles for the plots) later
}
# Following this process of extracting the necessary data from the models' prediction files
# I now want to graph some K-S test statistics between each pair of models:

# For Now, I will exclude the last one (UTAustin).
# I will also exclude three of the observations on one of the Reich lab kde model's predictions.

j = 1 # Refers to a vector in the list
x = 1 # the first model being compared
while (j <= 210) {

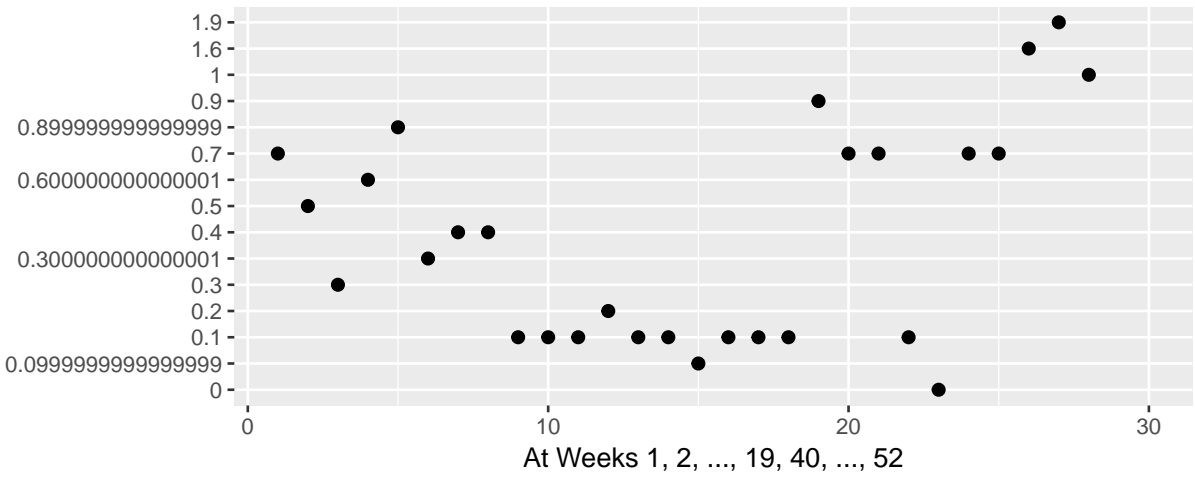
  while (x <= 21) {
    k = x + 1 # the second model being compared
    while (k <= 21) {
      # This for-loop places the 28 K-S comparisons for the pair of models into the jth place
      # in the list of Vectors.
      for (i in 1:28) {
        listofVectors[[j]][i] <- max(abs(eval(as.name(vectorNames[x]))[[i]] - eval(as.name(vectorNames[k]))[[i]]))
      }
      listofVectors[[j]][29] <- paste(vectorNames[x], vectorNames[k], sep = "&")
      k = k + 1
      j = j + 1
    }
    x = x + 1
  }
}

```

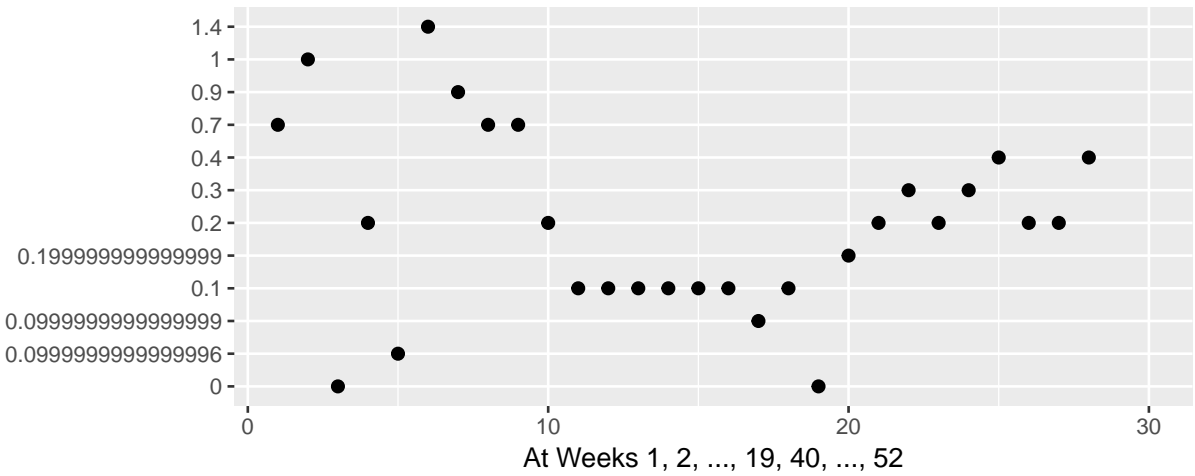
```
library(ggformula)
for (a in 1:210) {
  print(gf_point(listofVectors[[a]][1:28] ~ seq_along(listofVectors[[a]][1:28]), xlab = "At Weeks 1, 2, ..., 19, 40, ..., 52",
})
```

Relationships Between Models' Predictions for the Next

CU_EAKFC_SEIRS_Files_Vector&CU_EAKFC_SIRS_Files_Vector

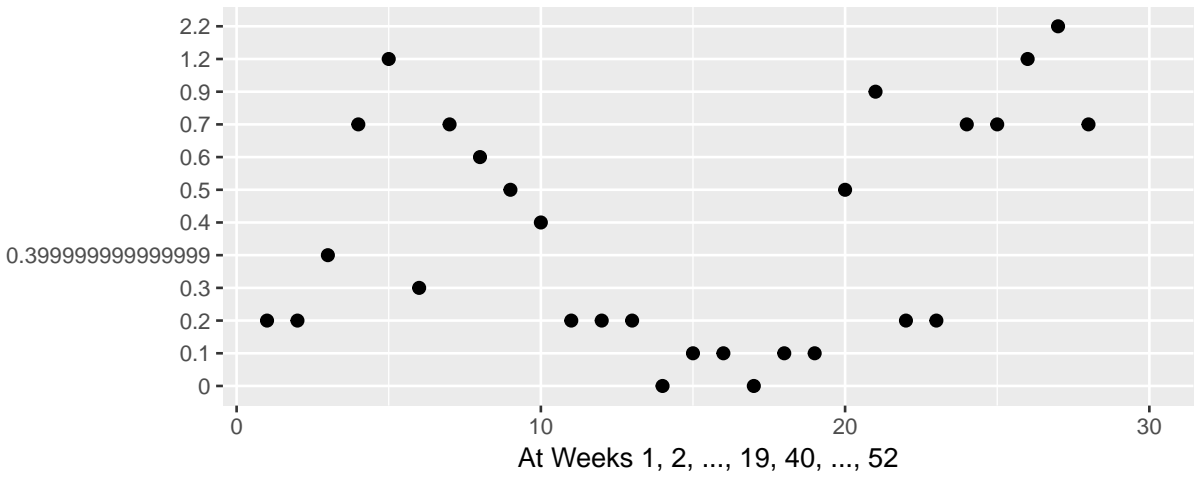


CU_EAKFC_SEIRS_Files_Vector&CU_EKF_SEIRS_Files_Vector

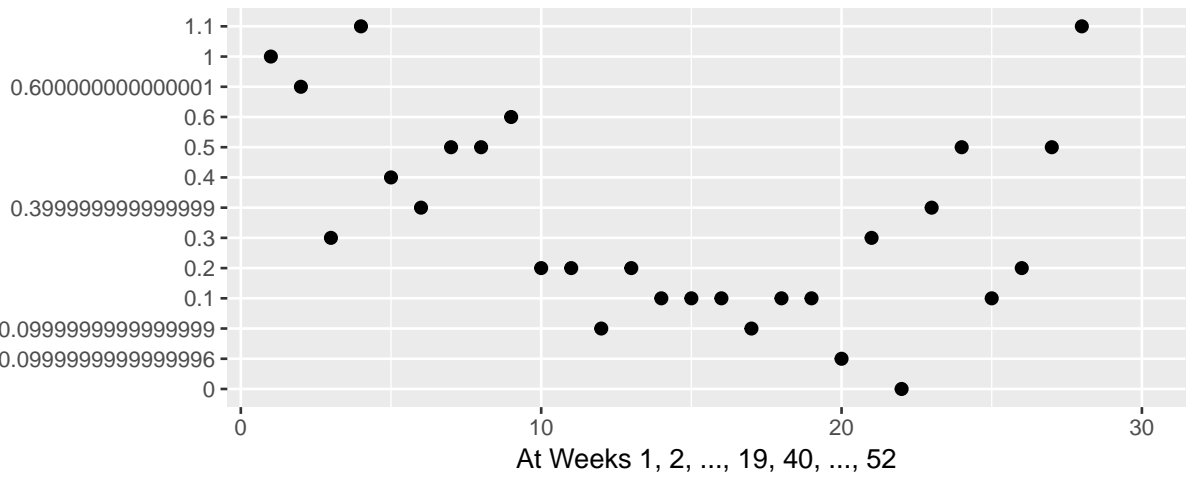


Relationships Between Models' Predictions for the Next

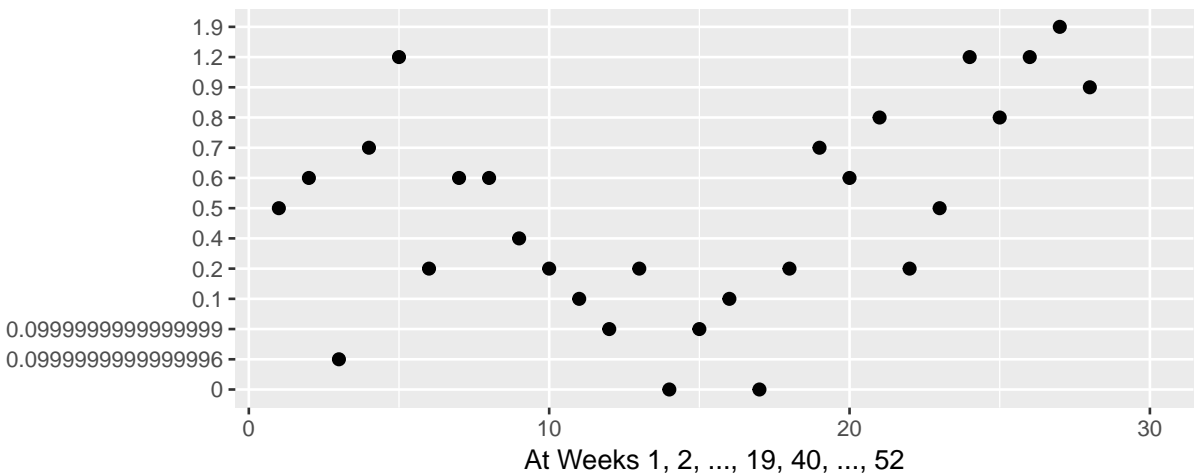
CU_EAKFC_SEIRS_Files_Vector&CU_EKF_SIRS_Files_Vector



CU_EAKFC_SEIRS_Files_Vector&CU_RHF_SEIRS_Files_Vector

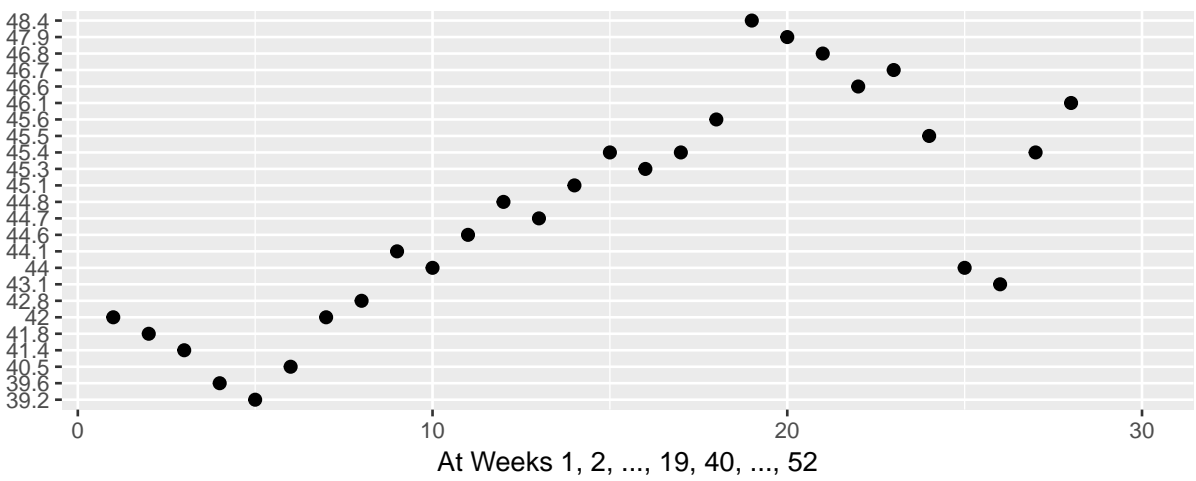


CU_EAKFC_SEIRS_Files_Vector&CU_RHF_SIRS_Files_Vector

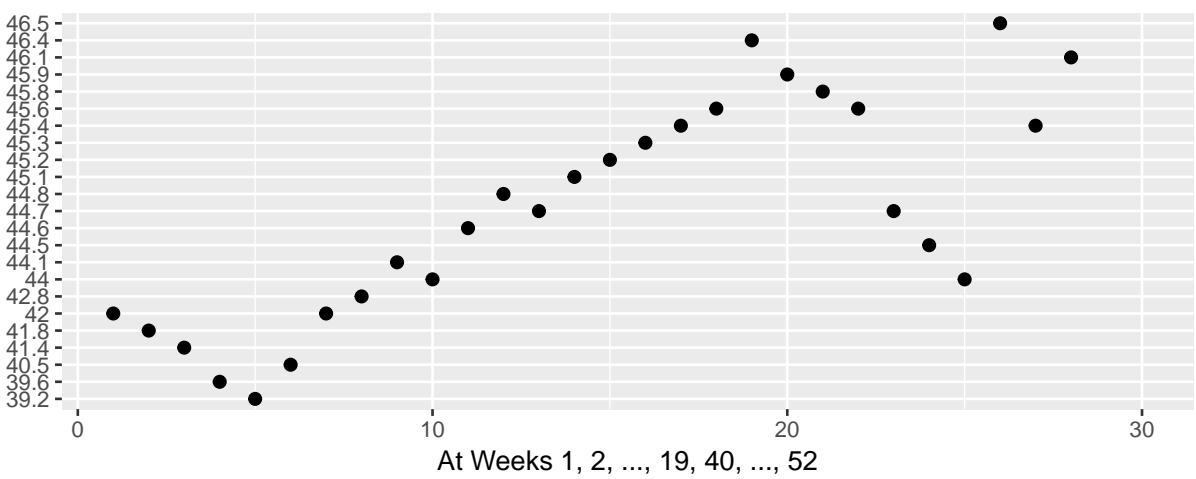


ats Between Models' Predictions for the Nex

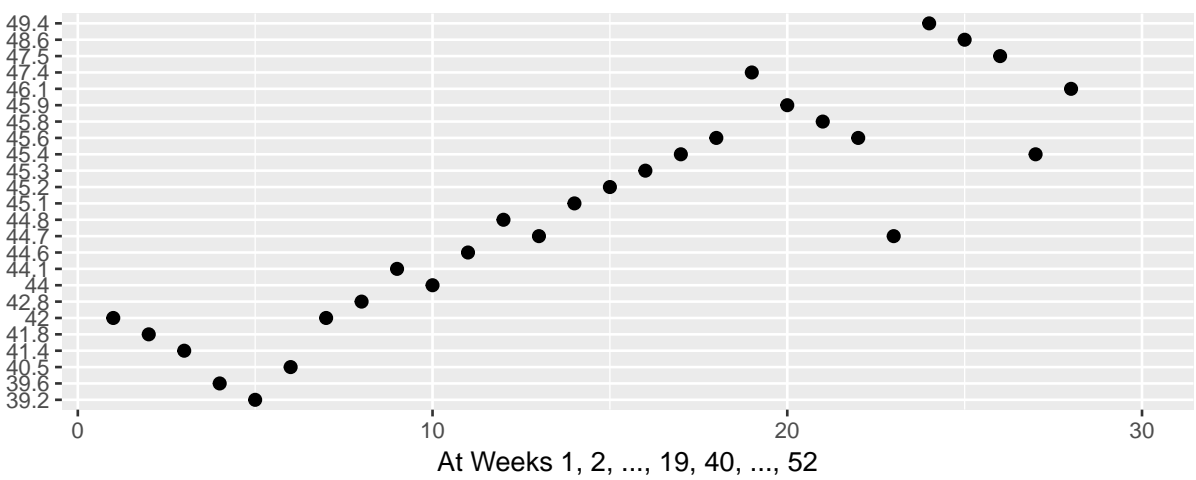
CU_EAKFC_SEIRS_Files_Vector&CUBMA_Files_Vector



CU_EAKFC_SEIRS_Files_Vector&Delphi_BasisRegression_PackageDefaults_F

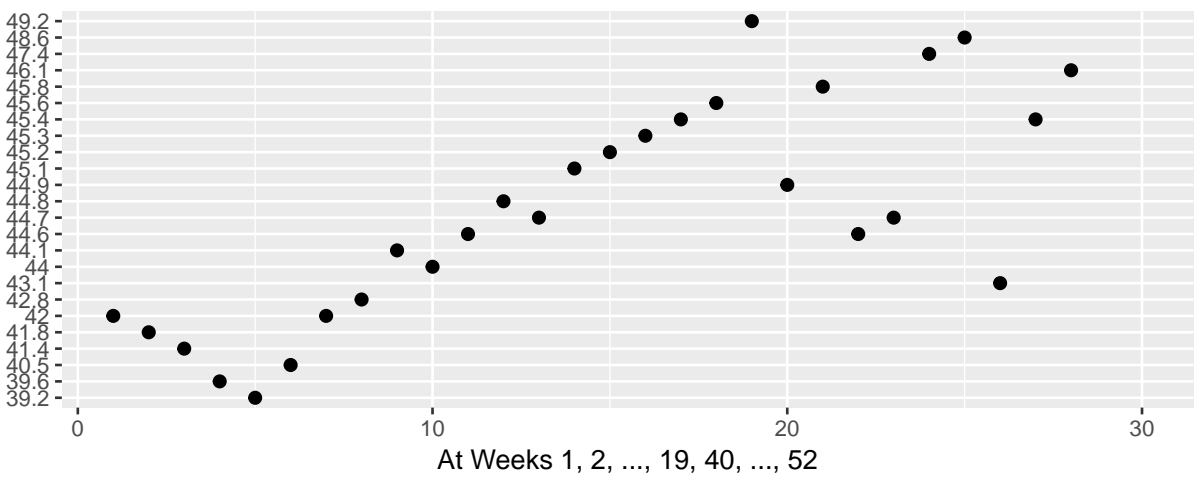


CU_EAKFC_SEIRS_Files_Vector&Delphi_DeltaDensity_PackageDefaults_Files_

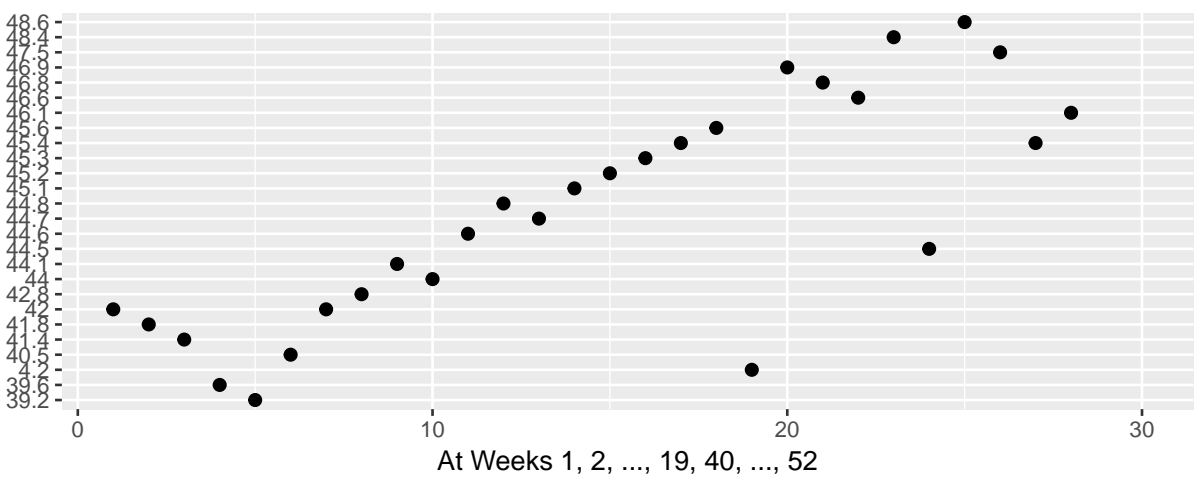


ats Between Models' Predictions for the Nex

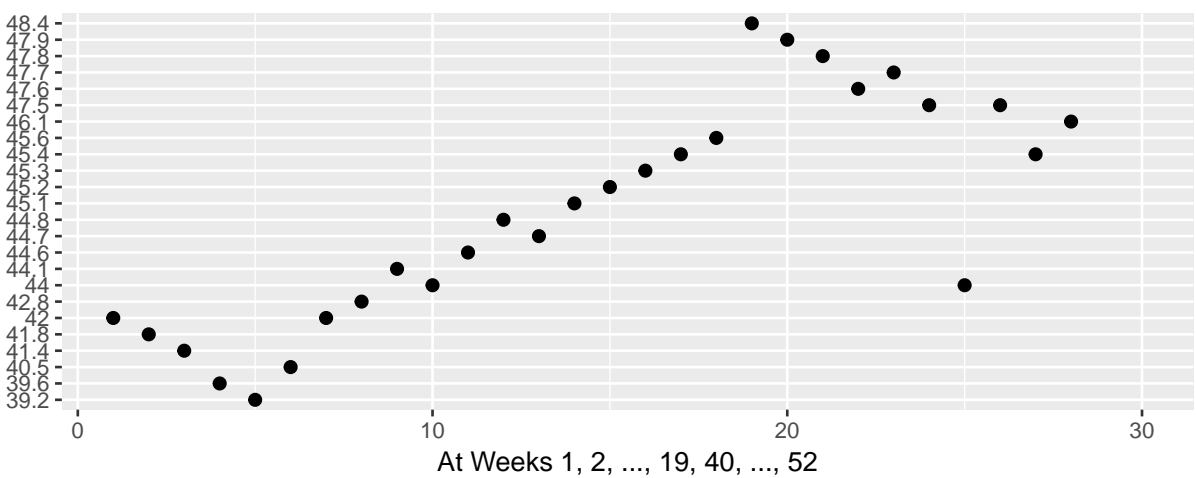
CU_EAKFC_SEIRS_Files_Vector&Delphi_EmpiricalBayes_Cond4_Files_Vector



CU_EAKFC_SEIRS_Files_Vector&Delphi_EmpiricalBayes_PackageDefaults_Fil

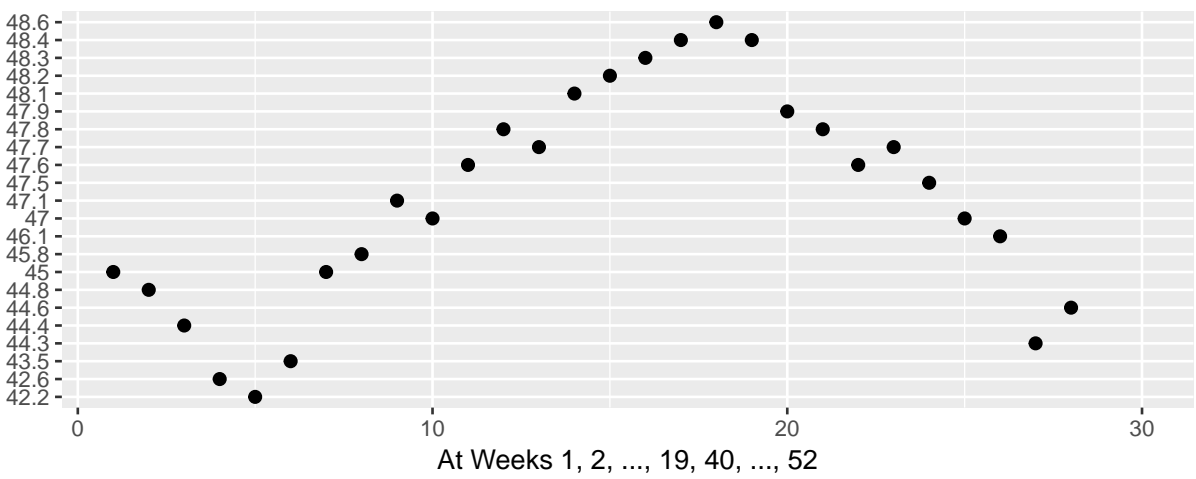


CU_EAKFC_SEIRS_Files_Vector&Delphi_EmpiricalFutures_PackageDefaults_F

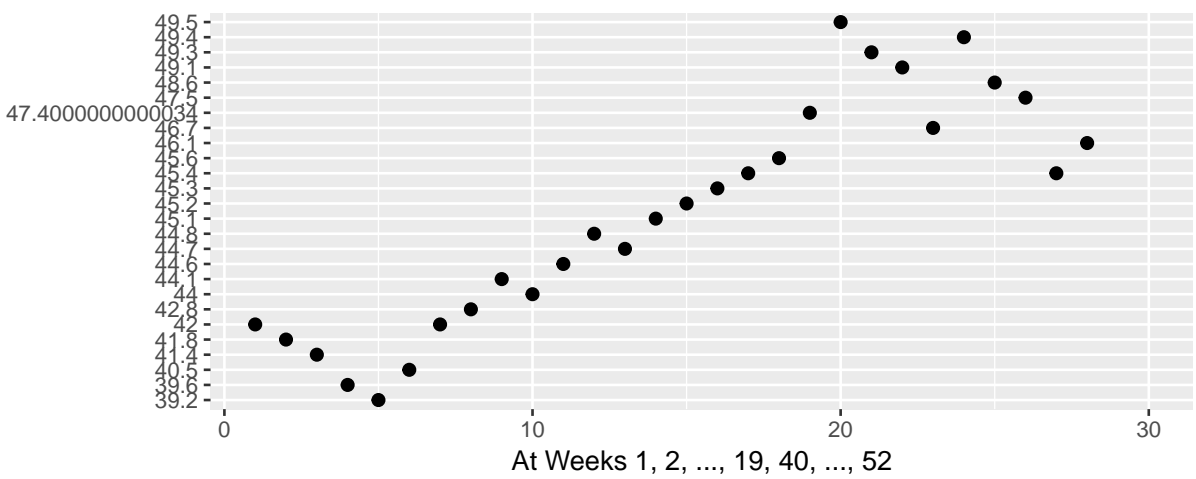


ats Between Models' Predictions for the Nex

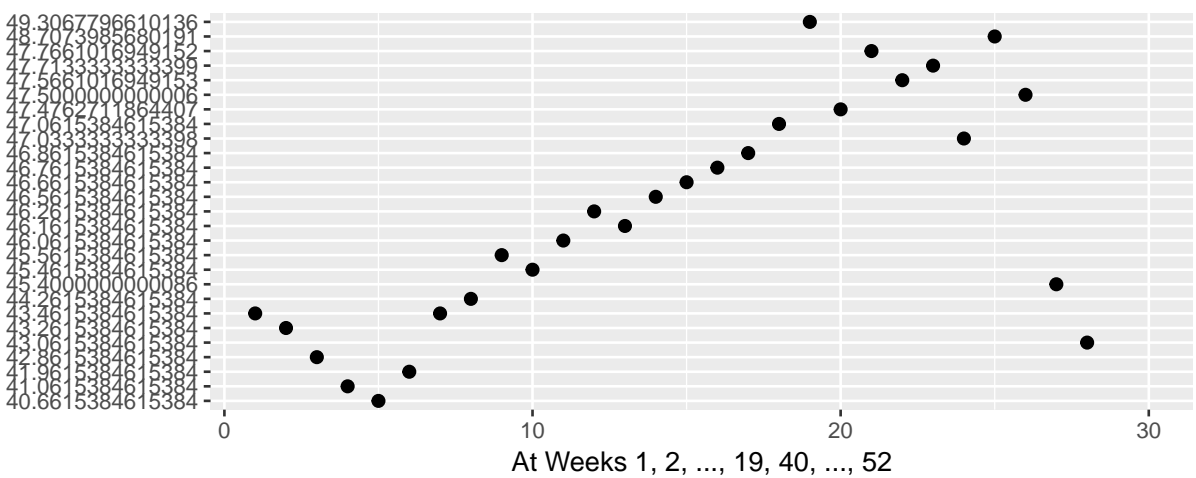
CU_EAKFC_SEIRS_Files_Vector&Delphi_EmpiricalTrajectories_PackageDefault



CU_EAKFC_SEIRS_Files_Vector&Delphi_MarkovianDeltaDensity_Pa

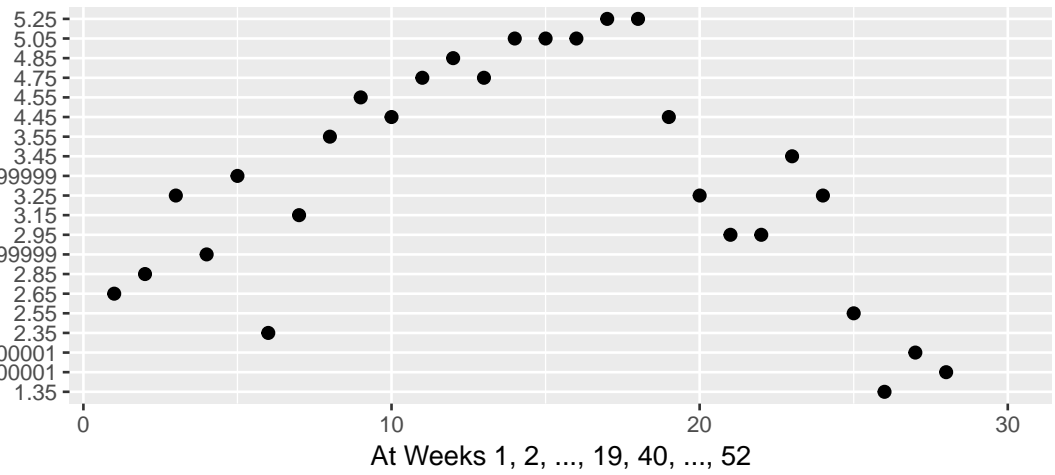


CU_EAKFC_SEIRS_Files_Vector&Delphi_Stat_FewerComponentsNo

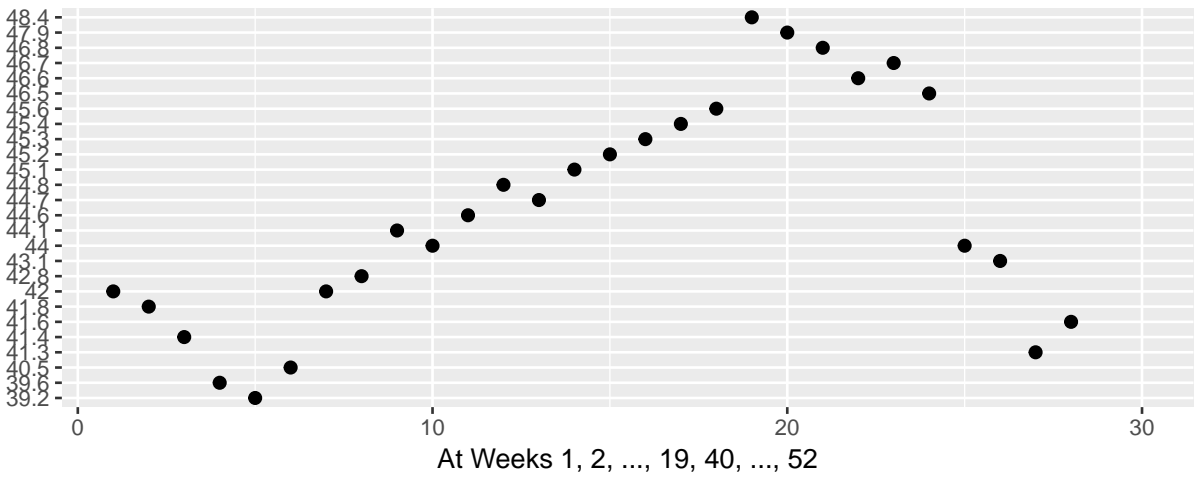


ats Between Models' Predictions for the Nex

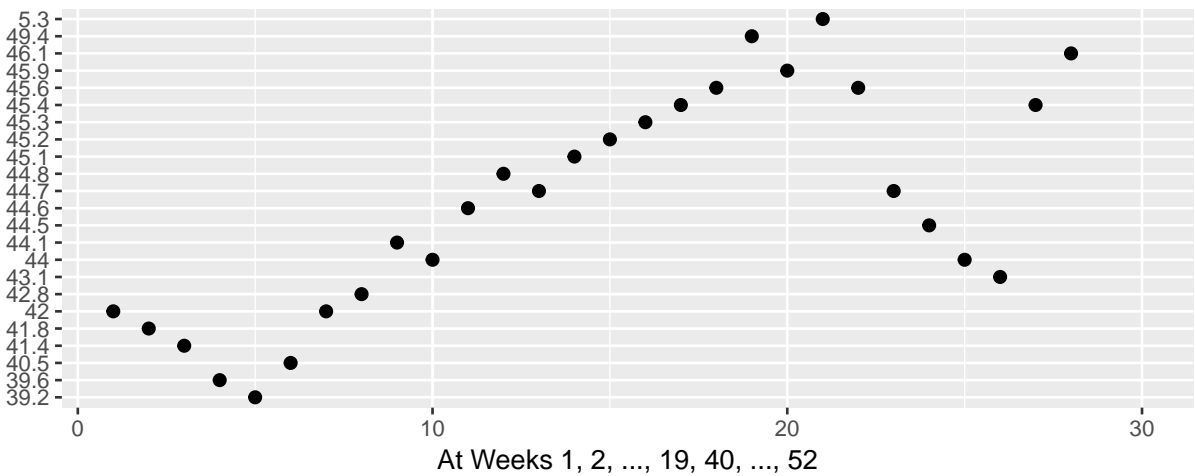
CU_EAKFC_SEIRS_Files_Vector&Delphi_Uniform_Files_Vector



CU_EAKFC_SEIRS_Files_Vector&LANL_DBM_Files_Vector

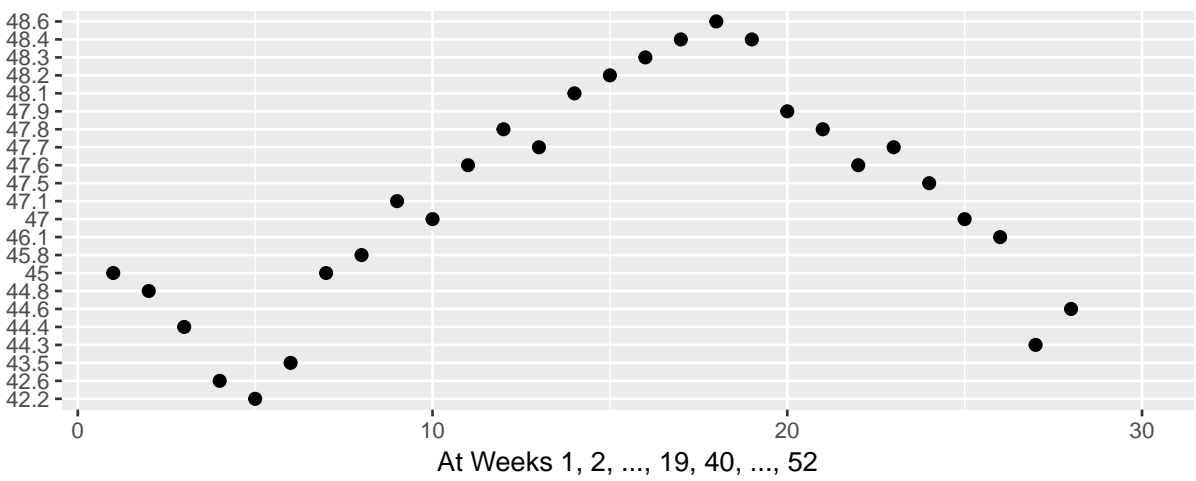


CU_EAKFC_SEIRS_Files_Vector&ReichLab_kcde_Files_Vector

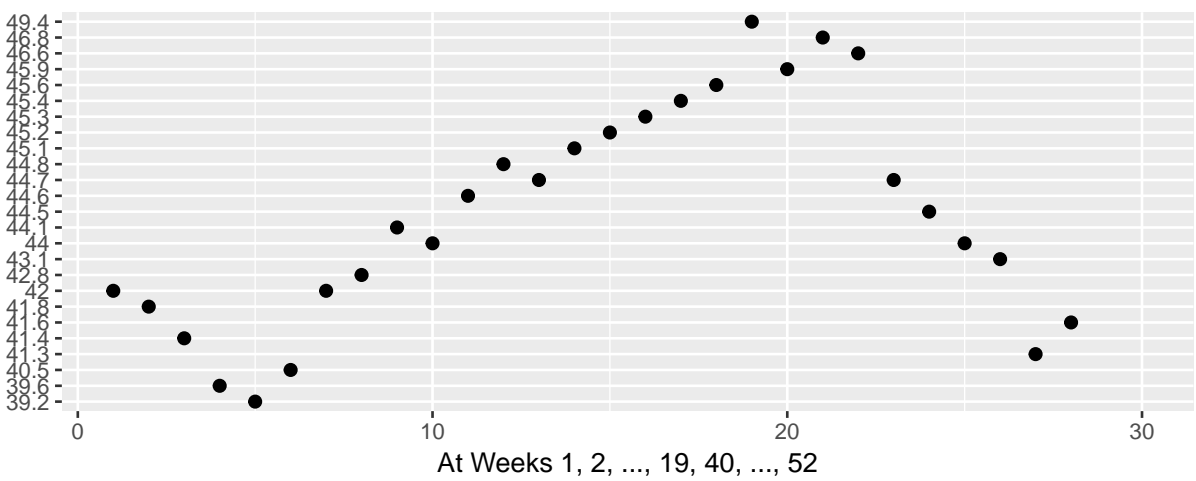


ats Between Models' Predictions for the Nex

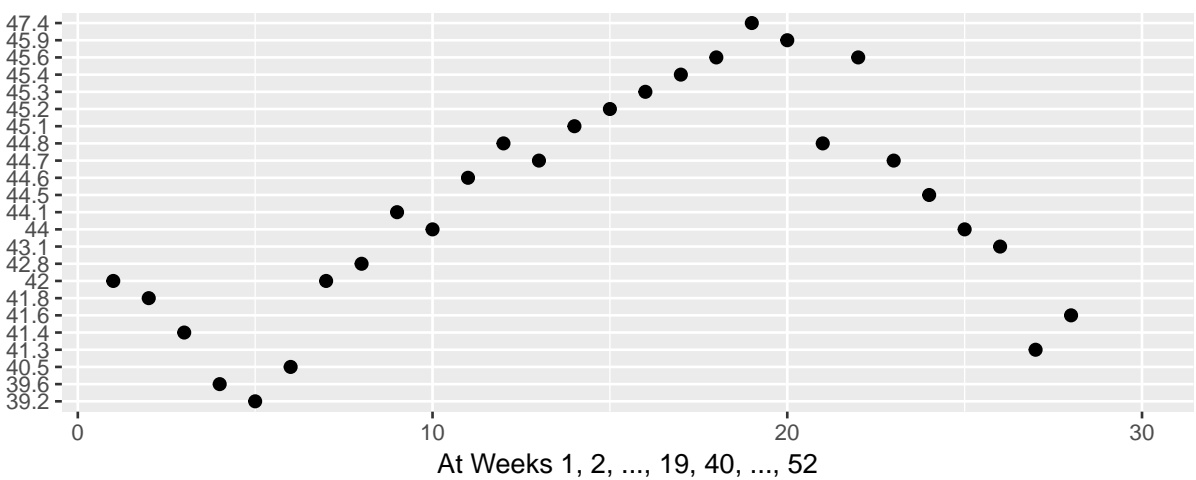
CU_EAKFC_SEIRS_Files_Vector&ReichLab_kde_Files_Vector



CU_EAKFC_SEIRS_Files_Vector&ReichLab_sarima_seasonal_difference_FALS

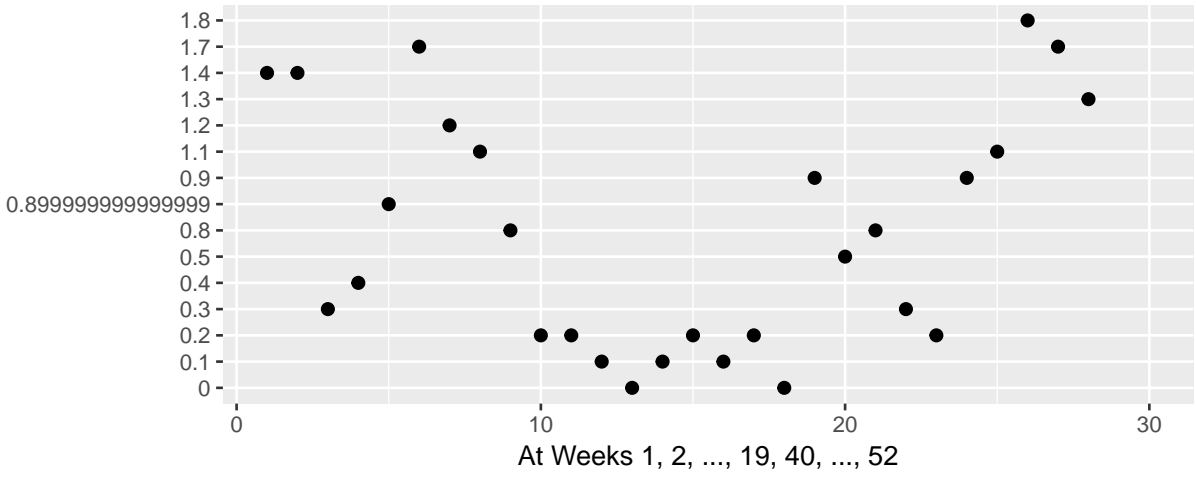


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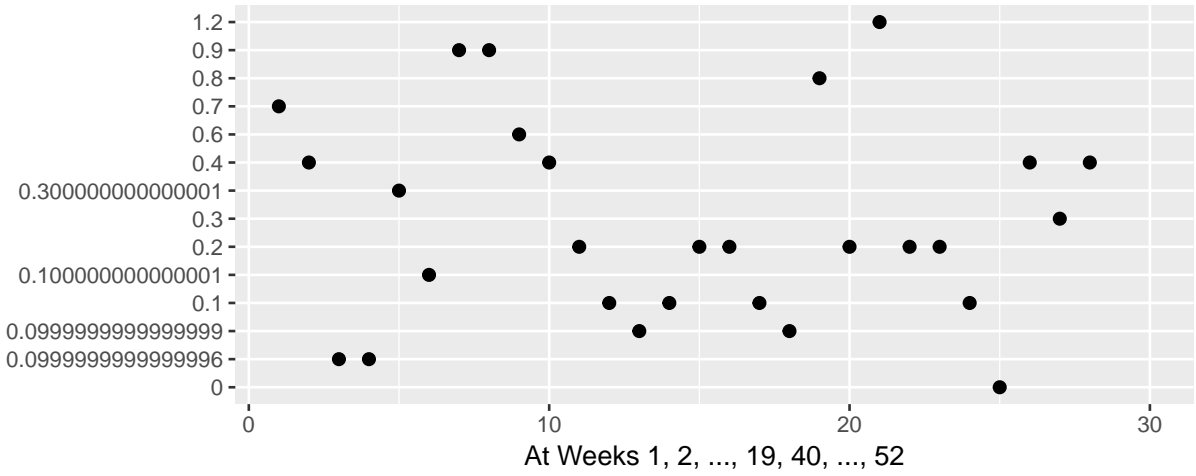


Relationships Between Models' Predictions for the Next

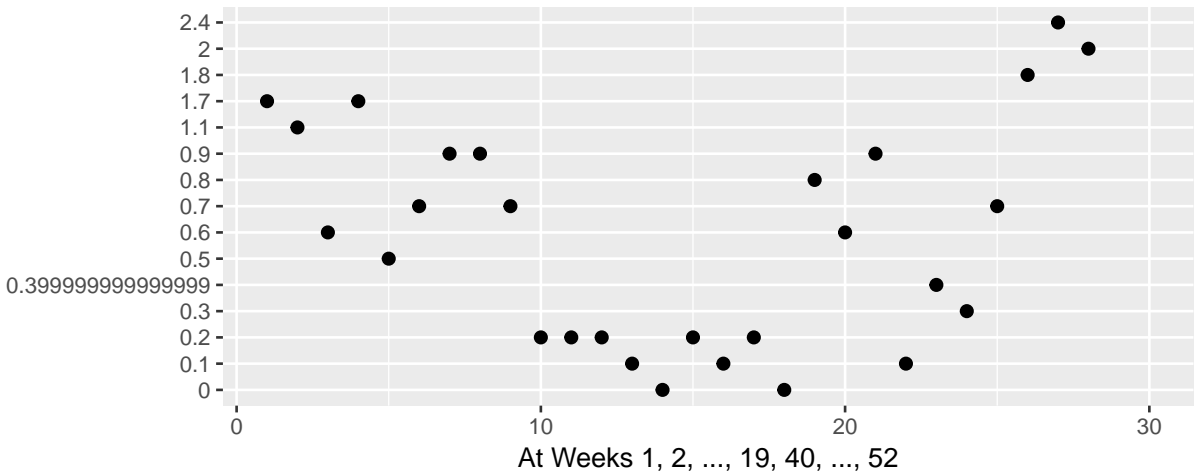
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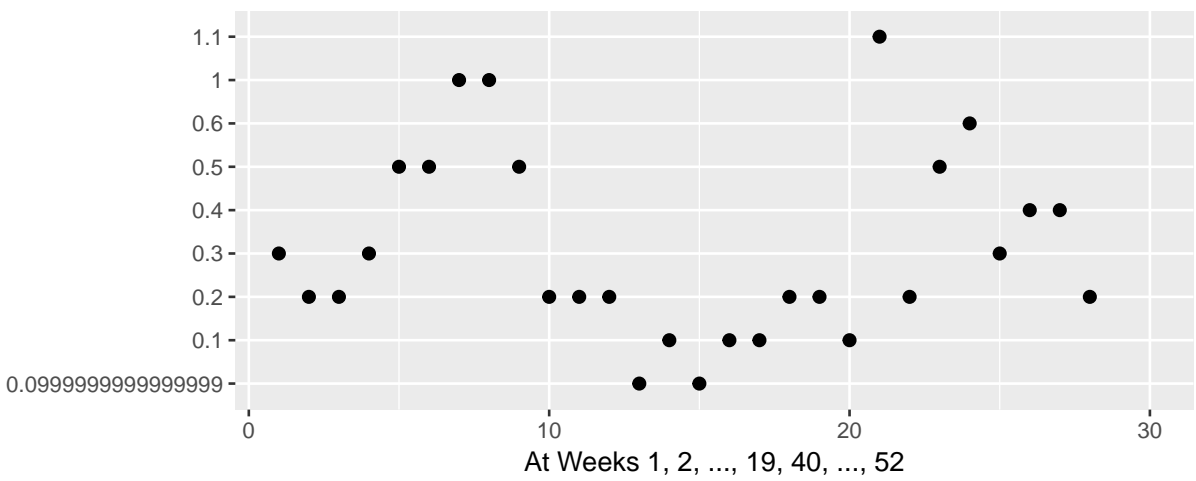


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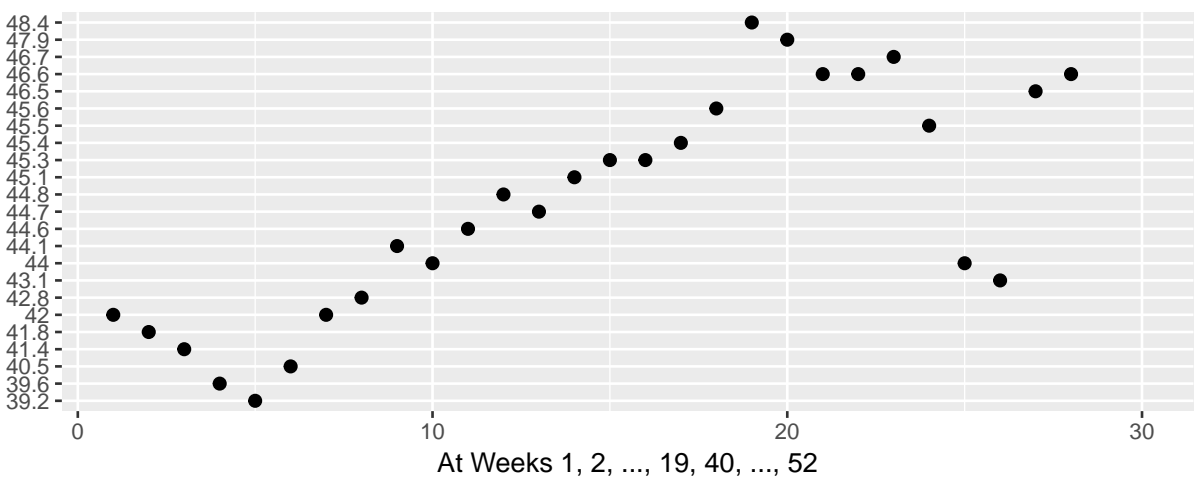


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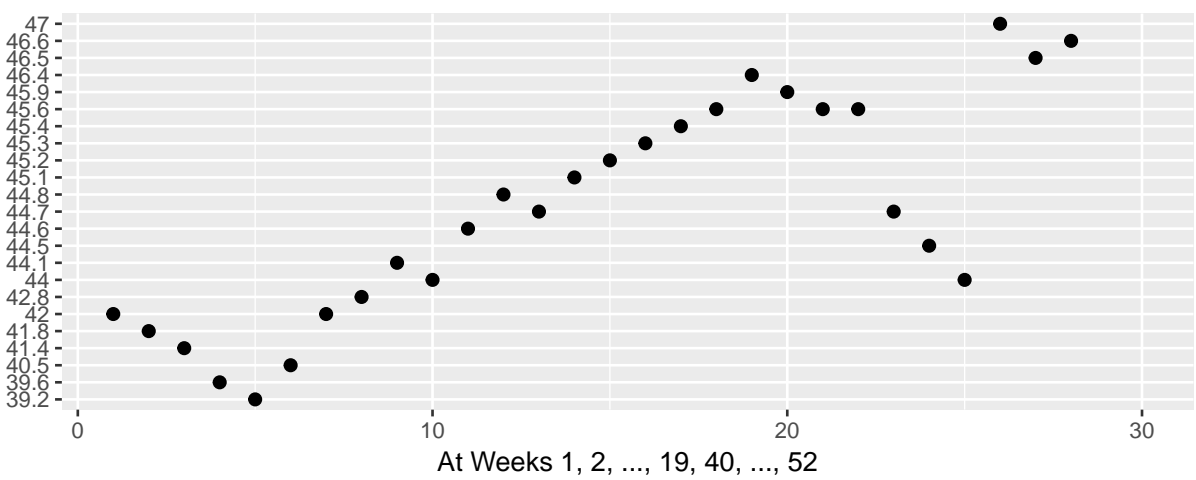
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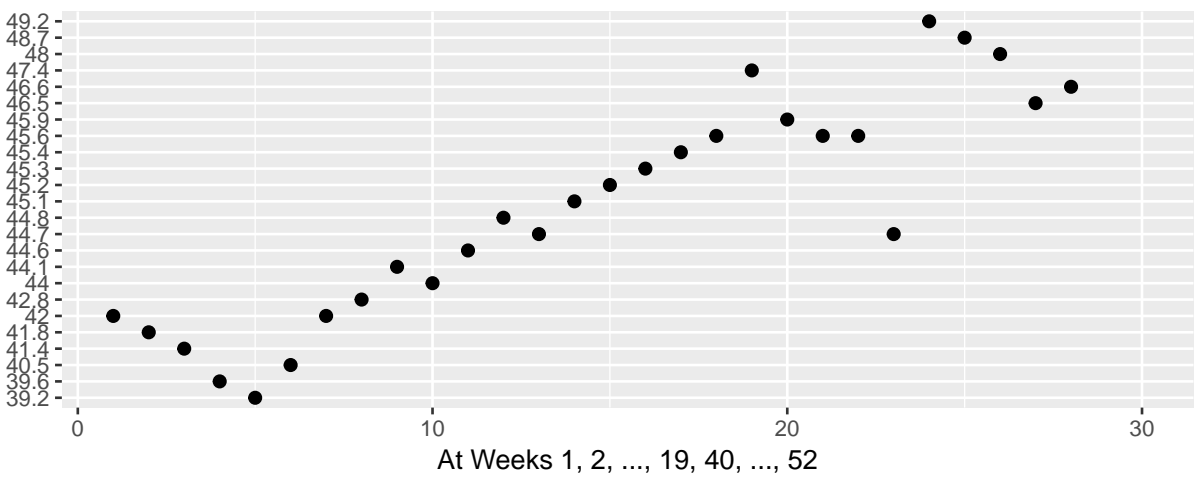


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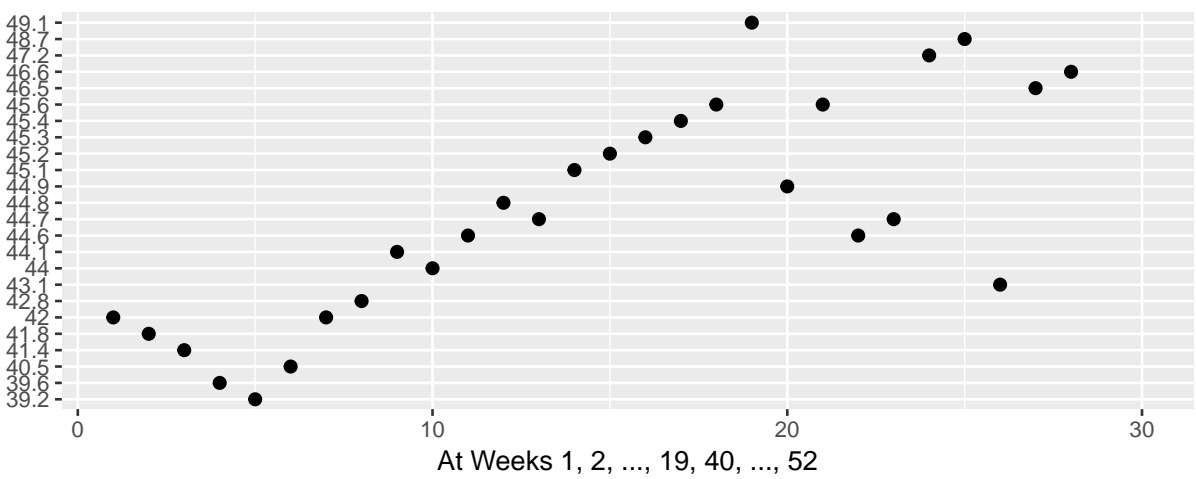


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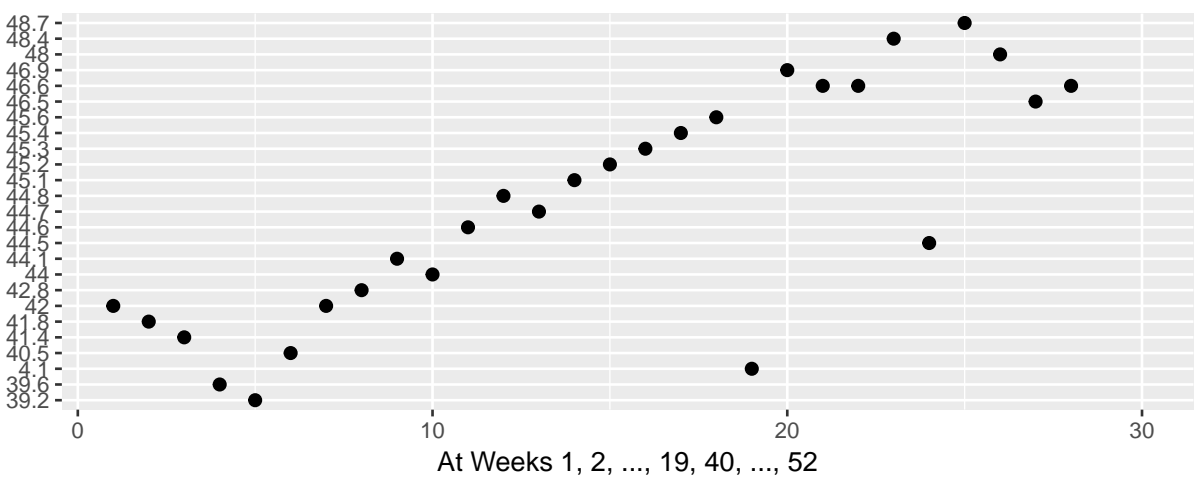
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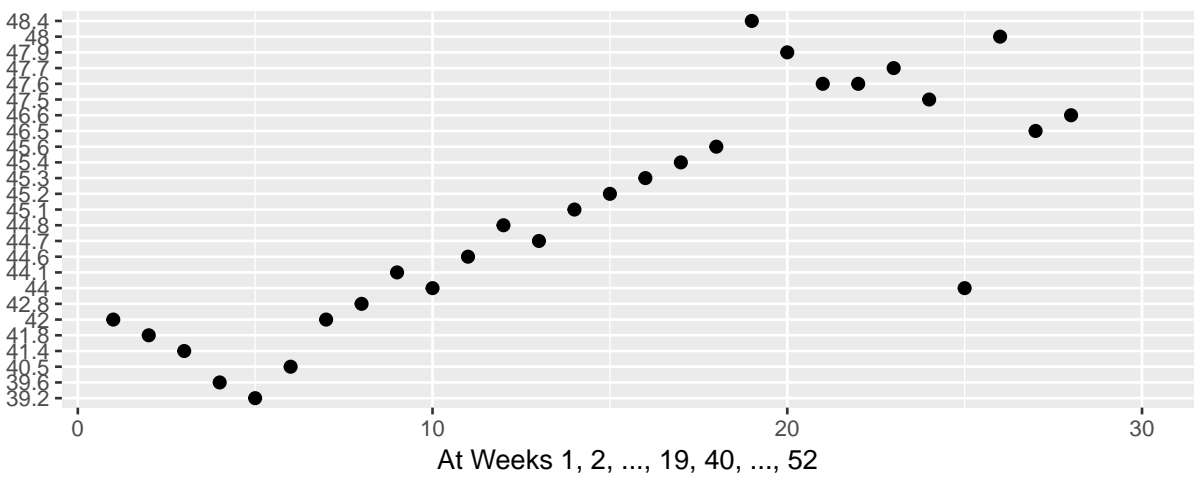


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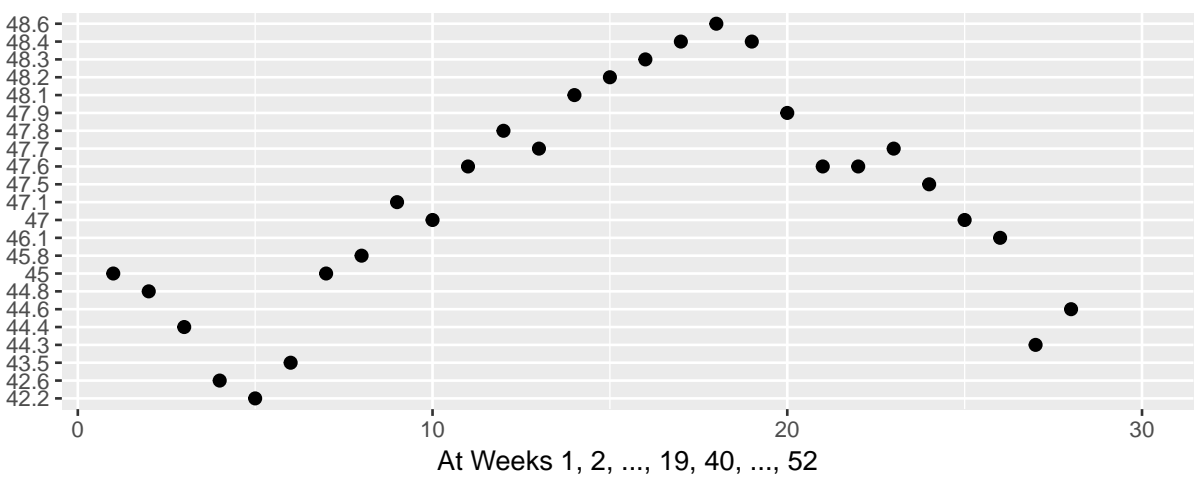


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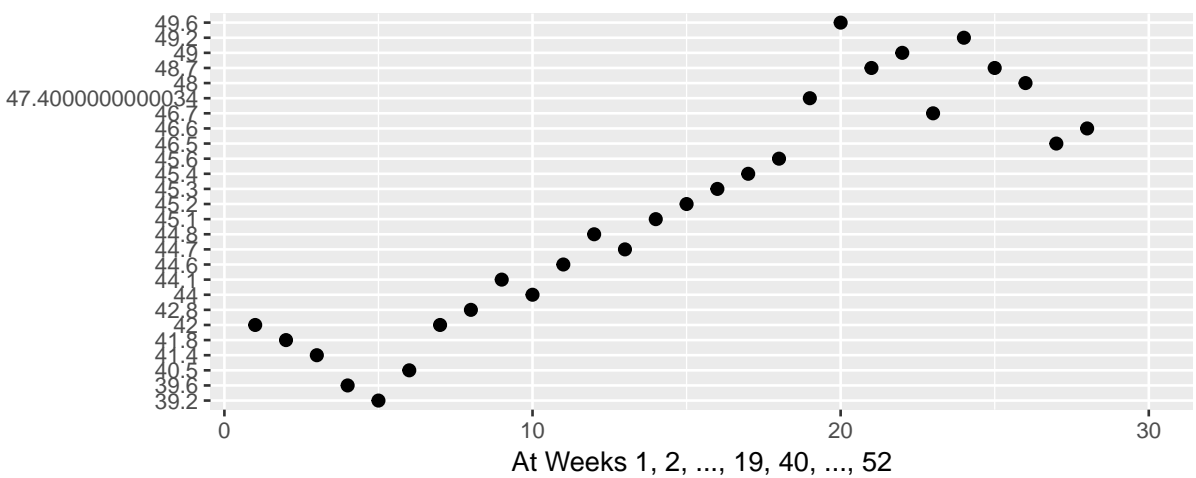
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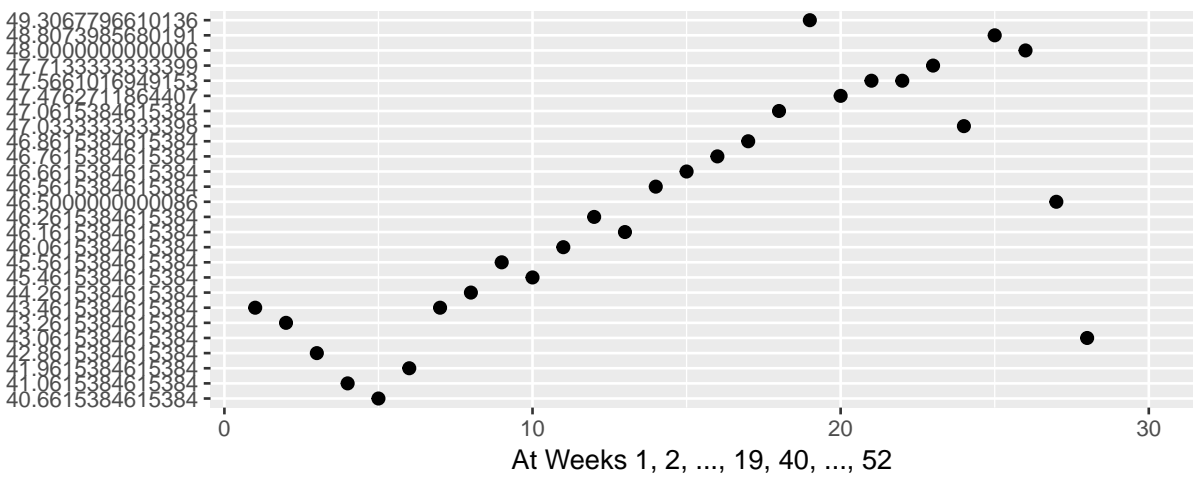


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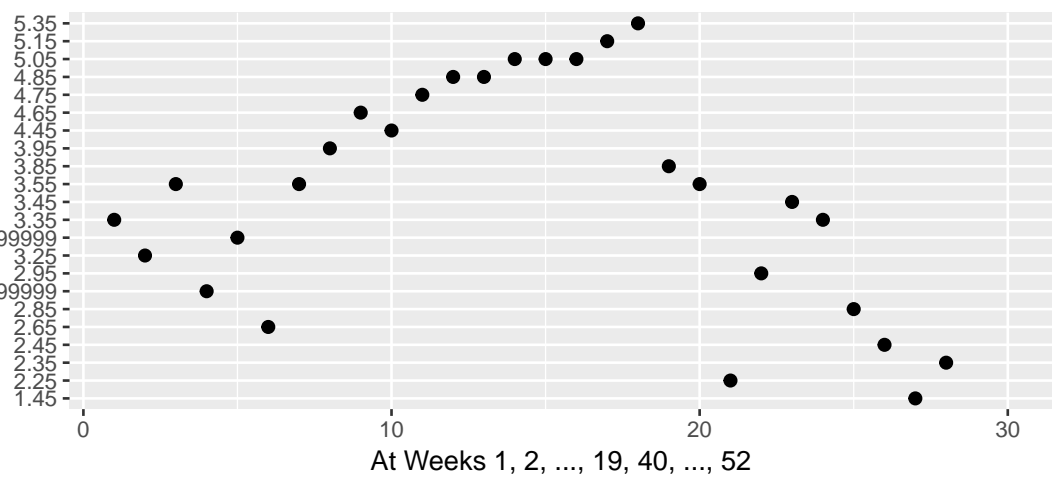


Relationships Between Models' Predictions for the Next

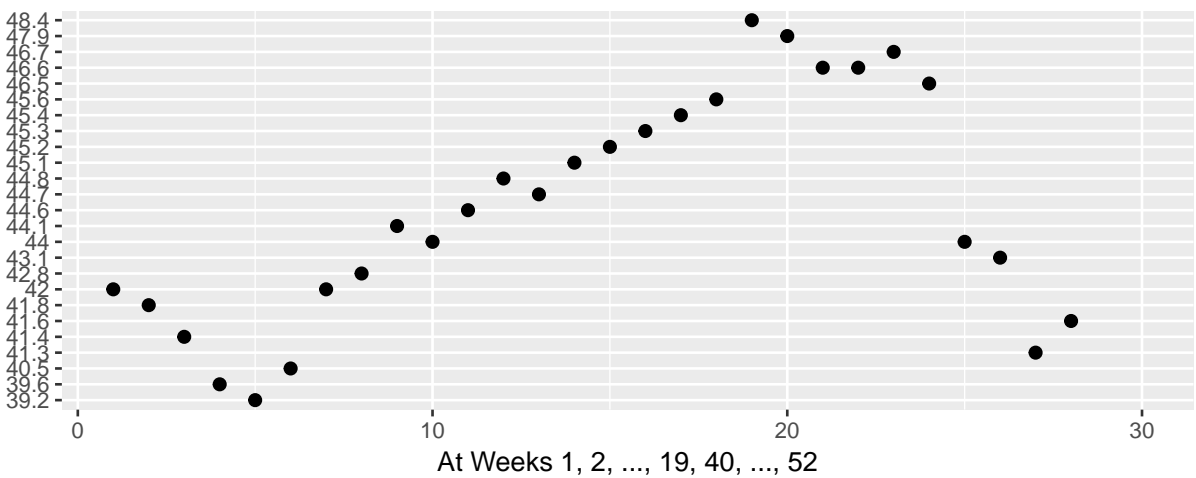
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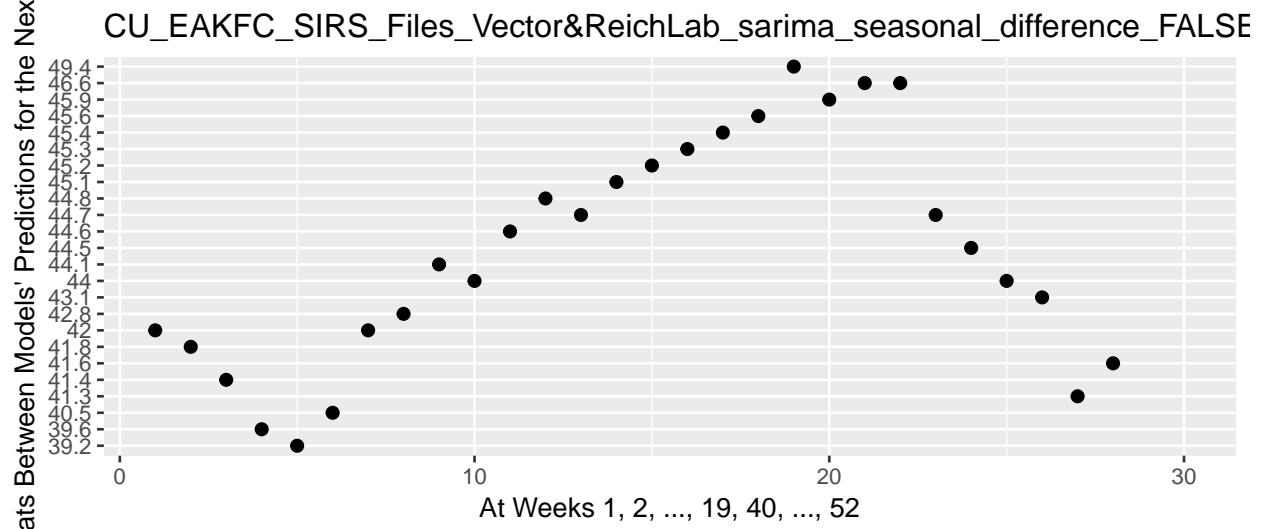
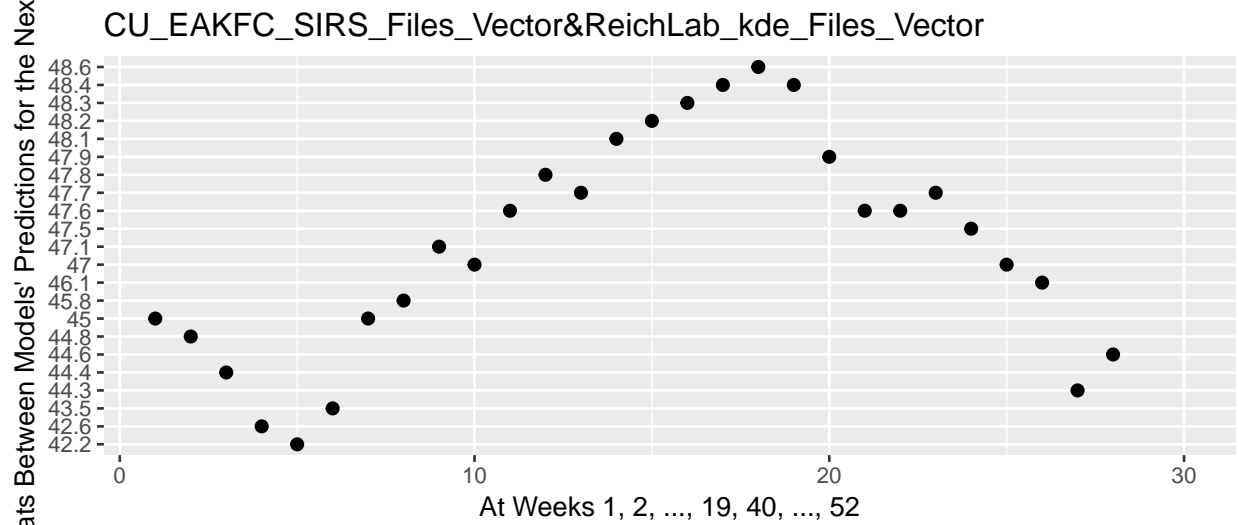
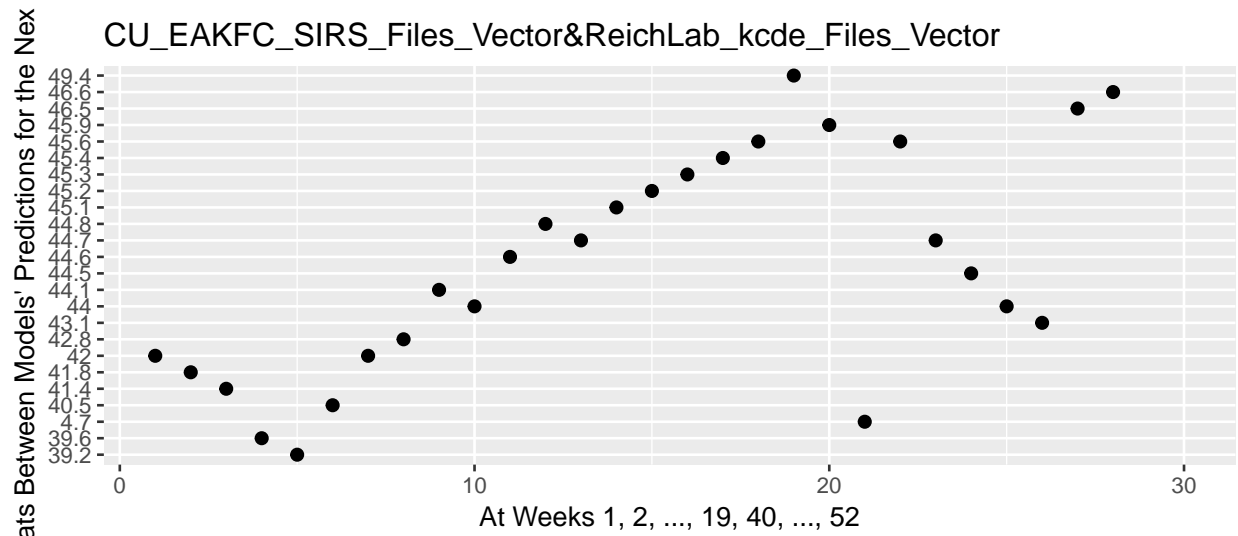


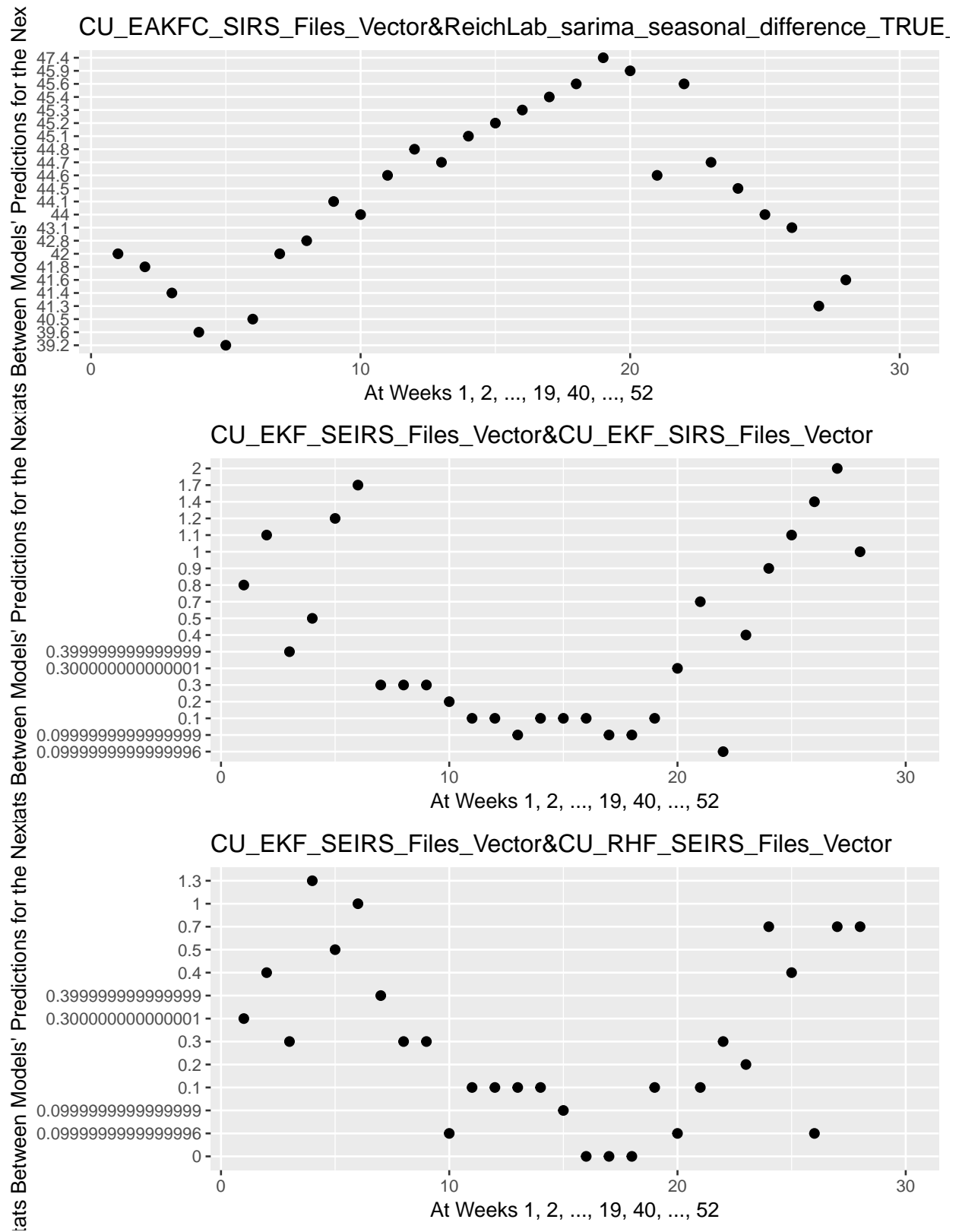
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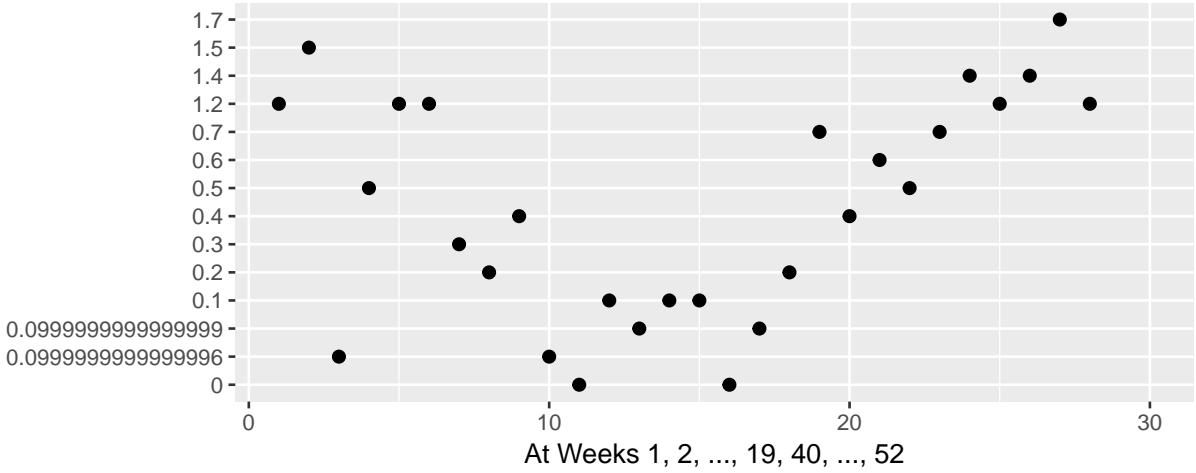




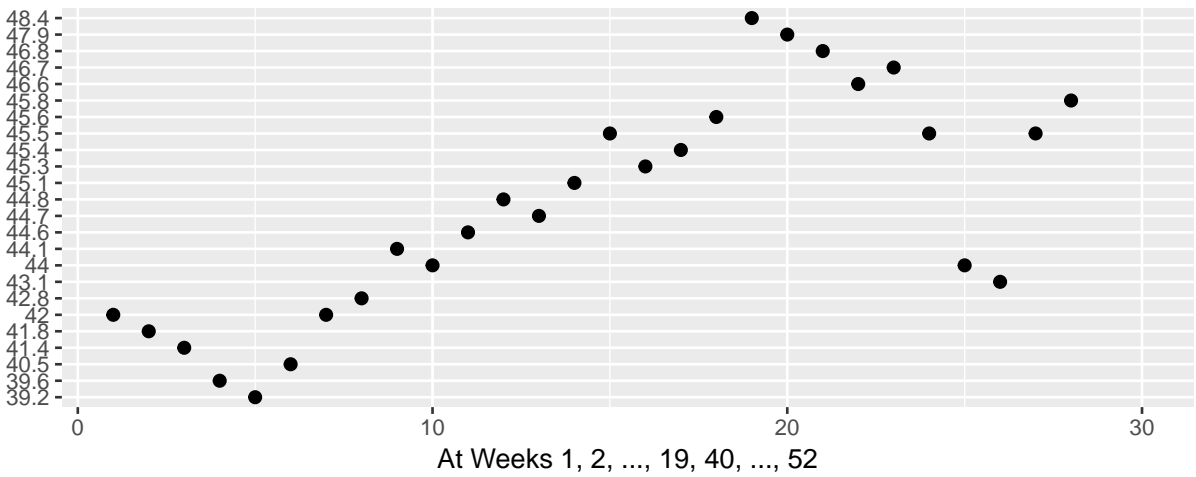


ats Between Models' Predictions for the Nex

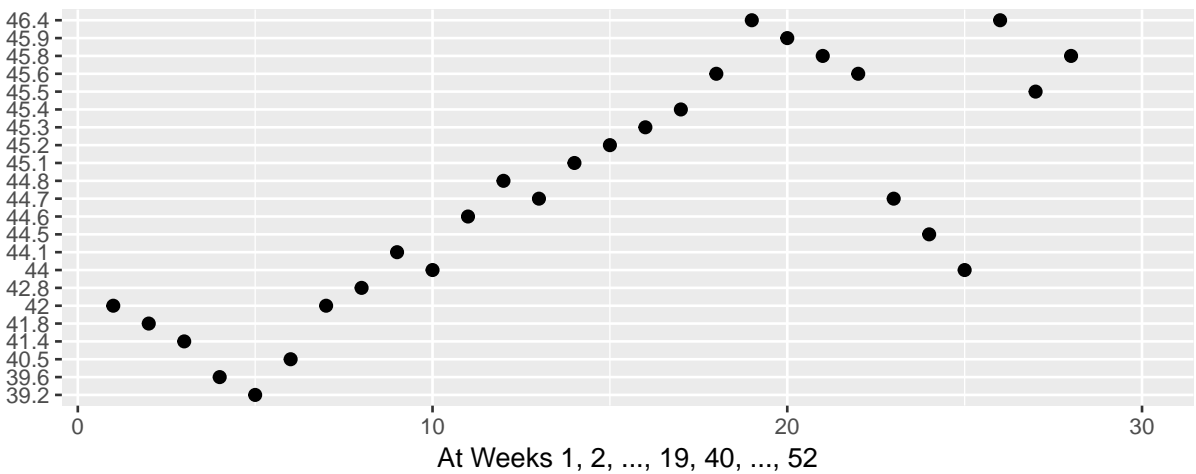
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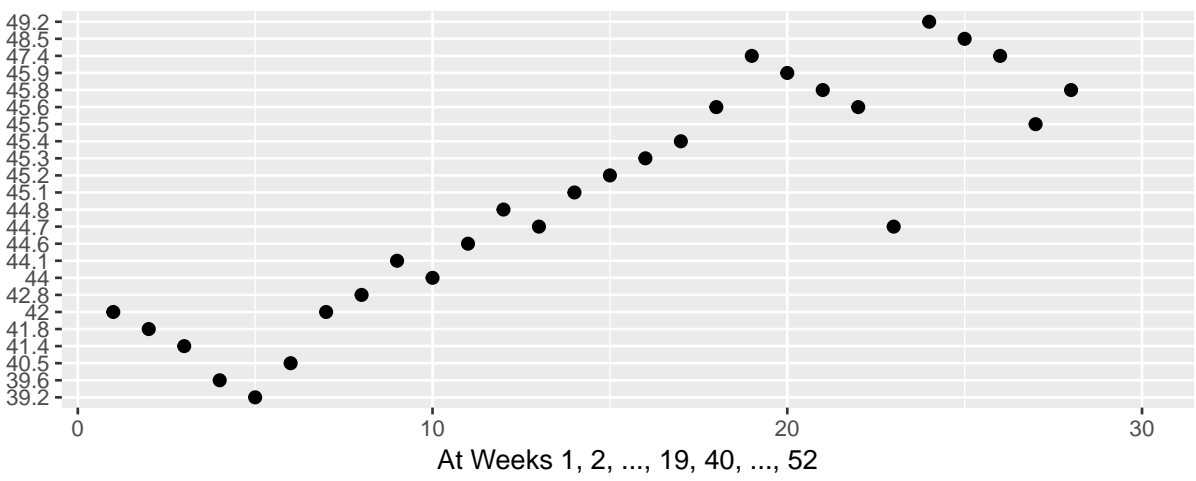


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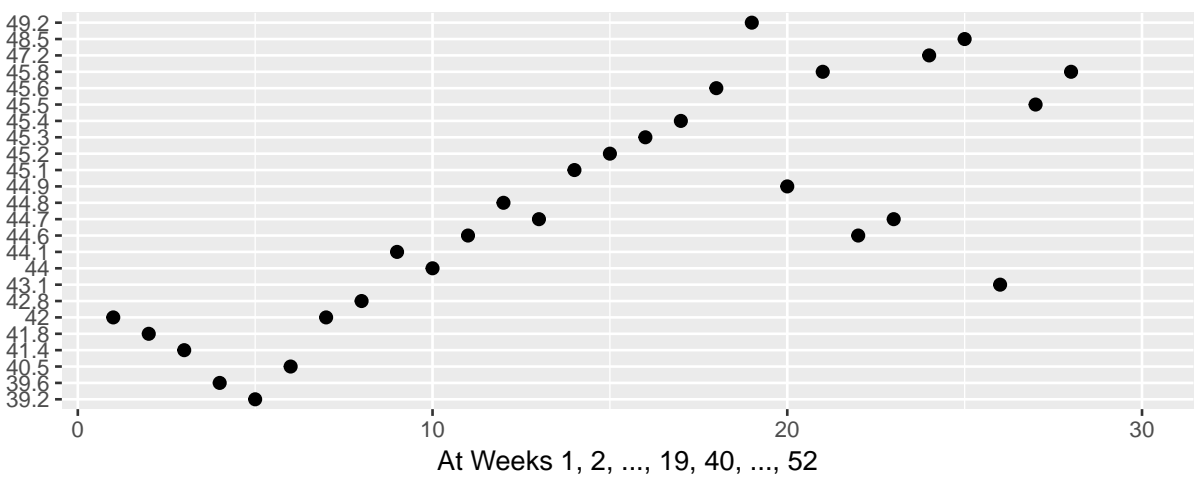


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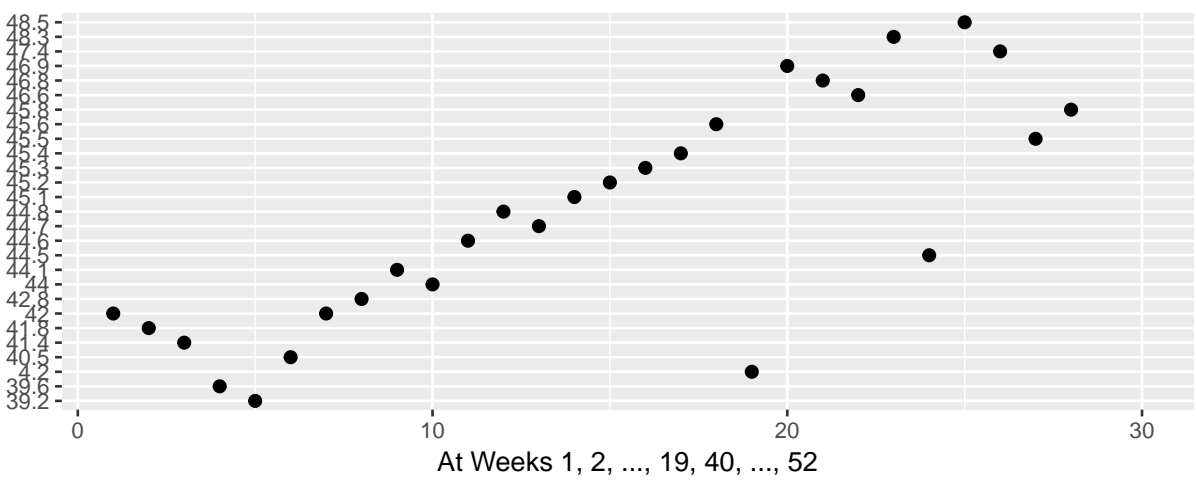
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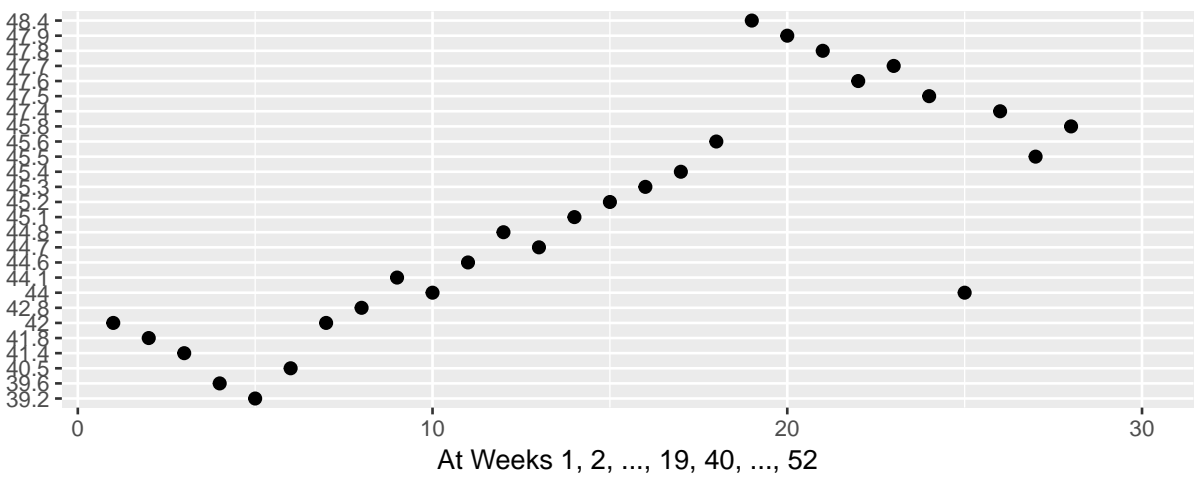


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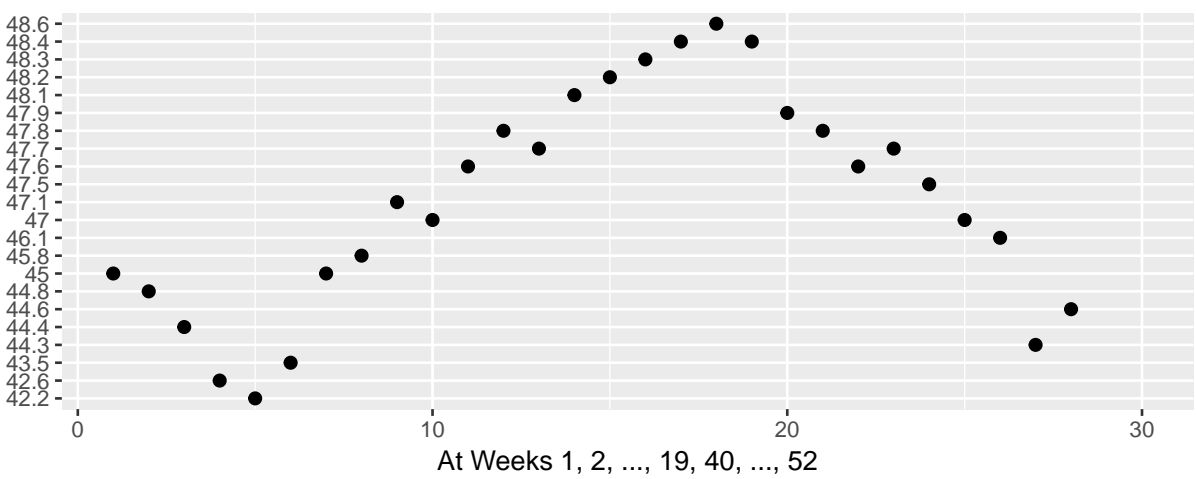


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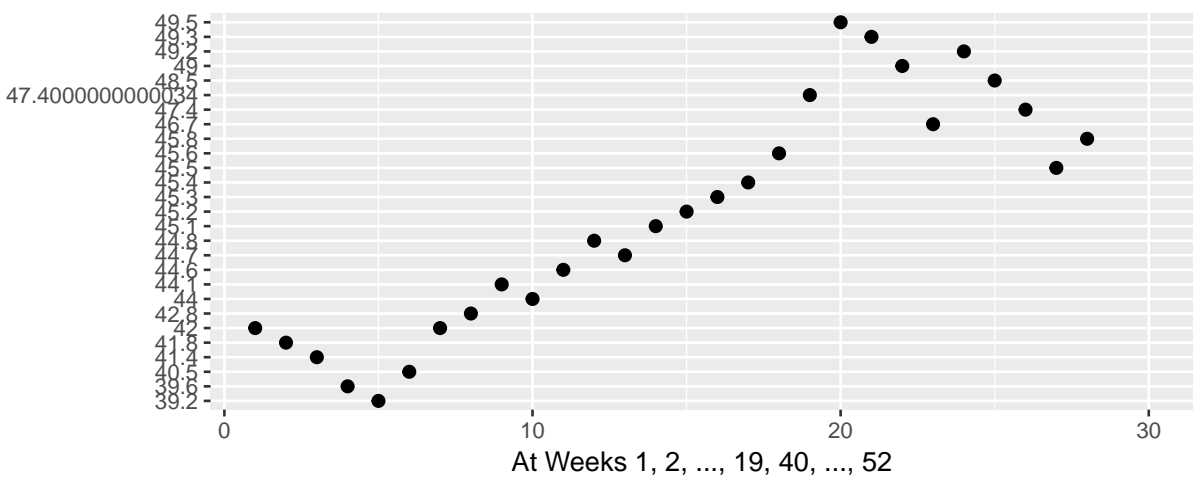
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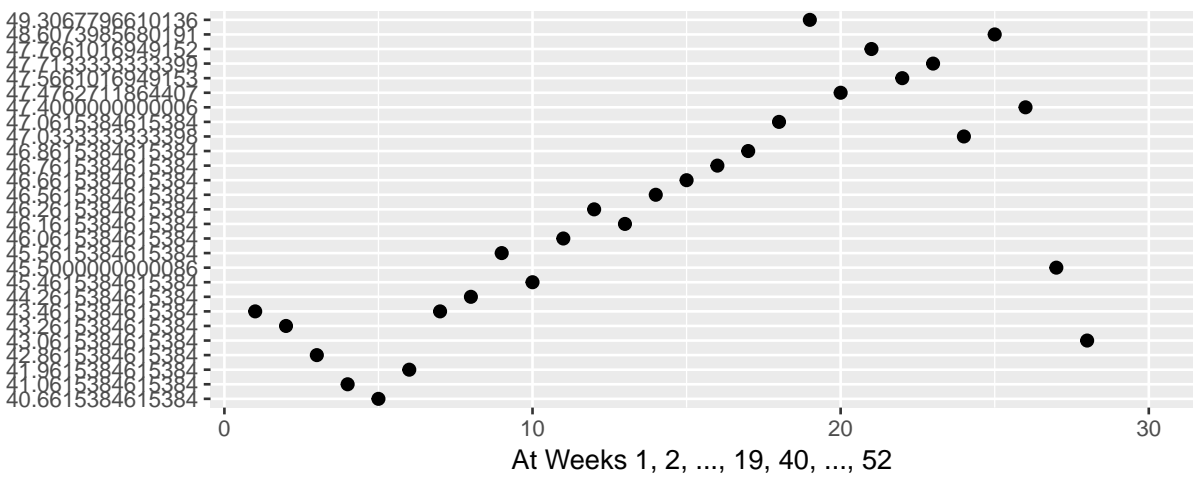


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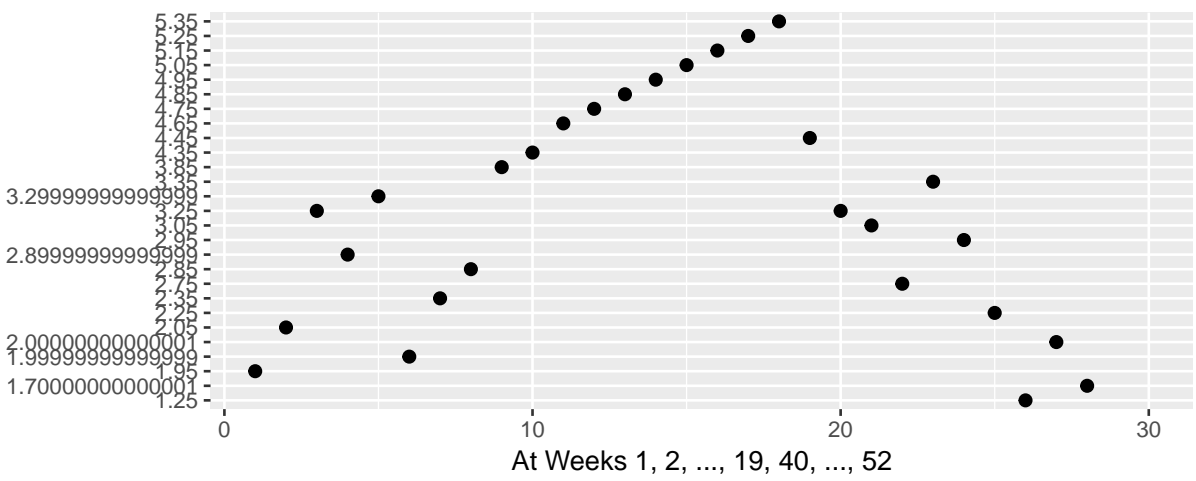


Relationships Between Models' Predictions for the Next

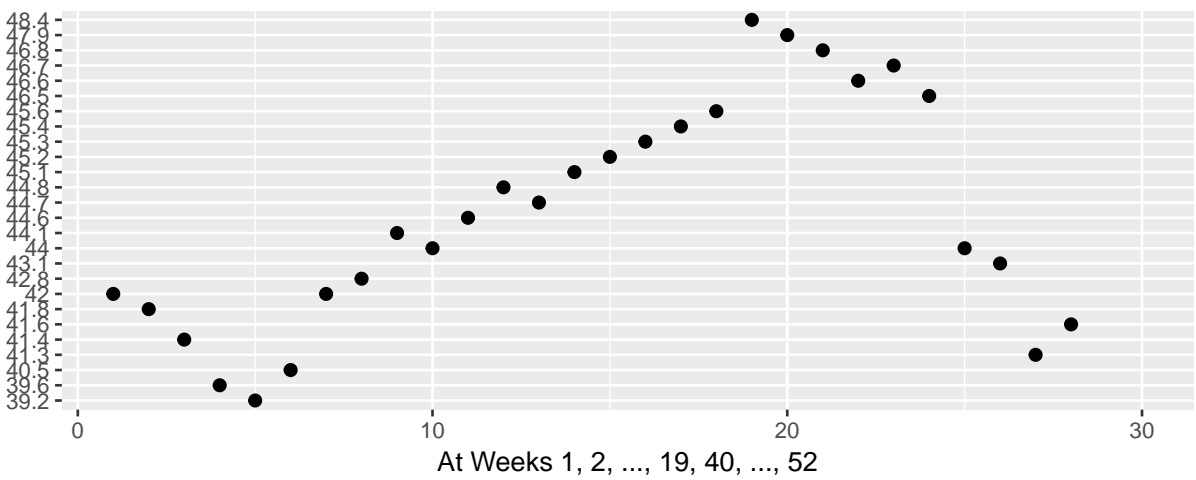
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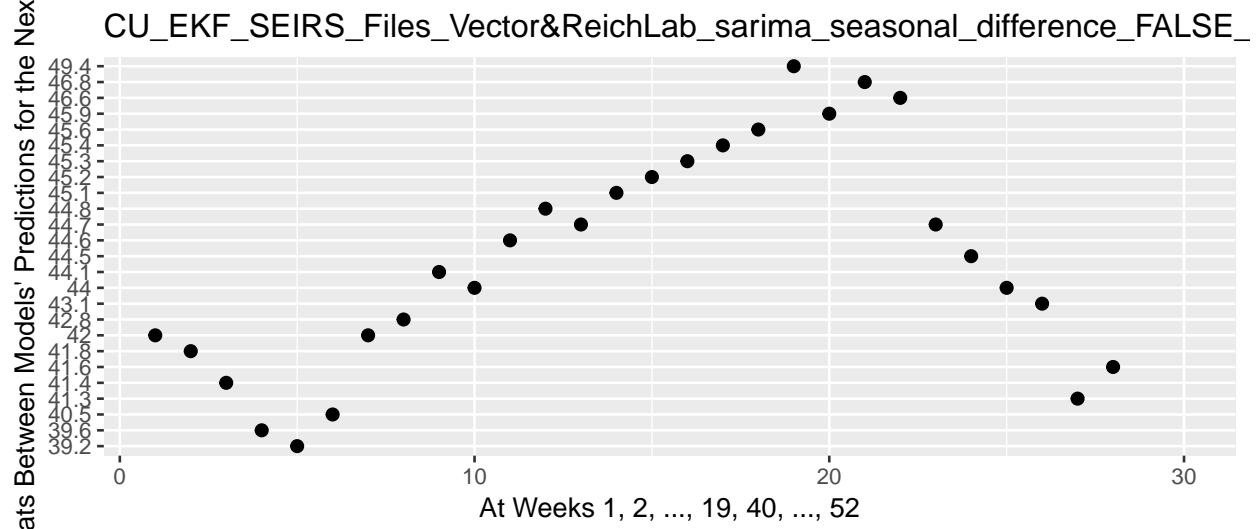
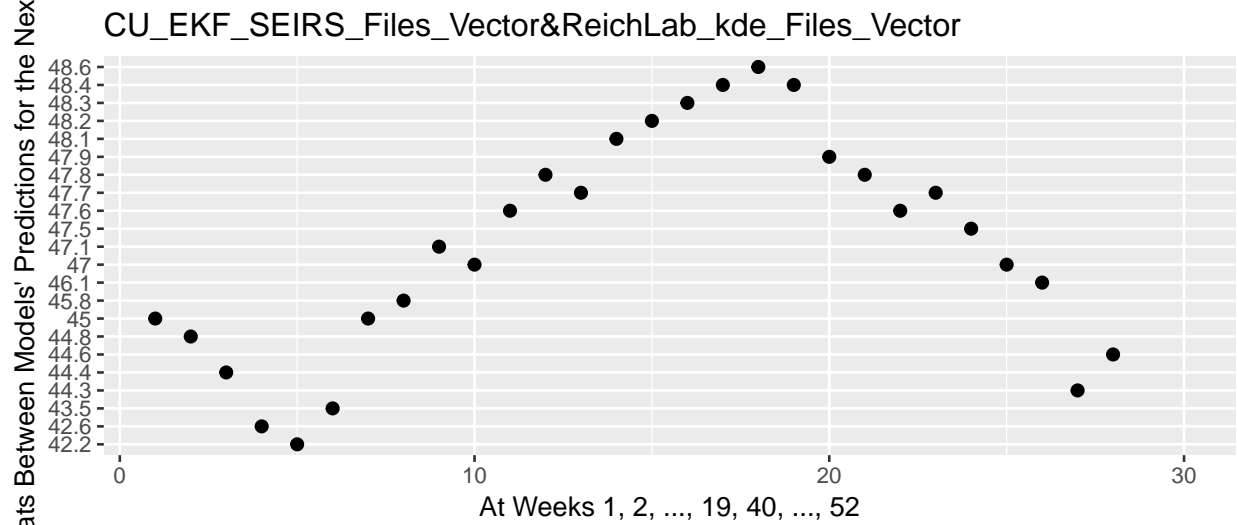
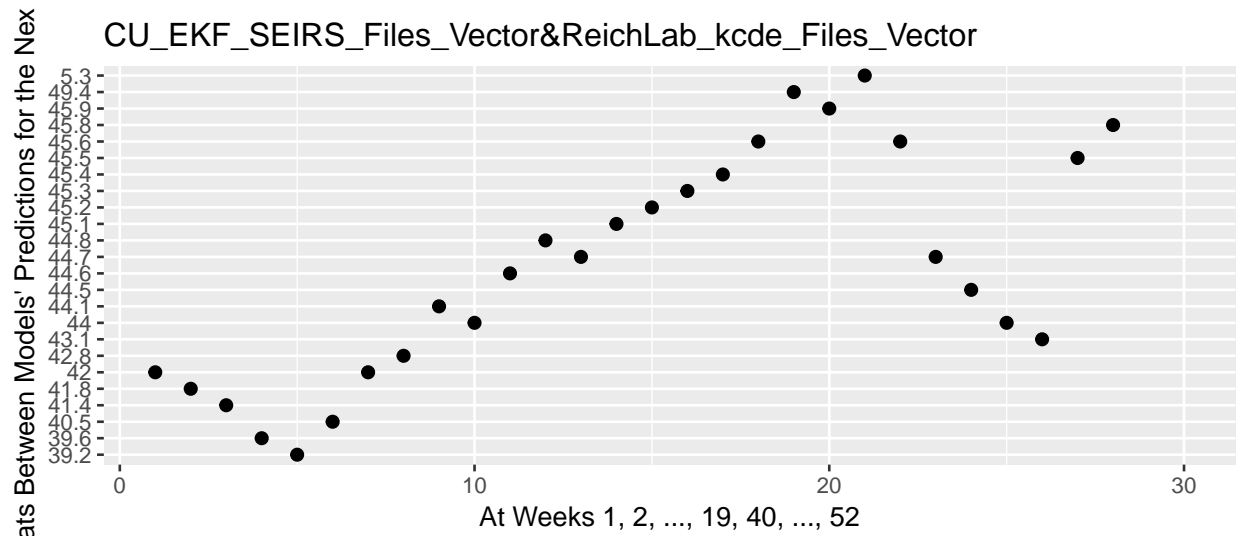


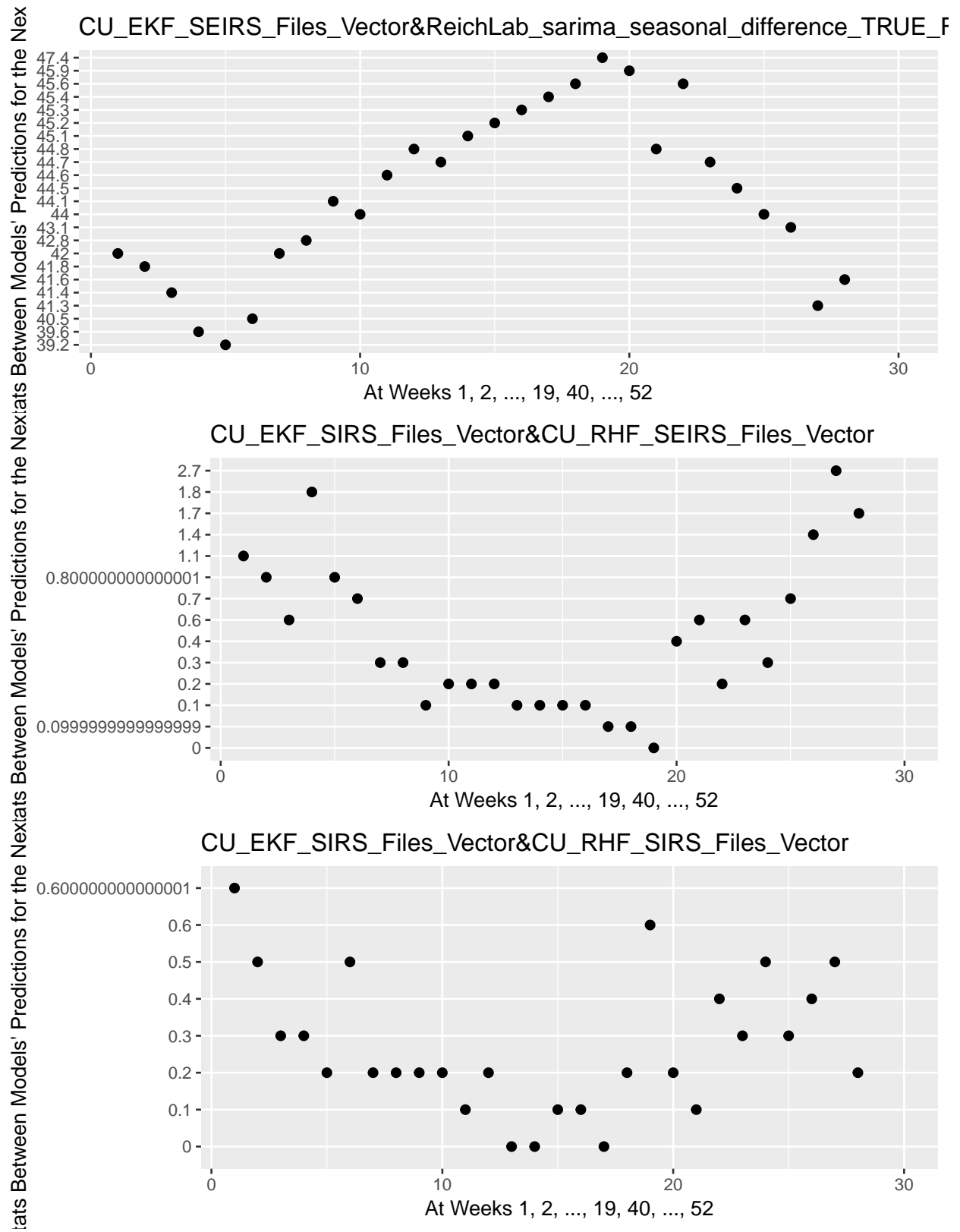
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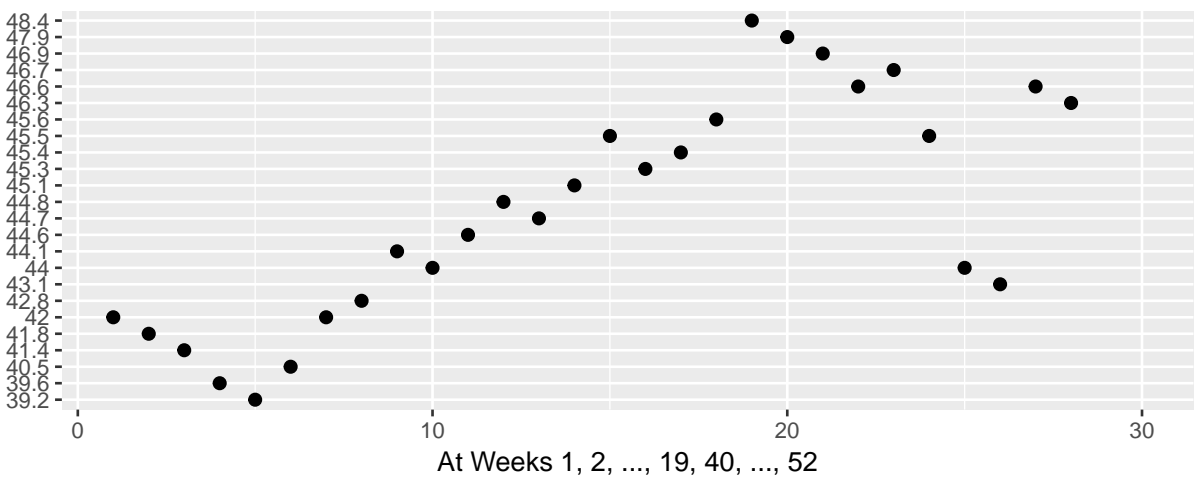




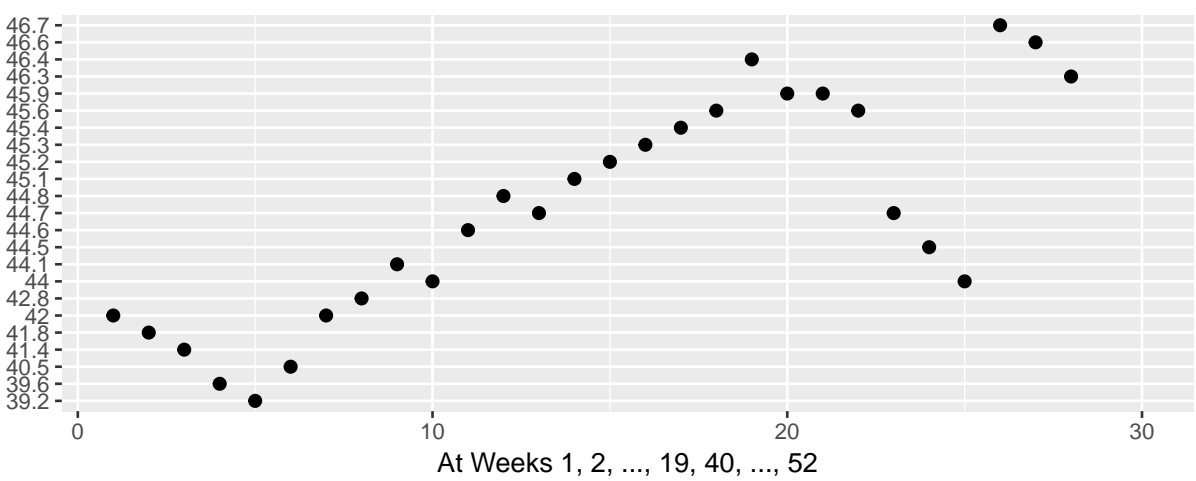


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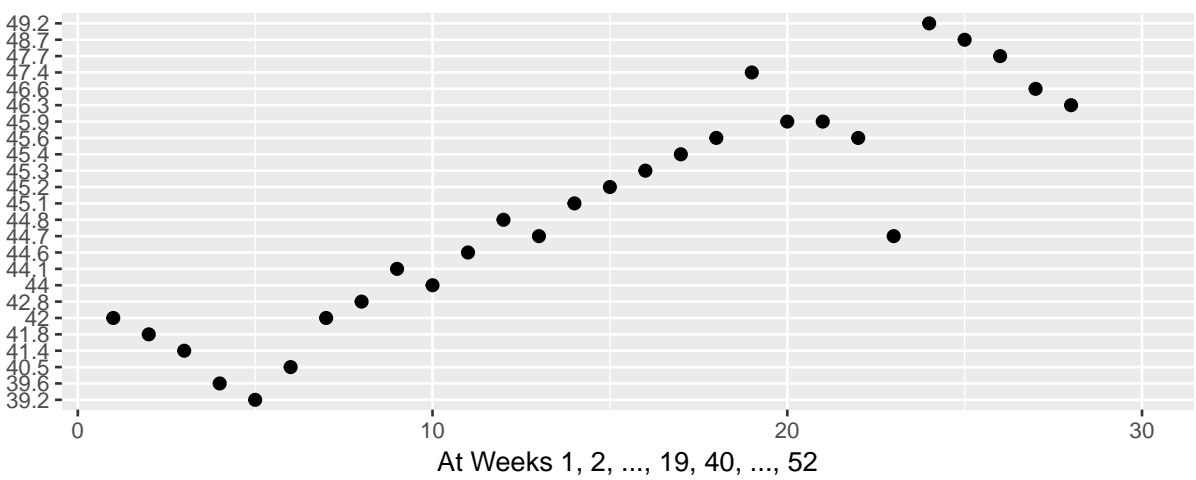
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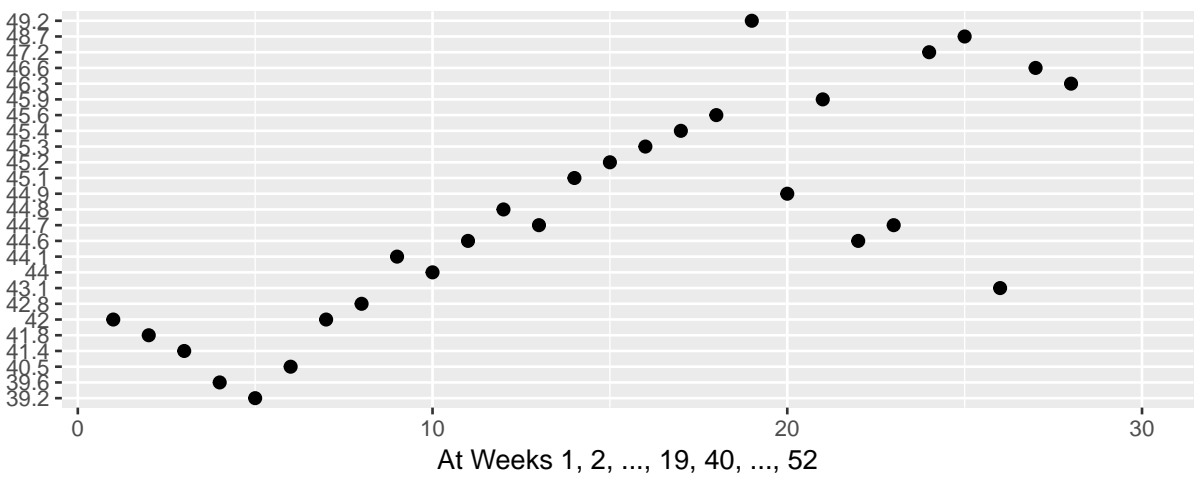


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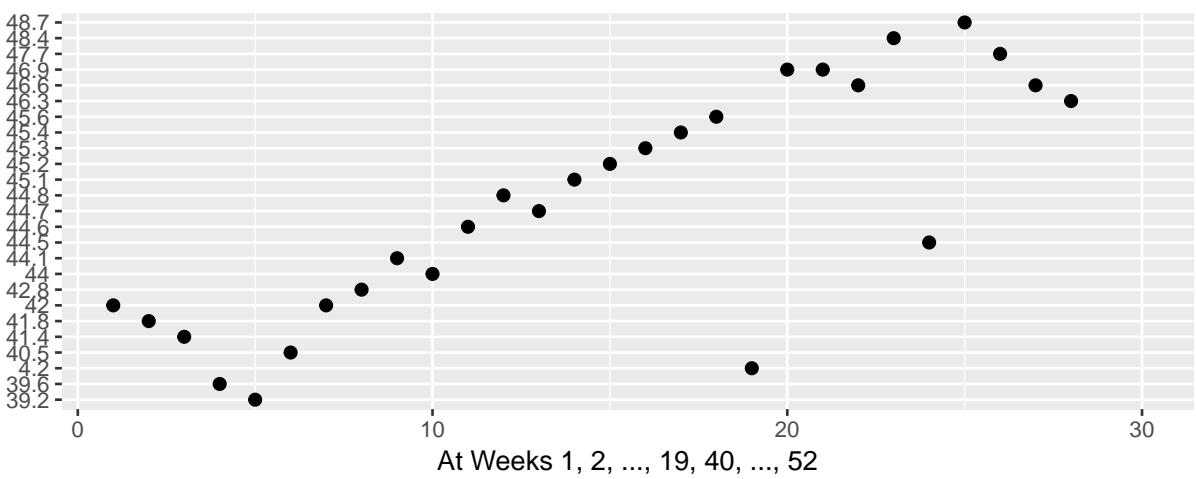


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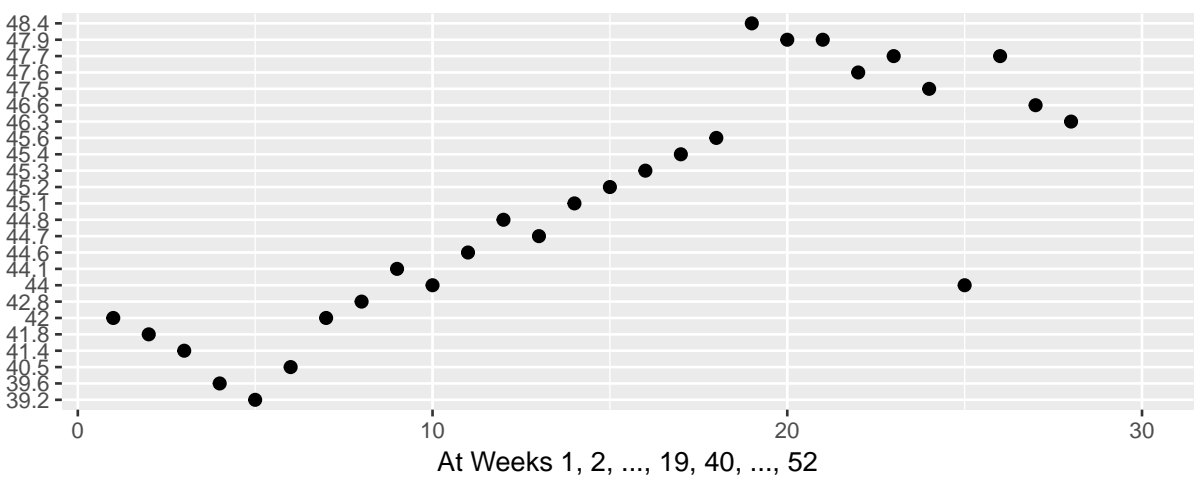
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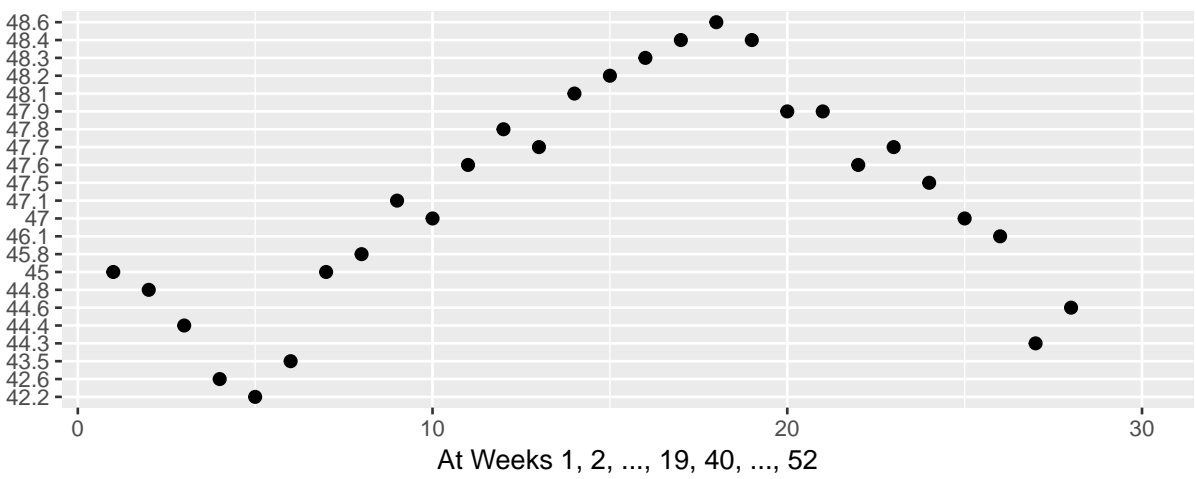


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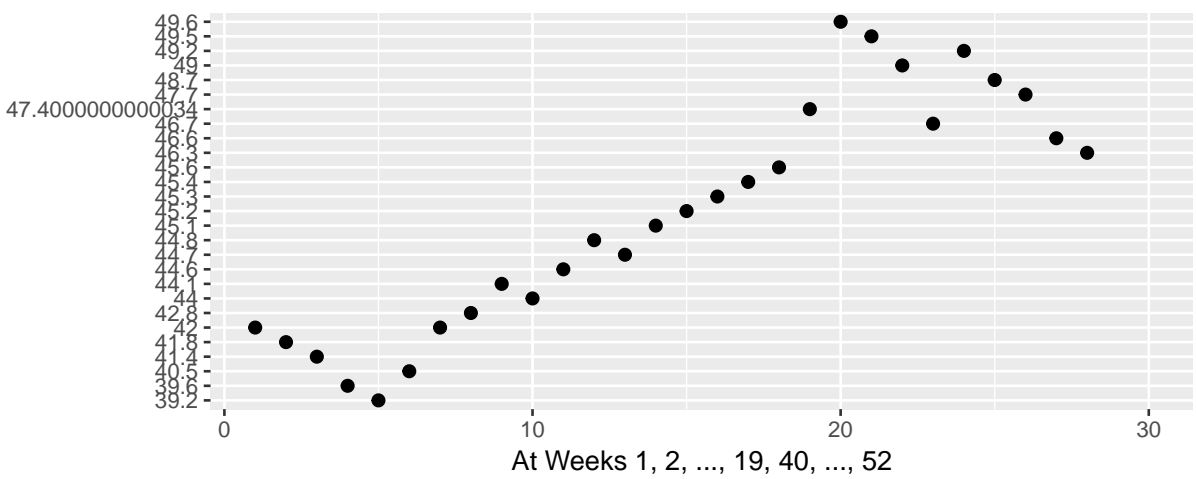


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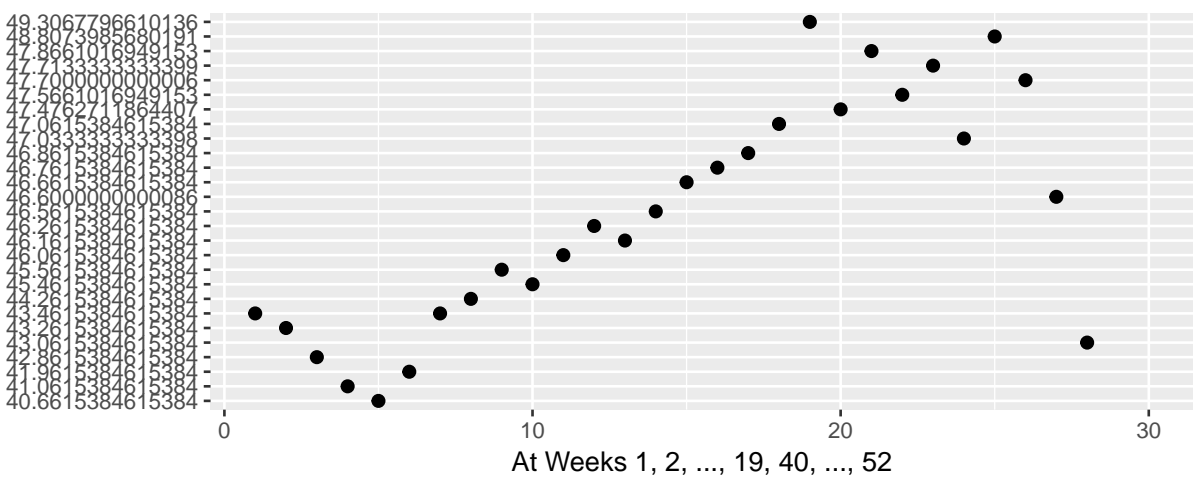
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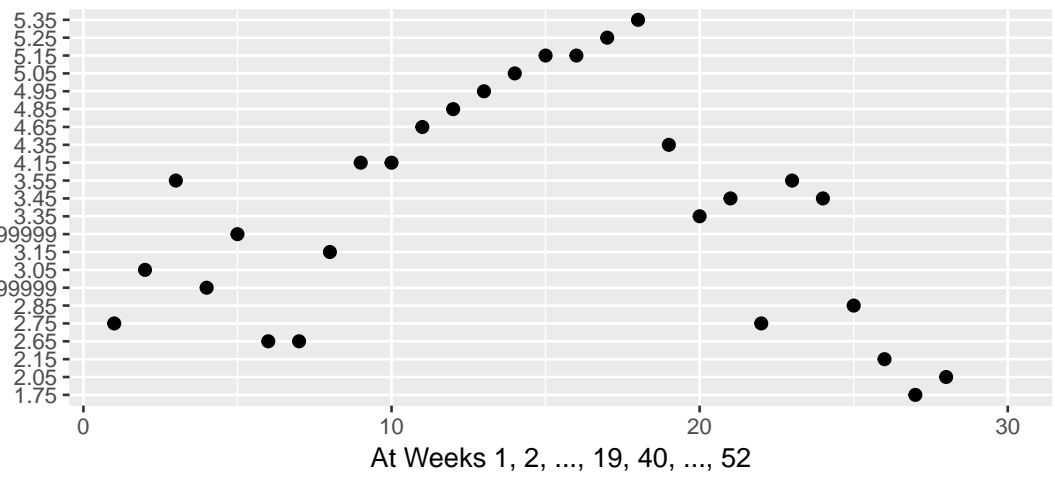


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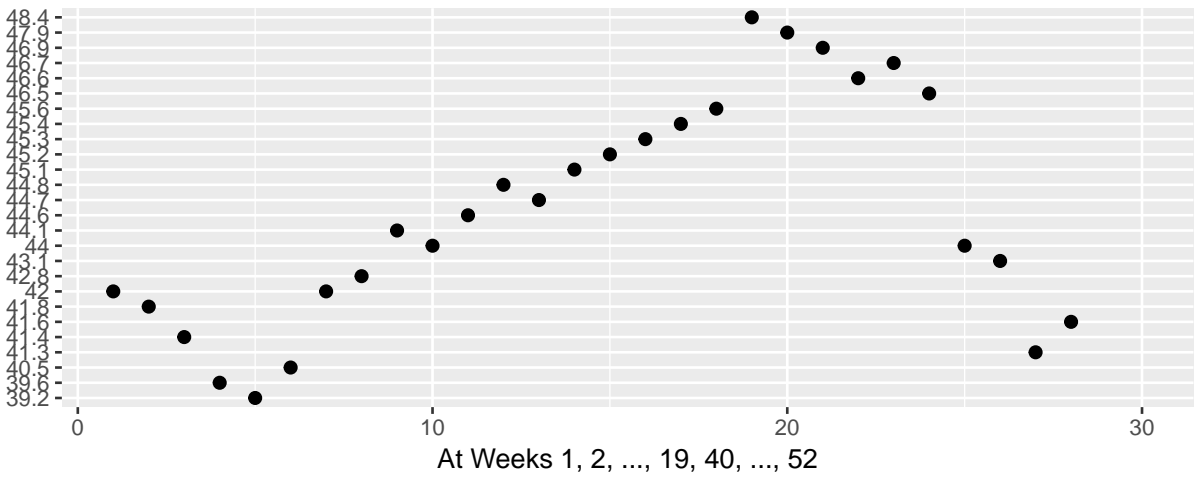


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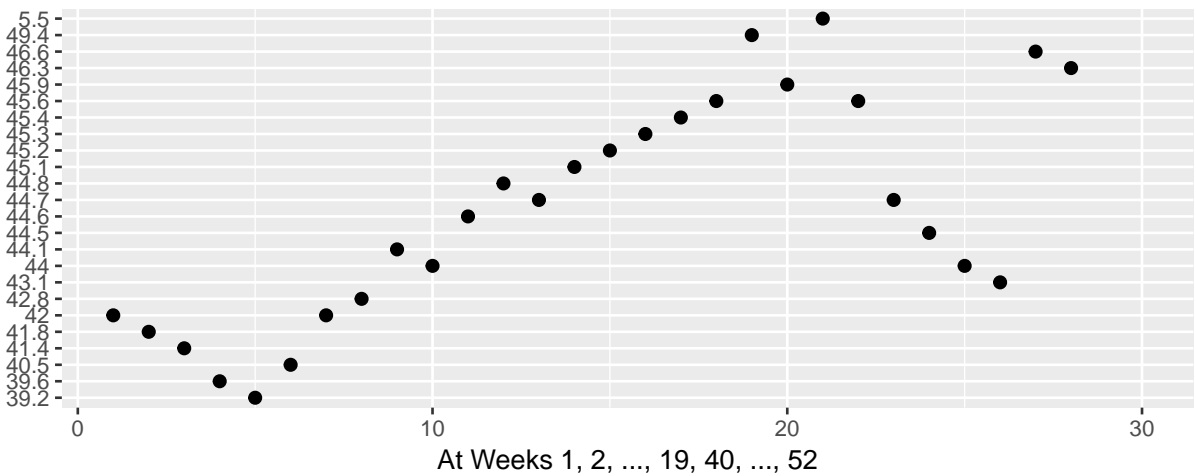
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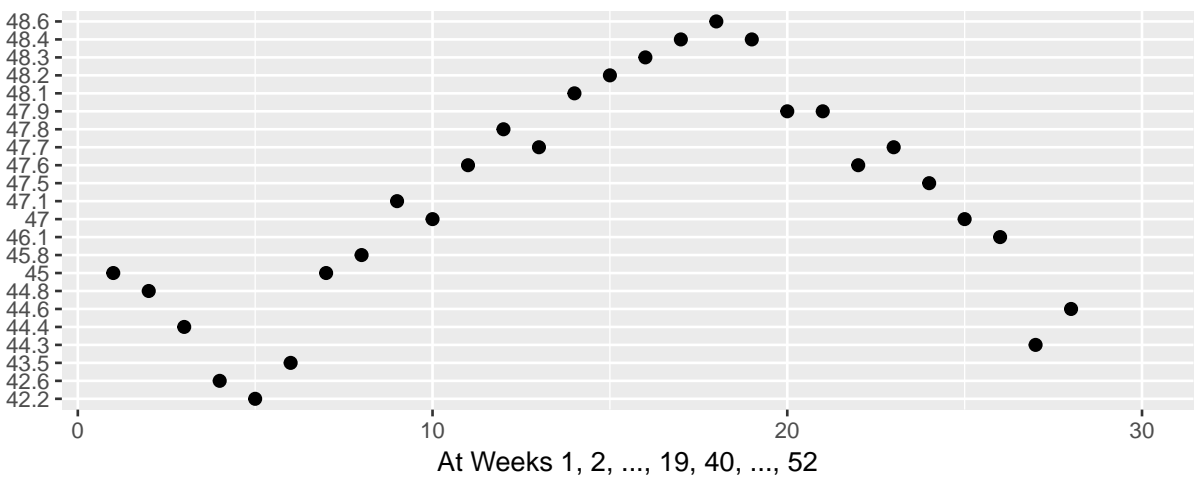


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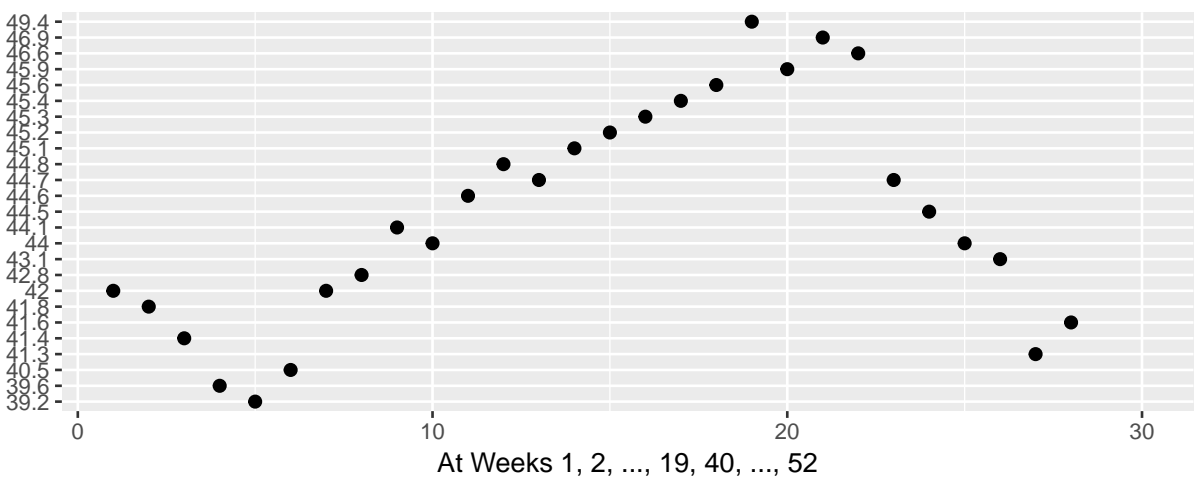


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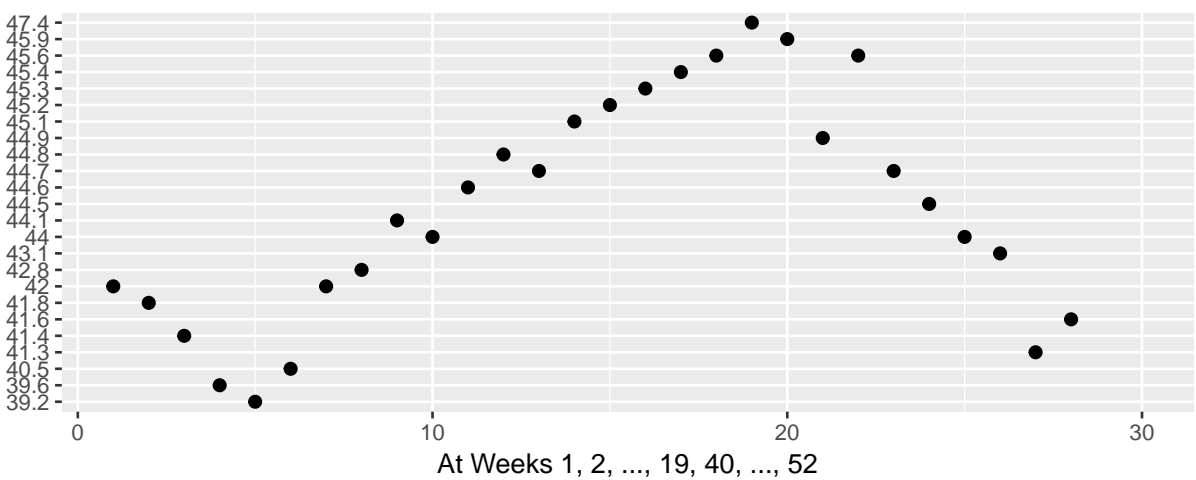
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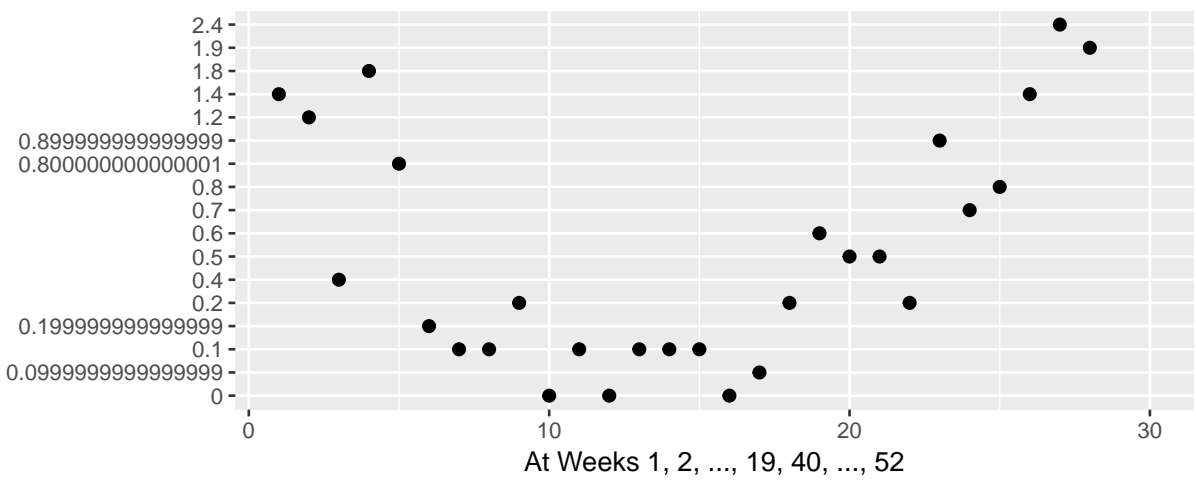


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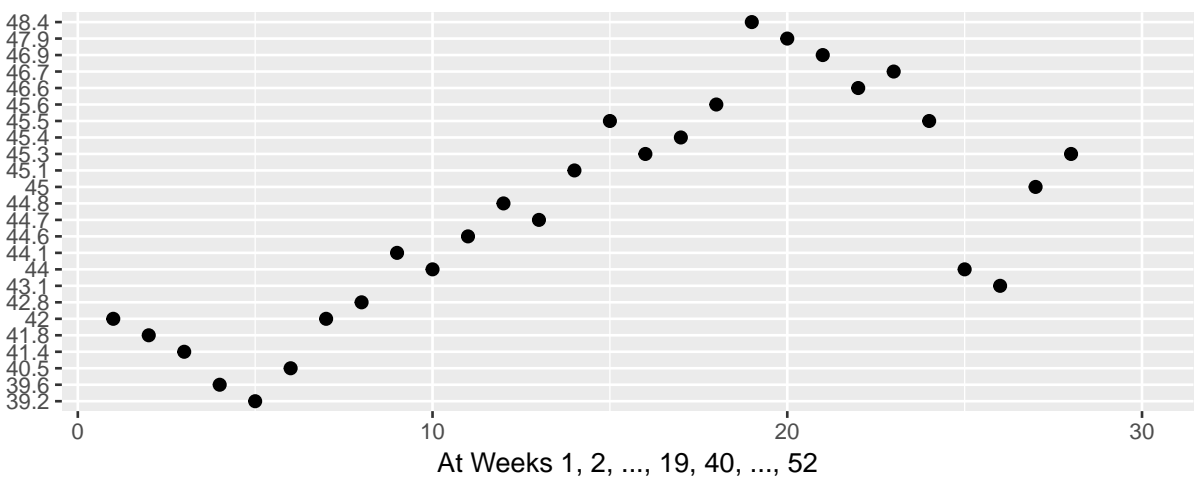


ats Between Models' Predictions for the Next

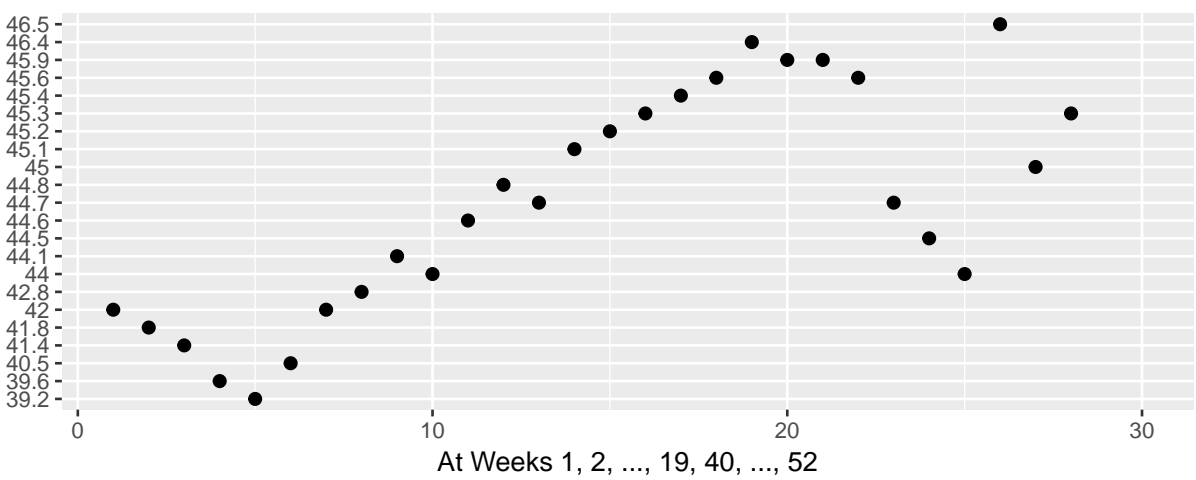
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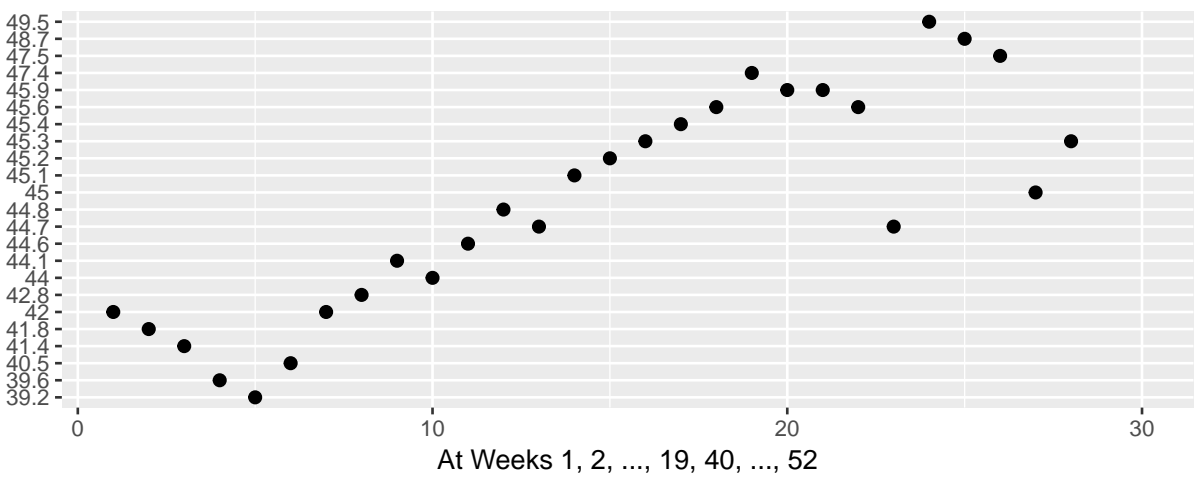


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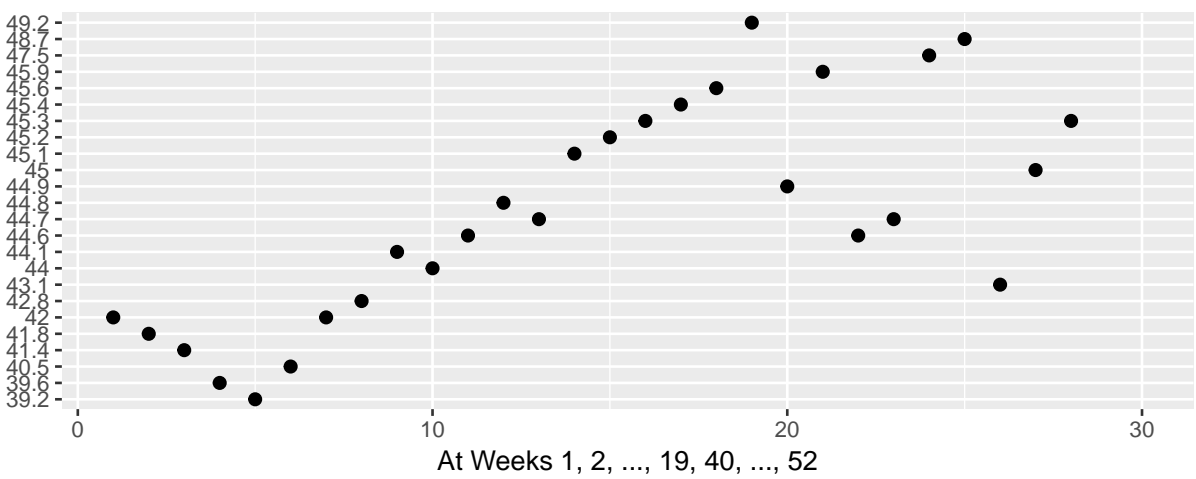


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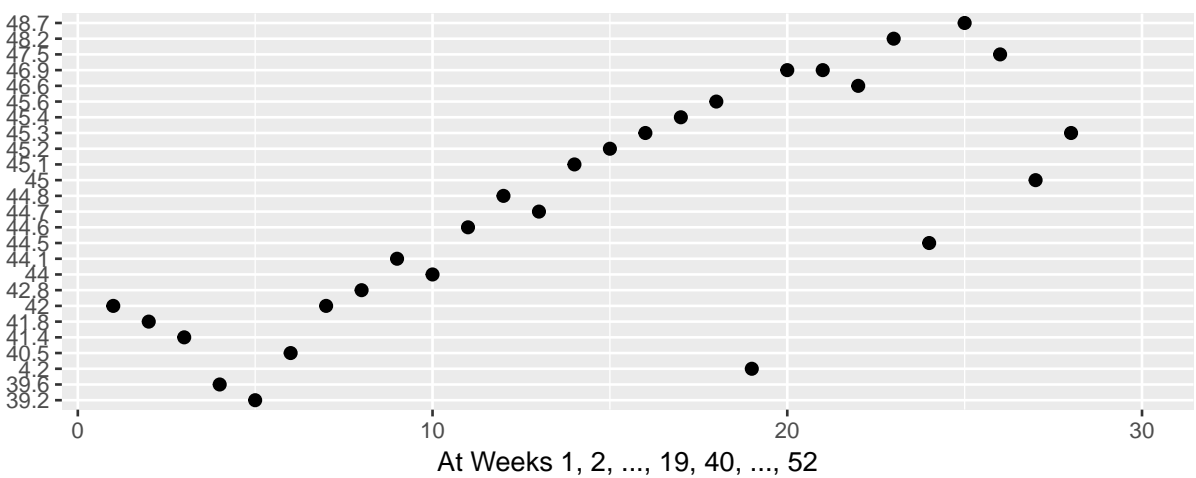
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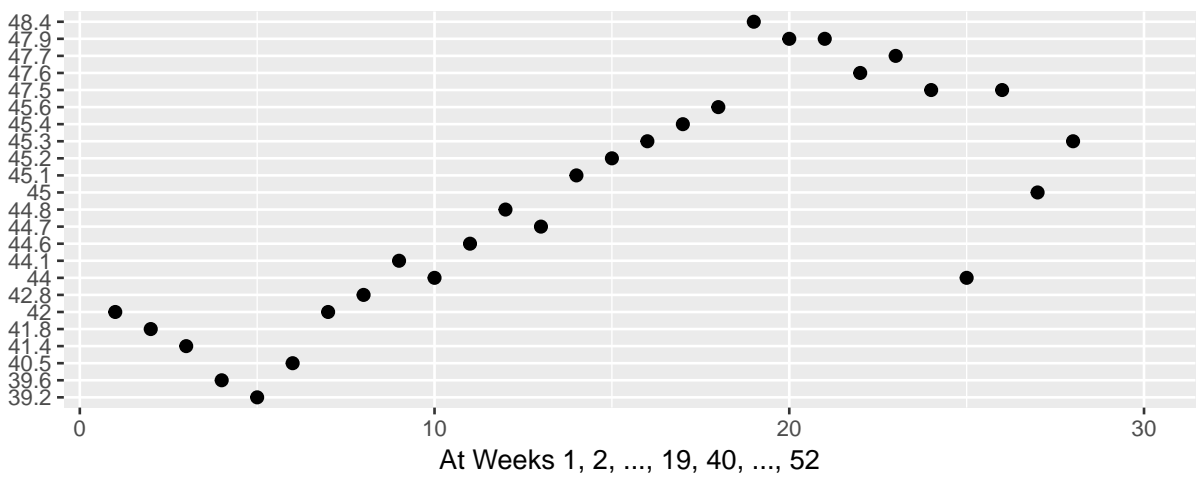


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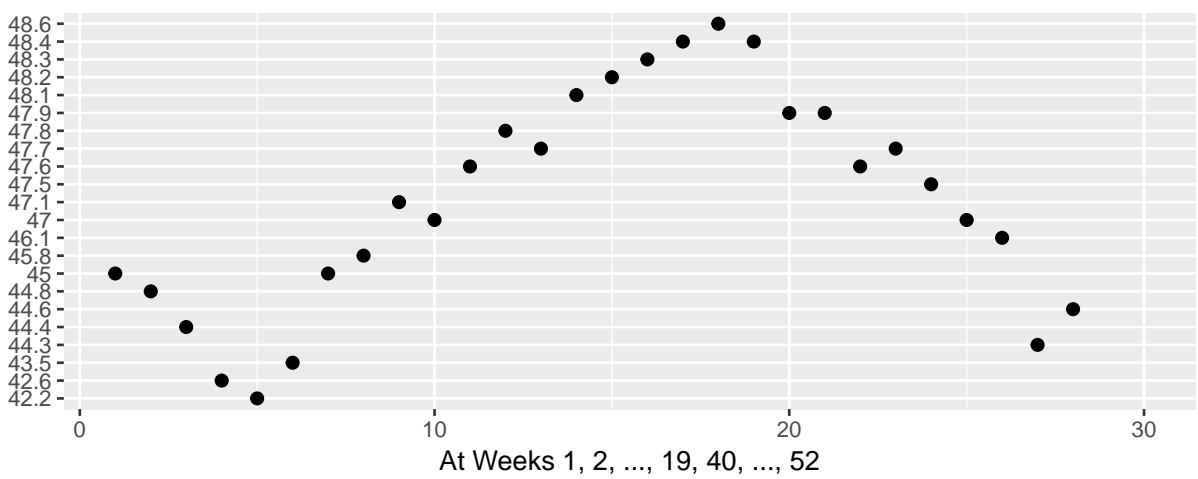


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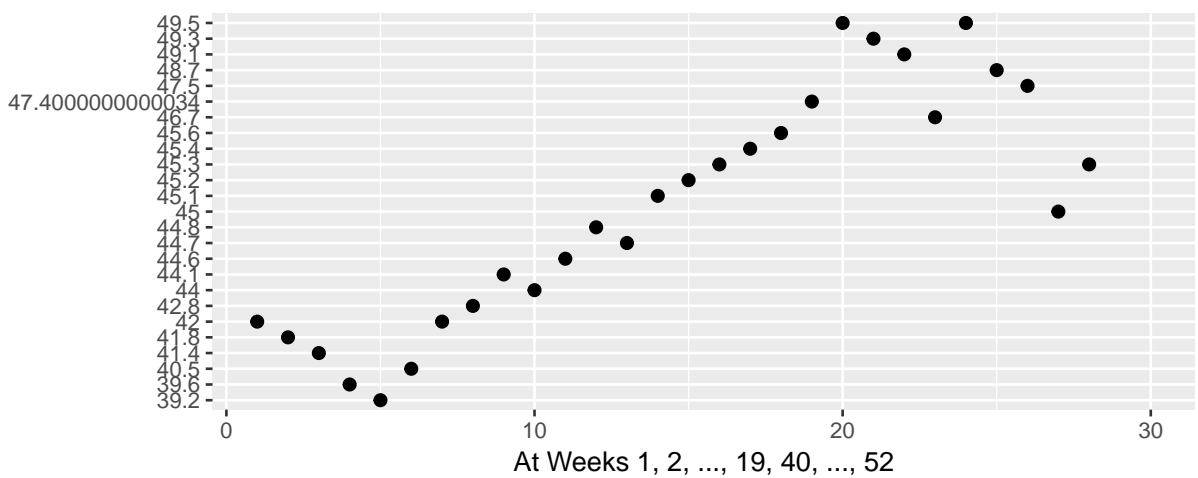
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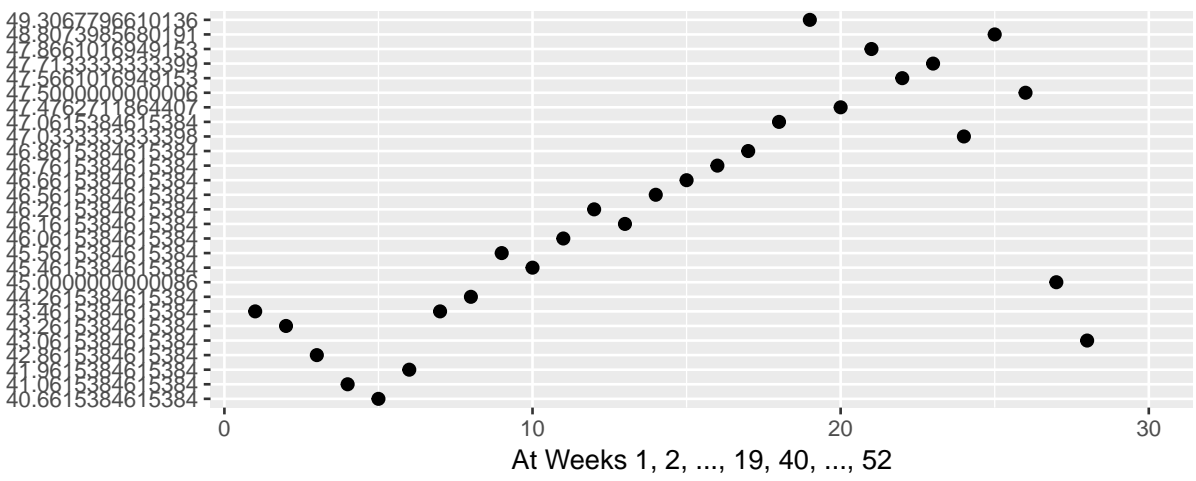


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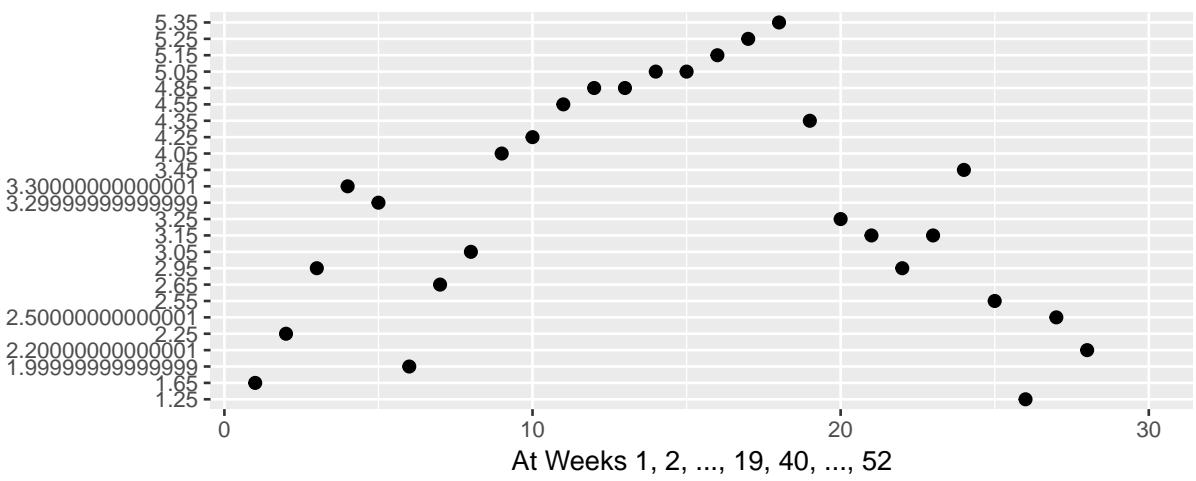


Relationships Between Models' Predictions for the Next

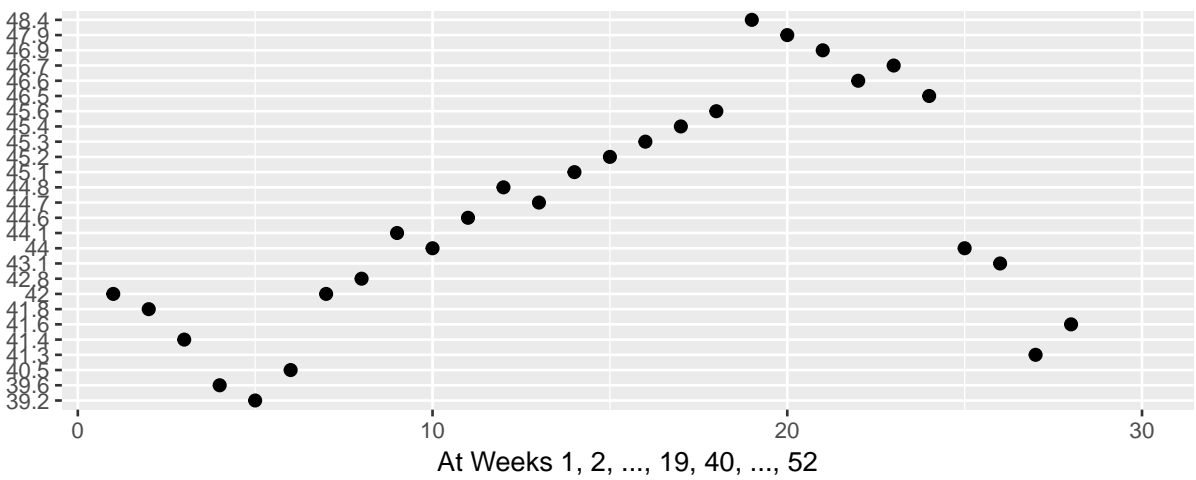
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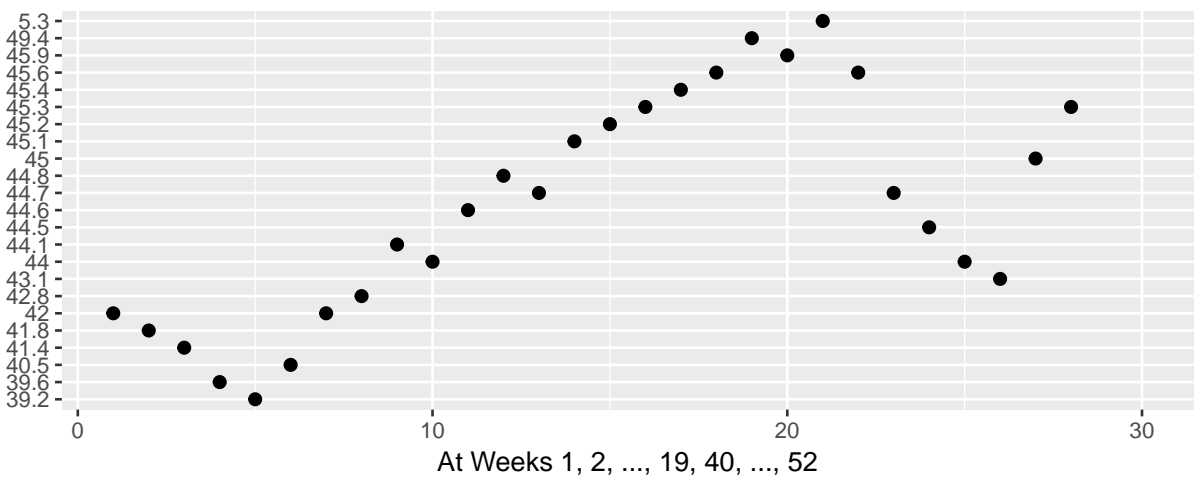


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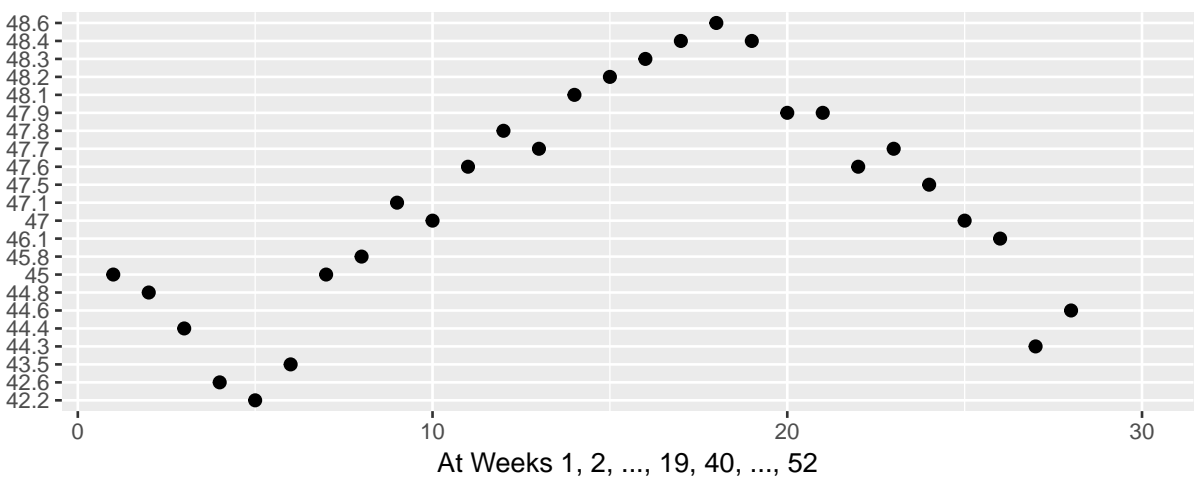


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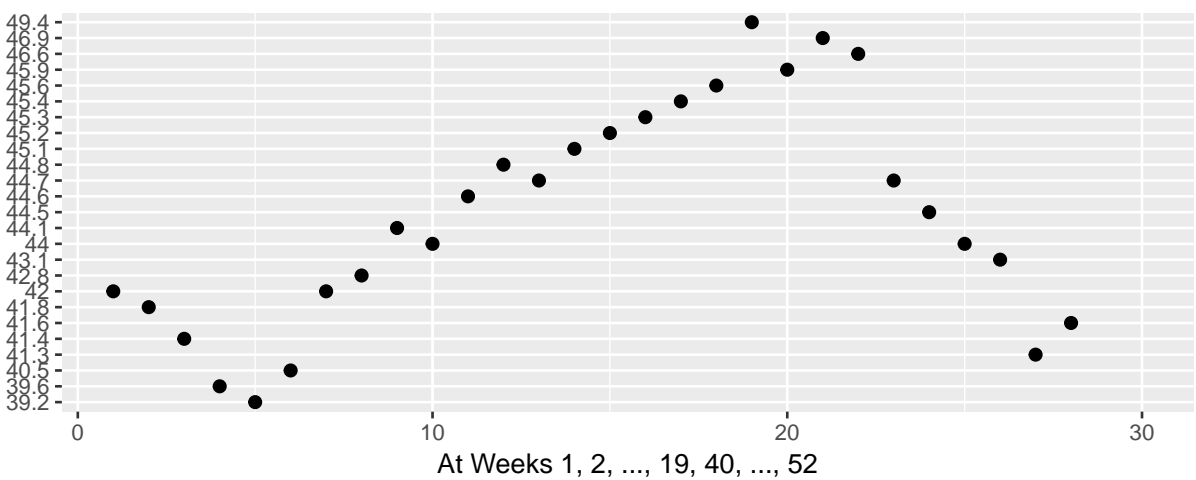
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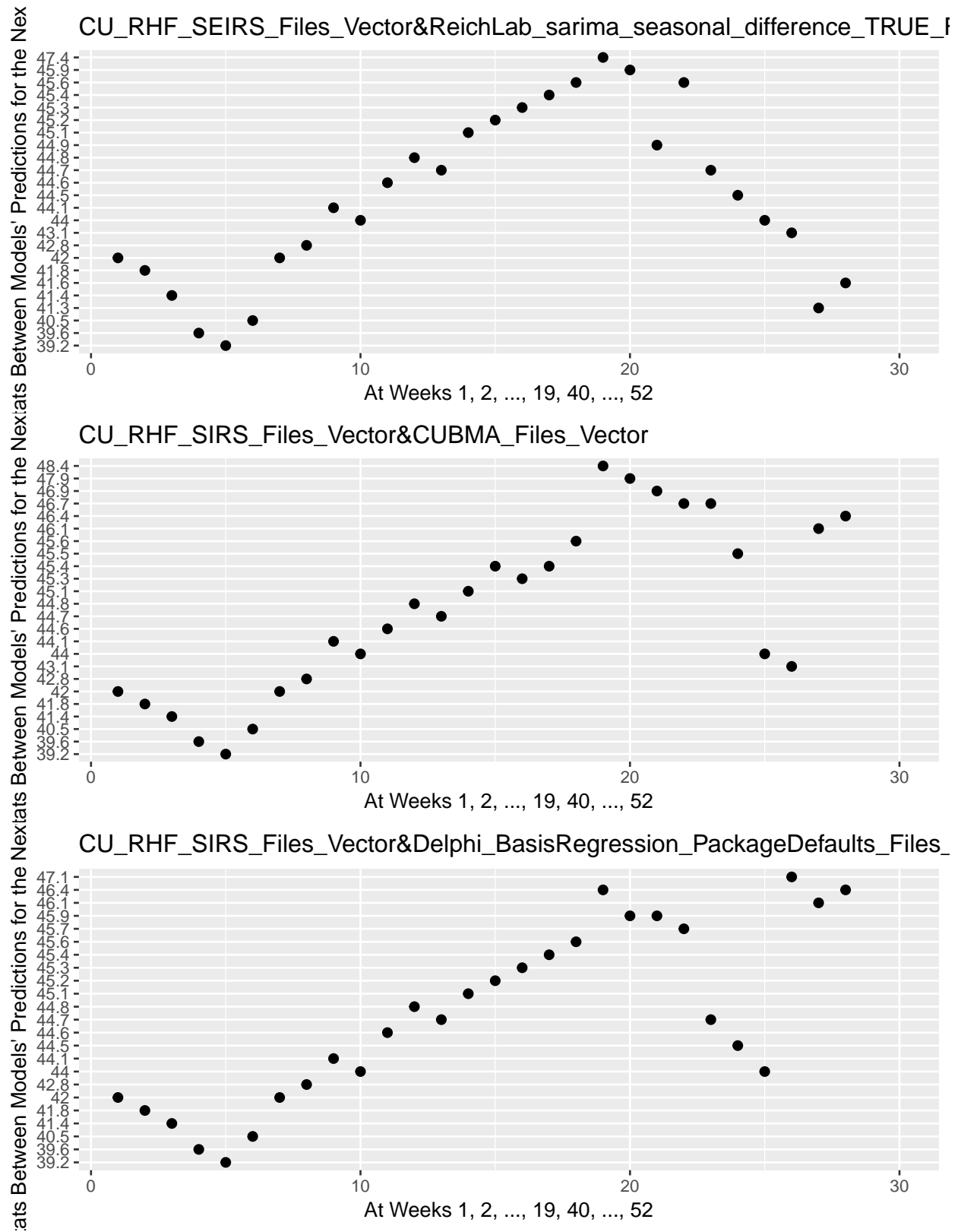


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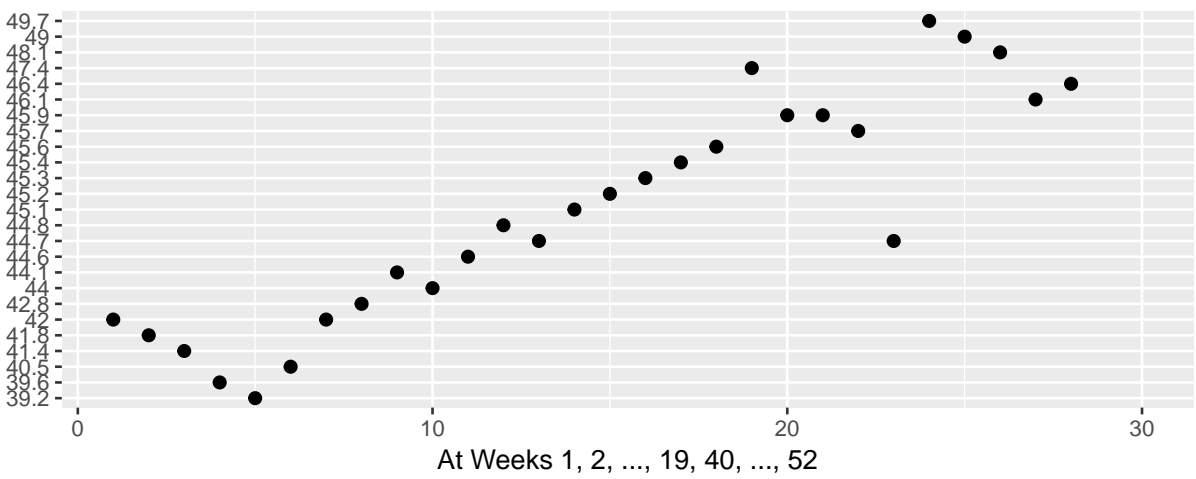
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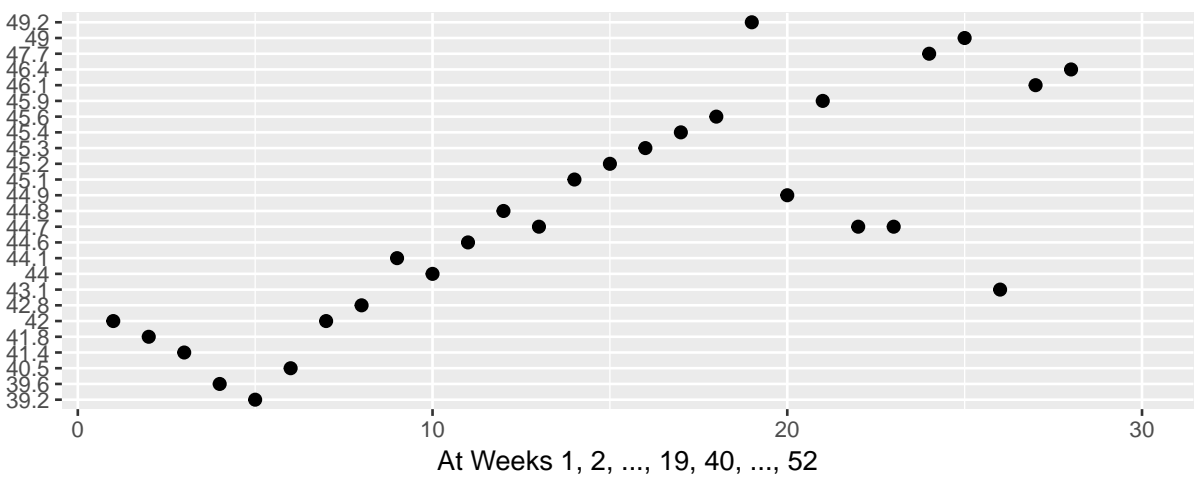


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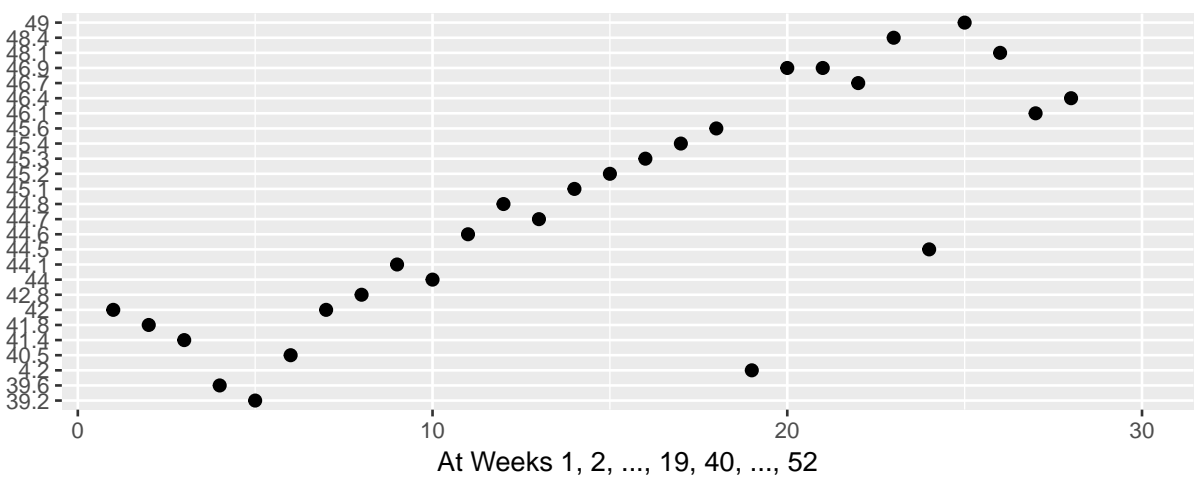
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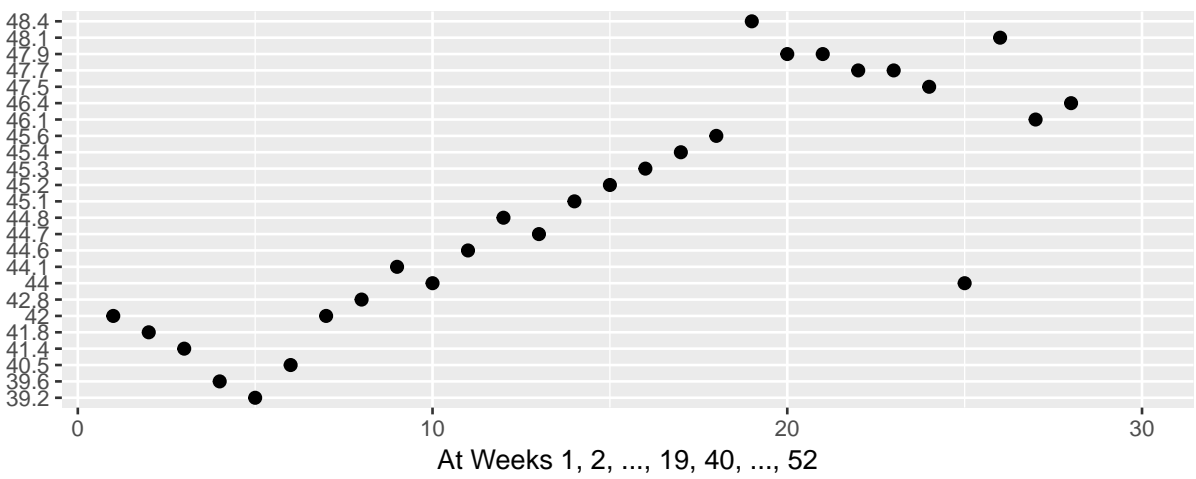


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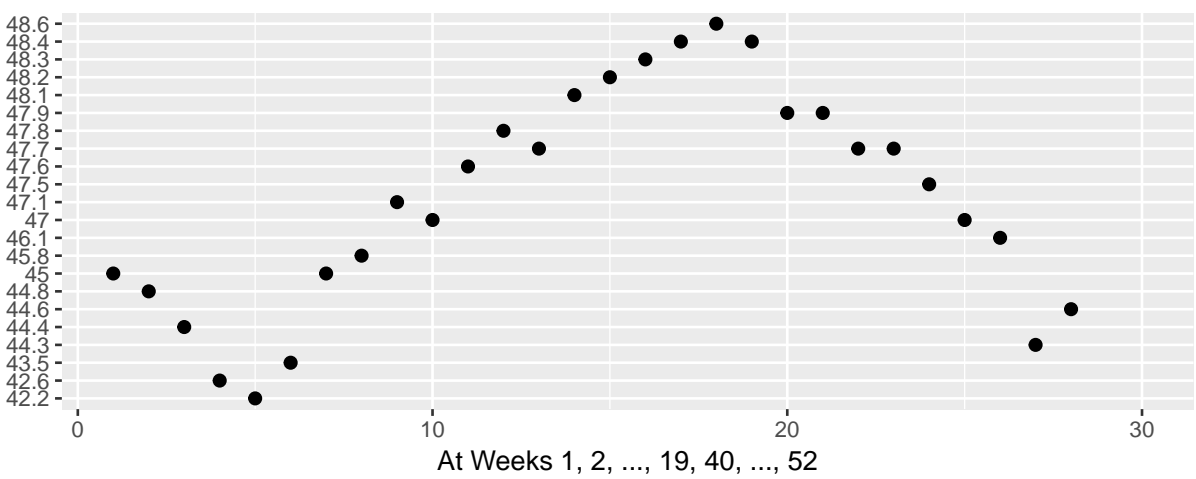


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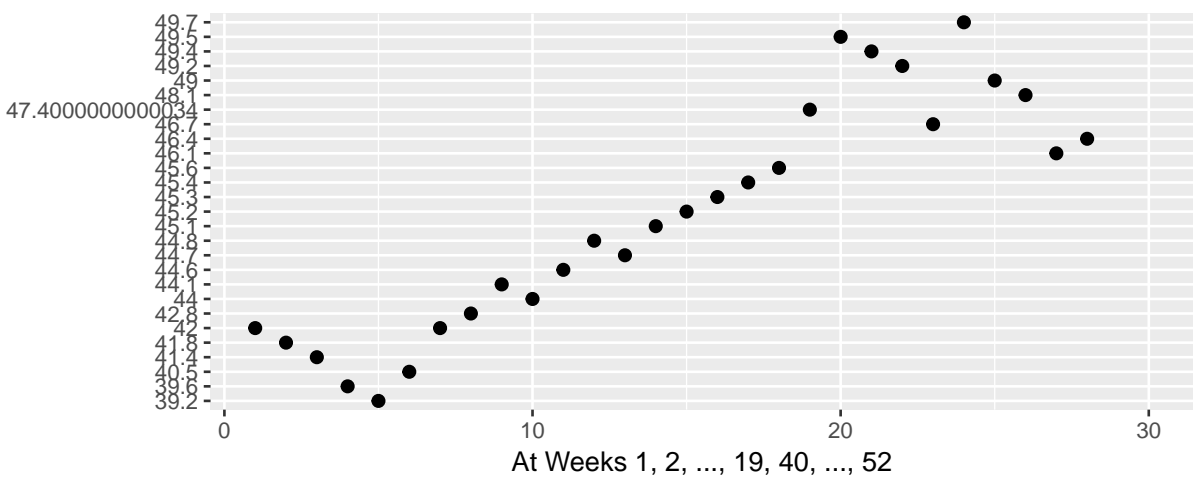
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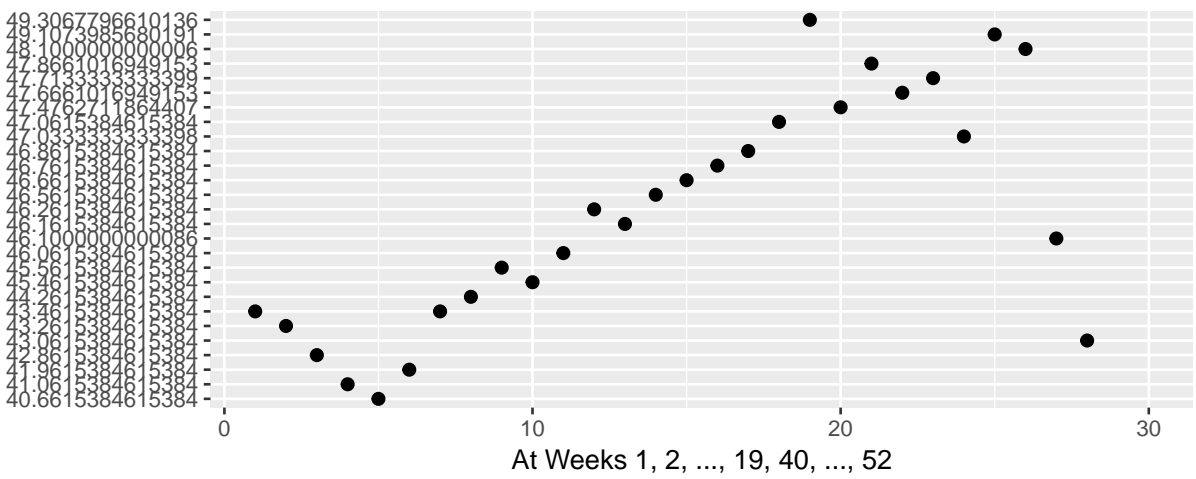


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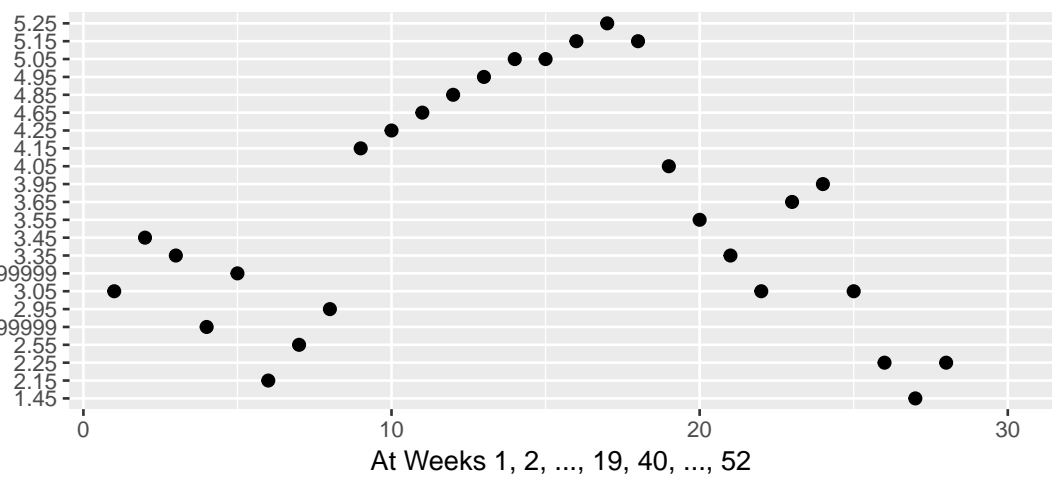


Relationships Between Models' Predictions for the Next

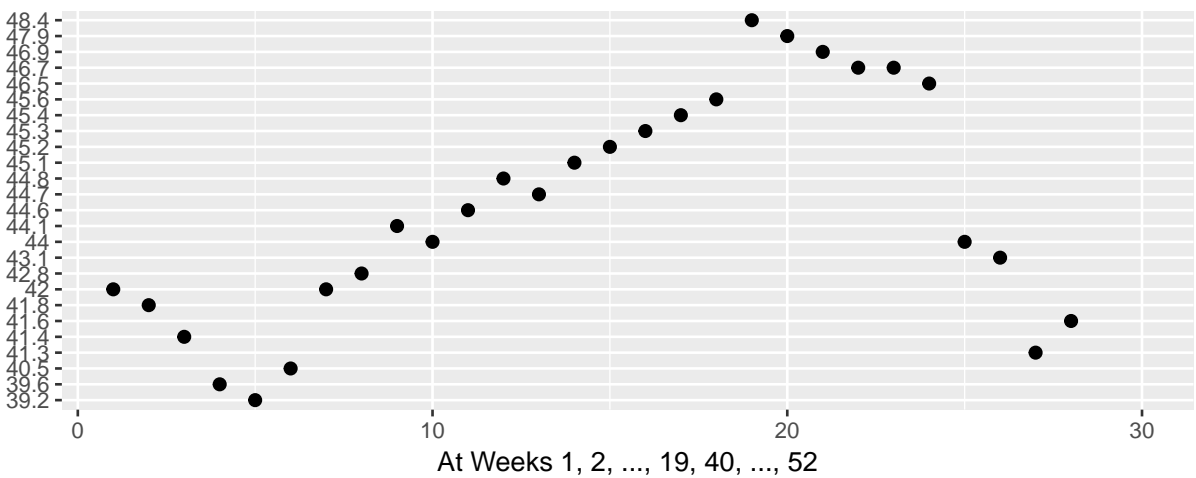
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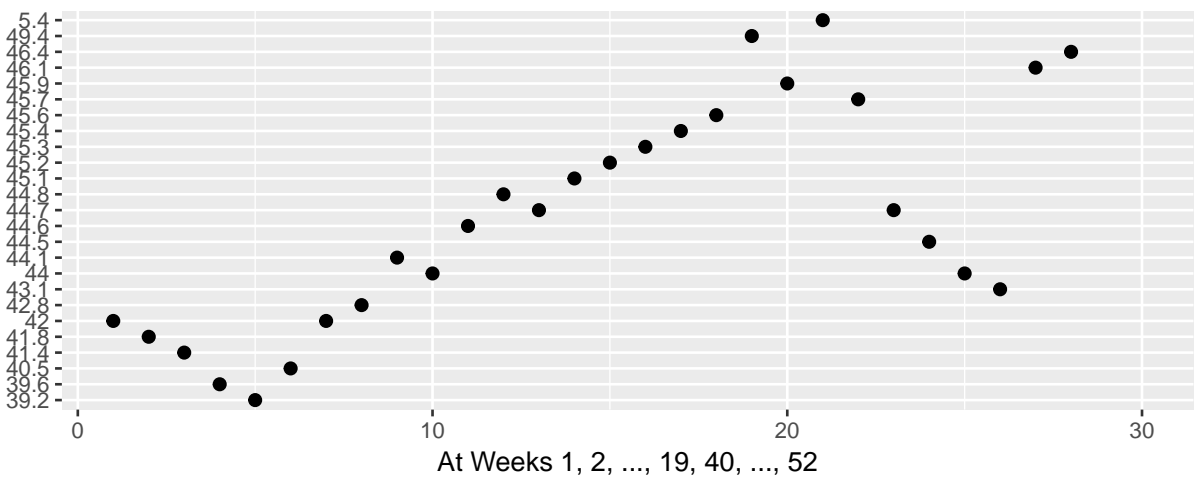


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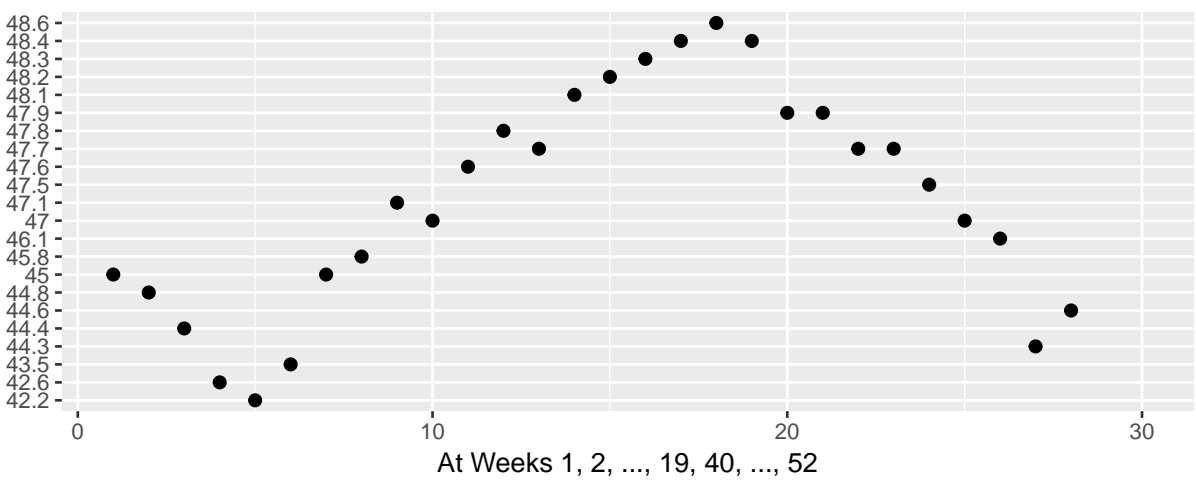


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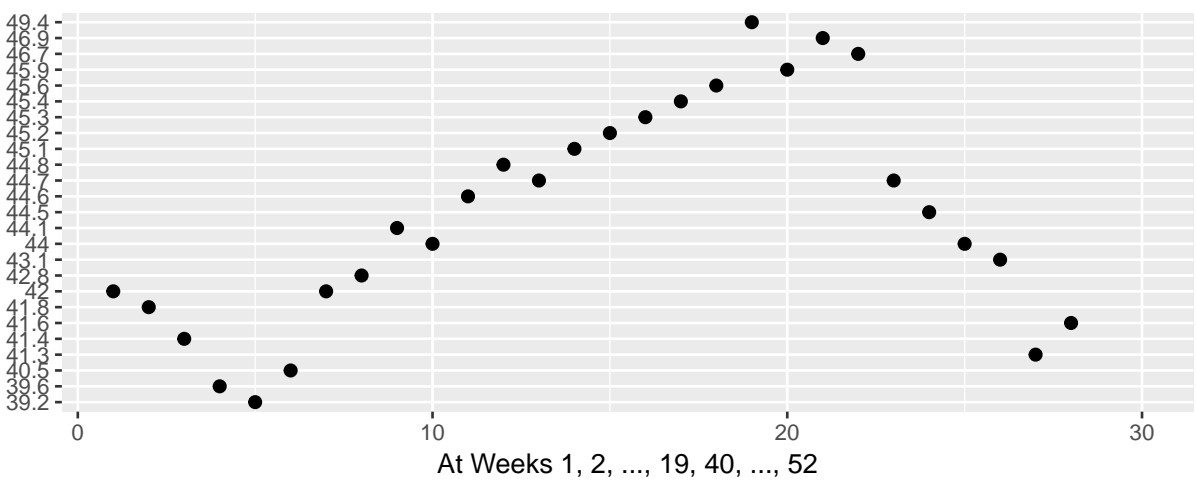
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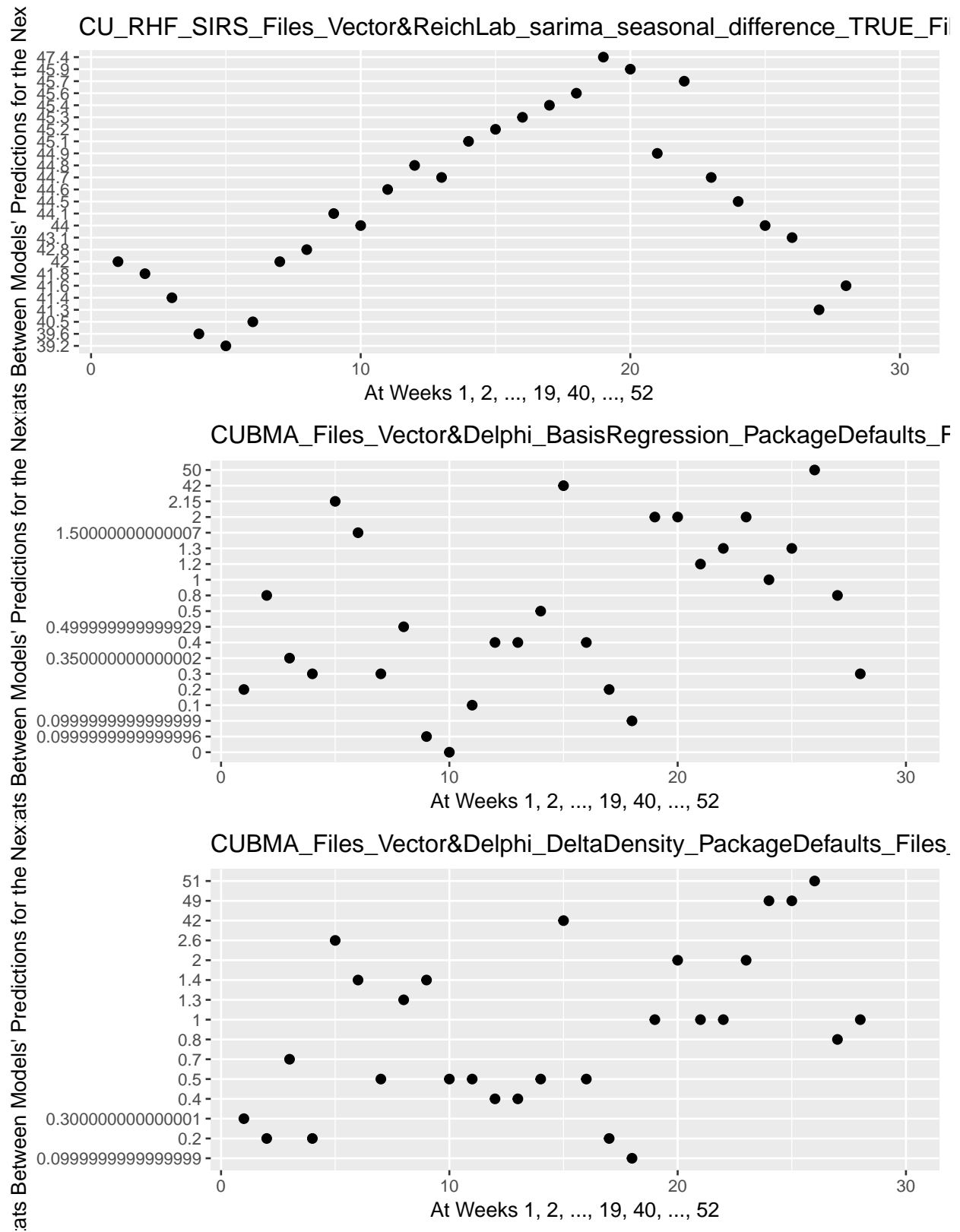


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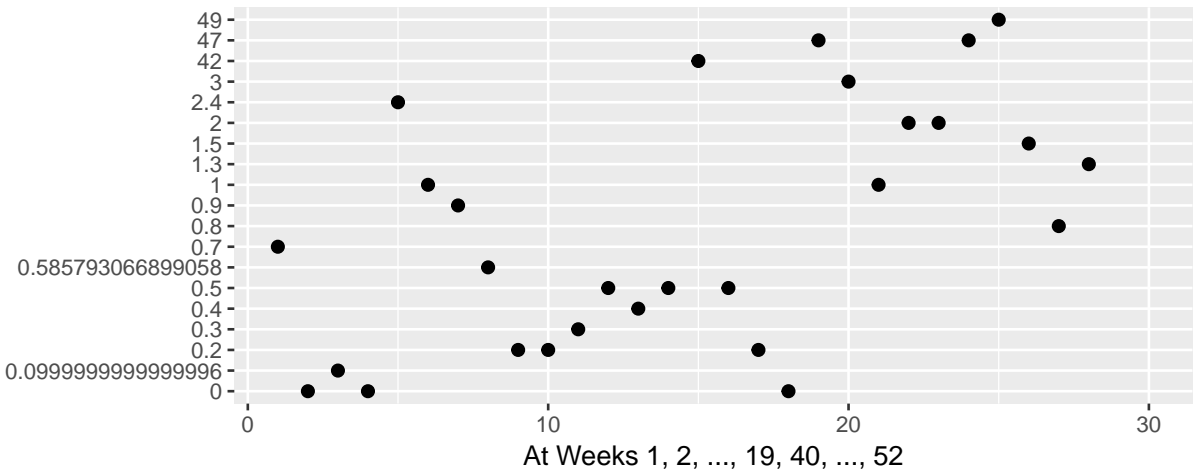
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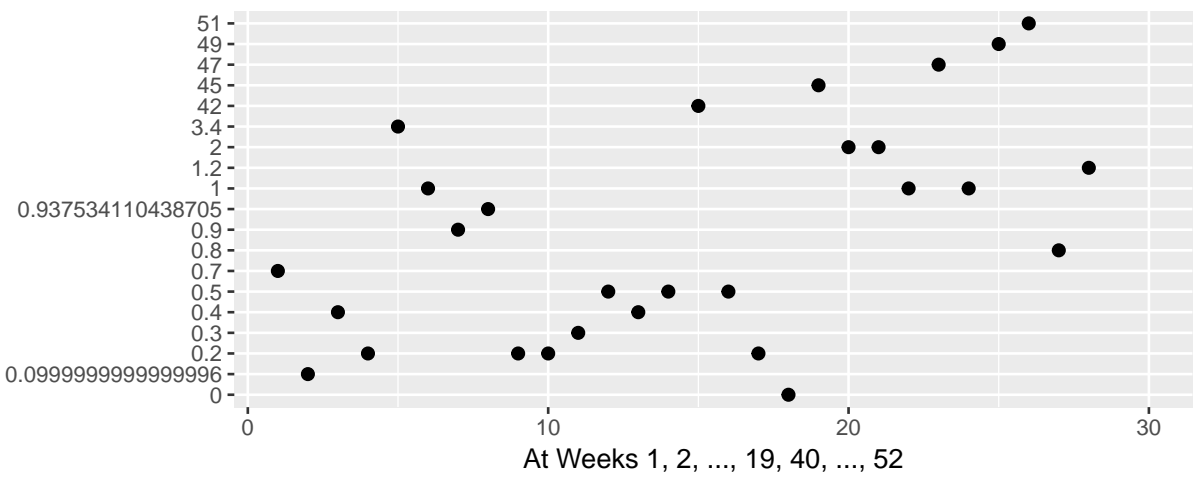


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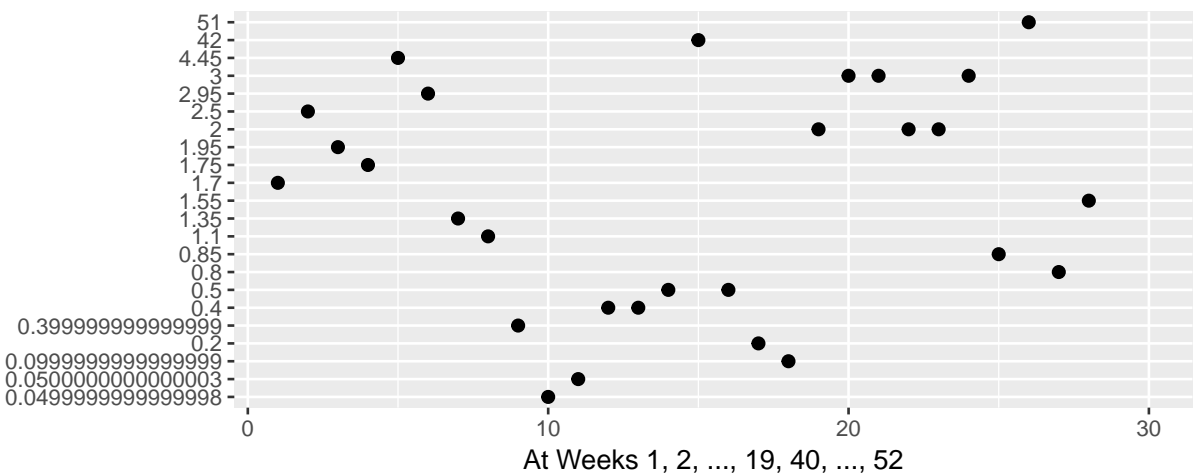
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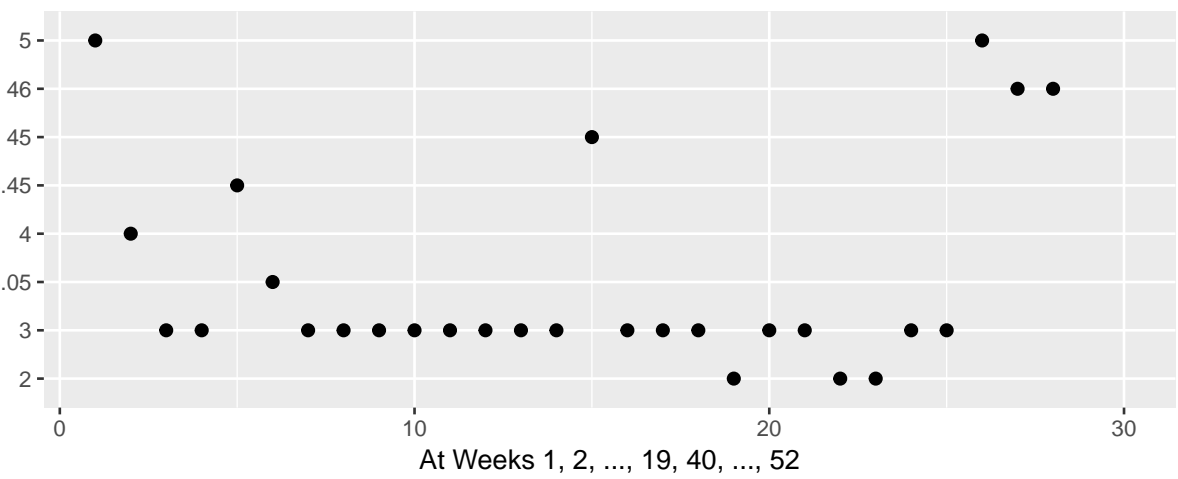


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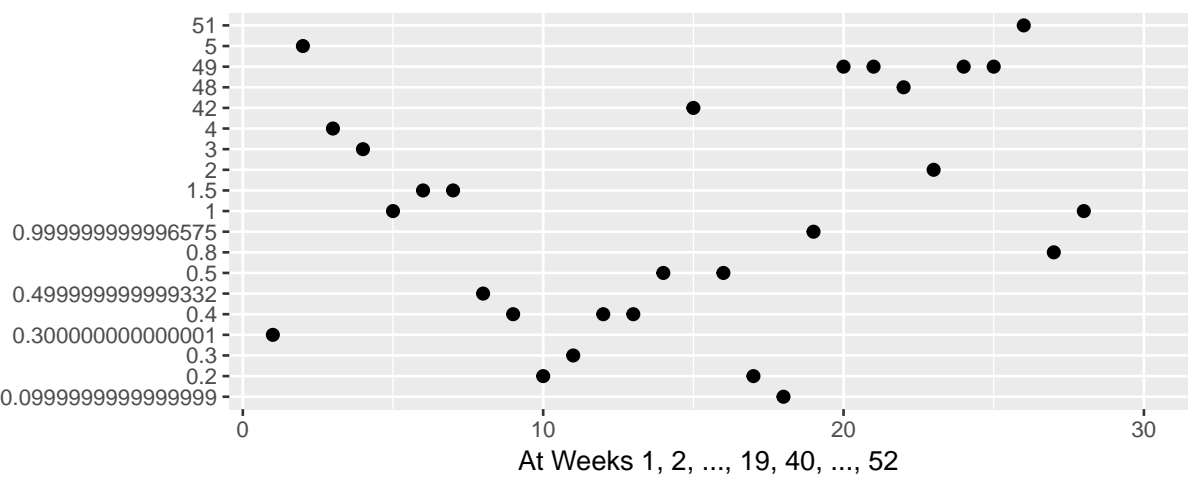


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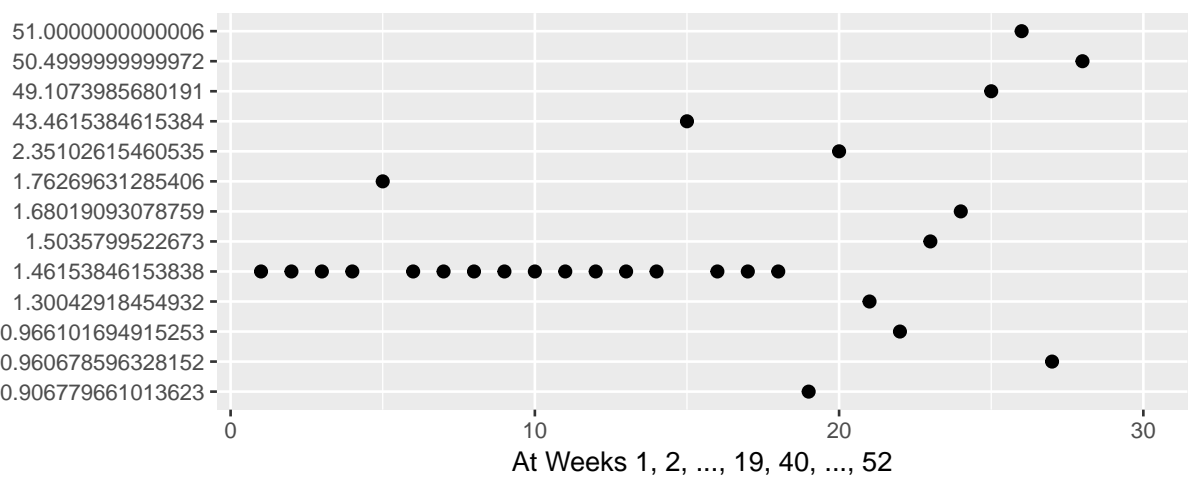
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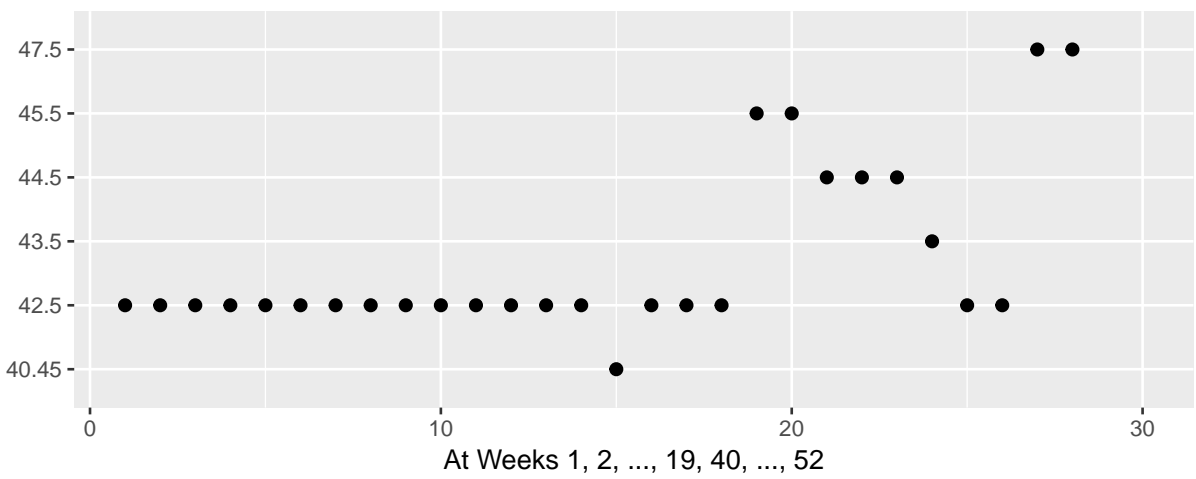


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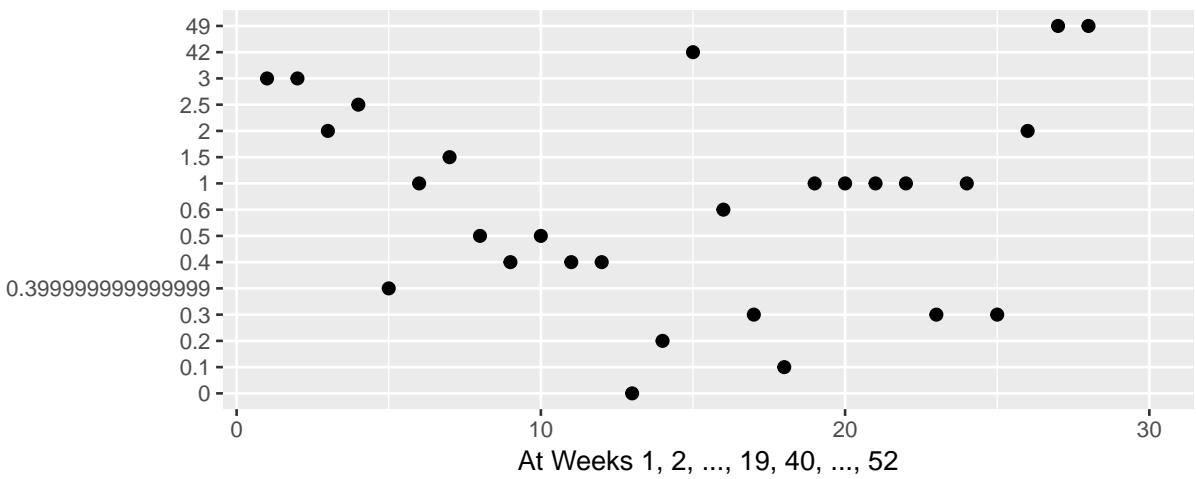


Relationships Between Models' Predictions for the Next

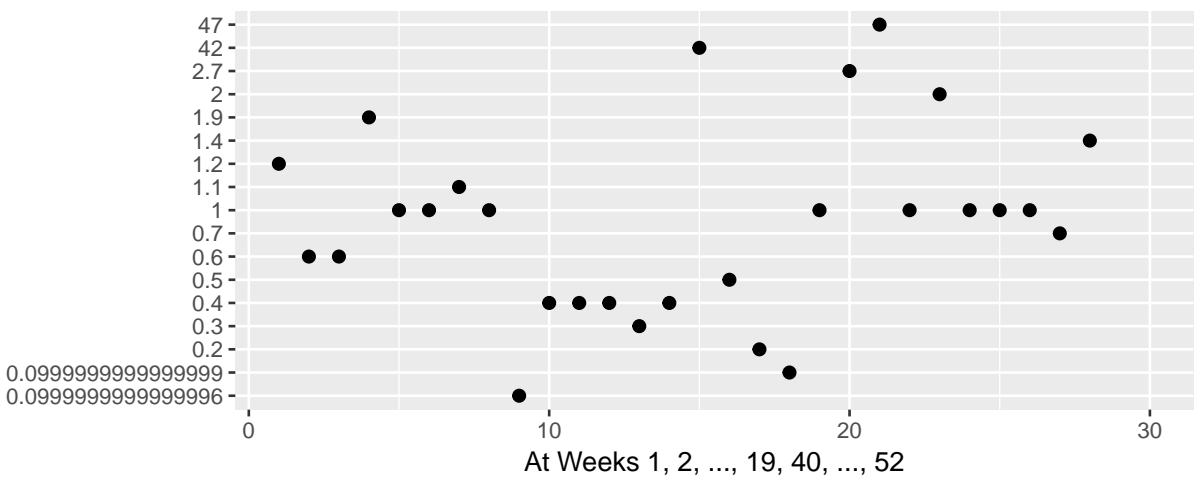
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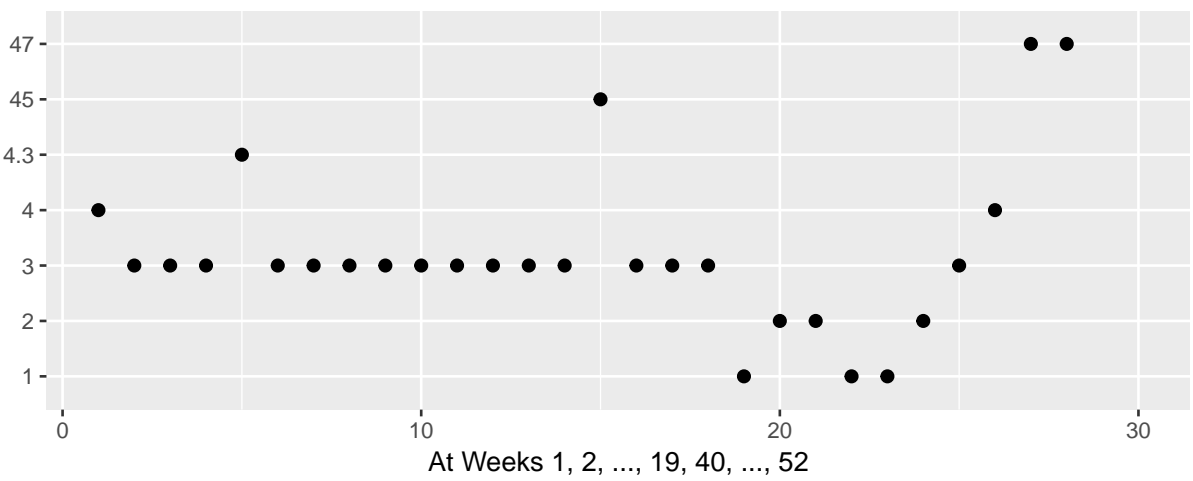


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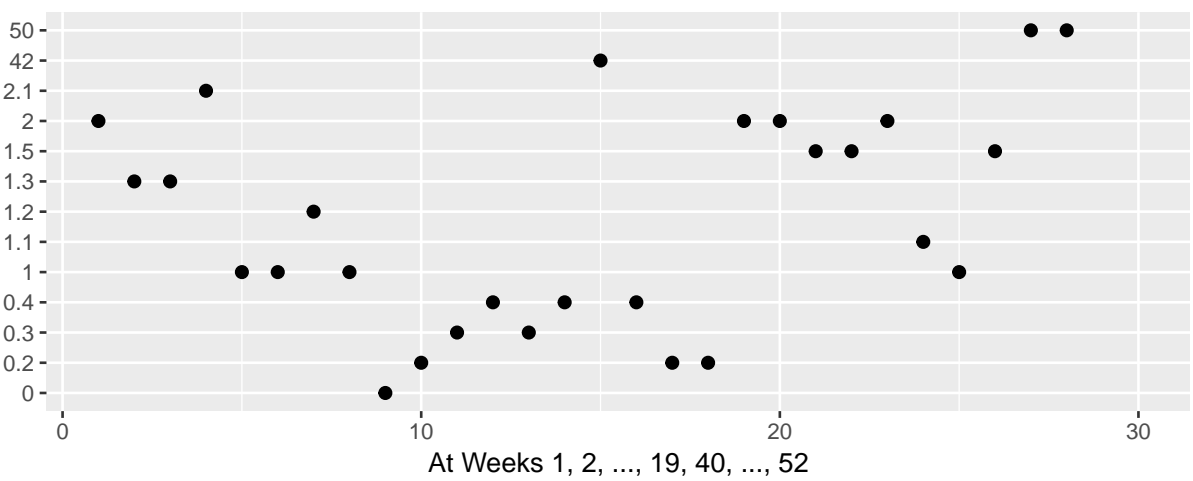


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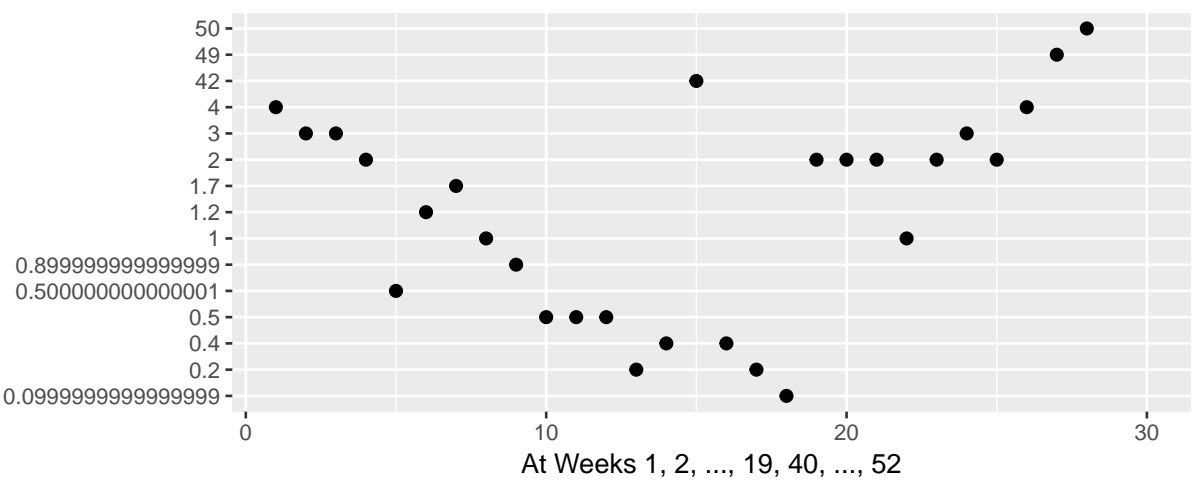
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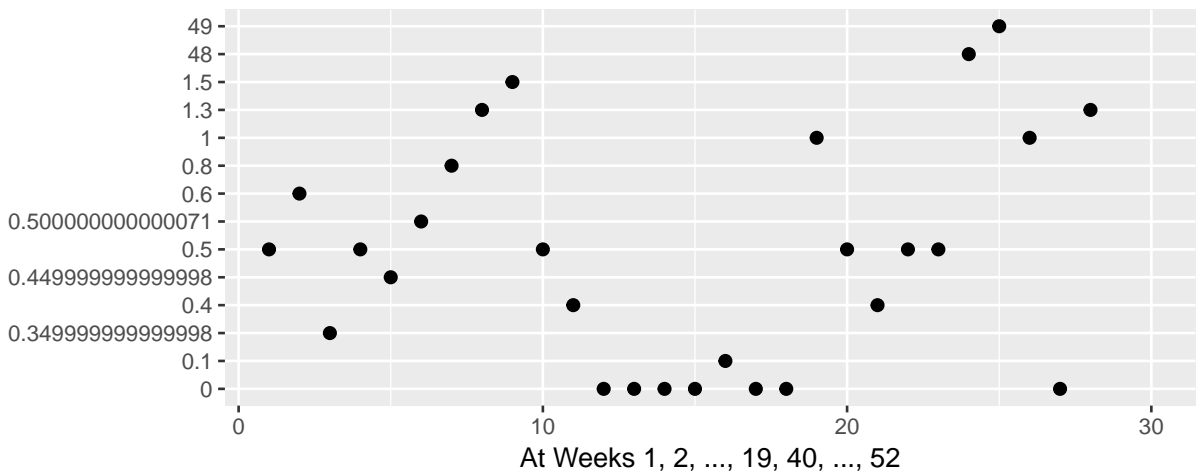


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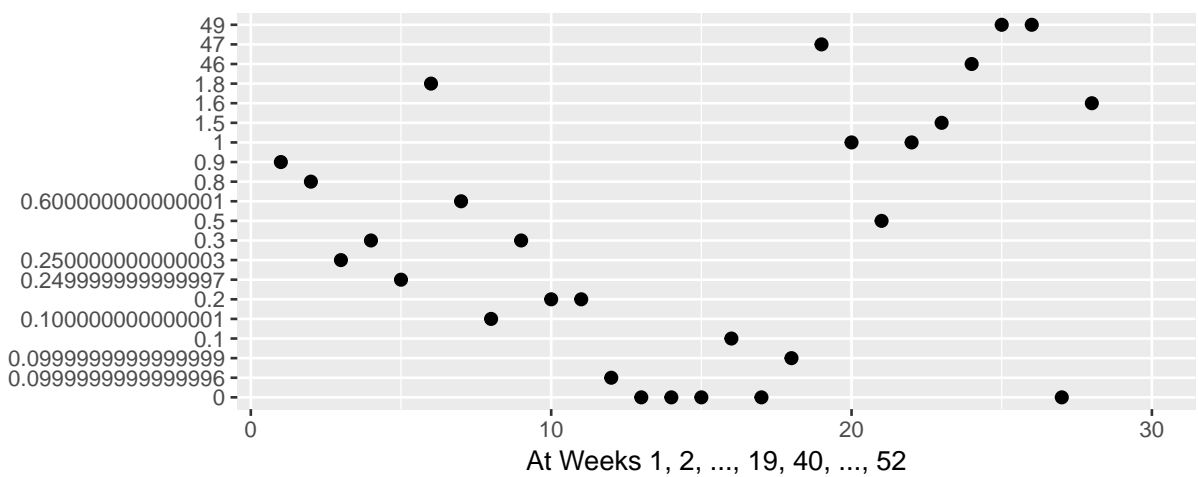


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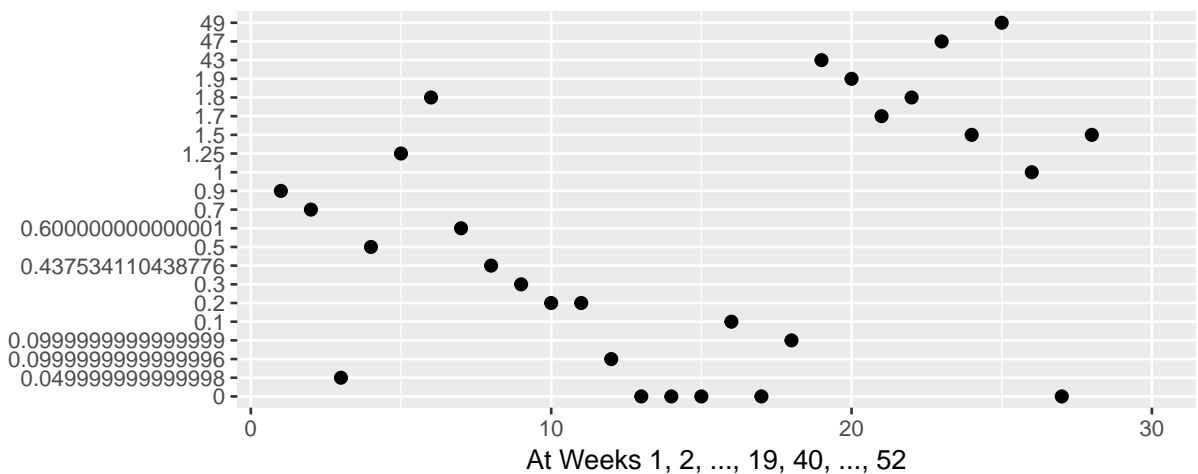
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Delphi_BasisRegression_PackageDefaults_Files_Vector&Delphi_En

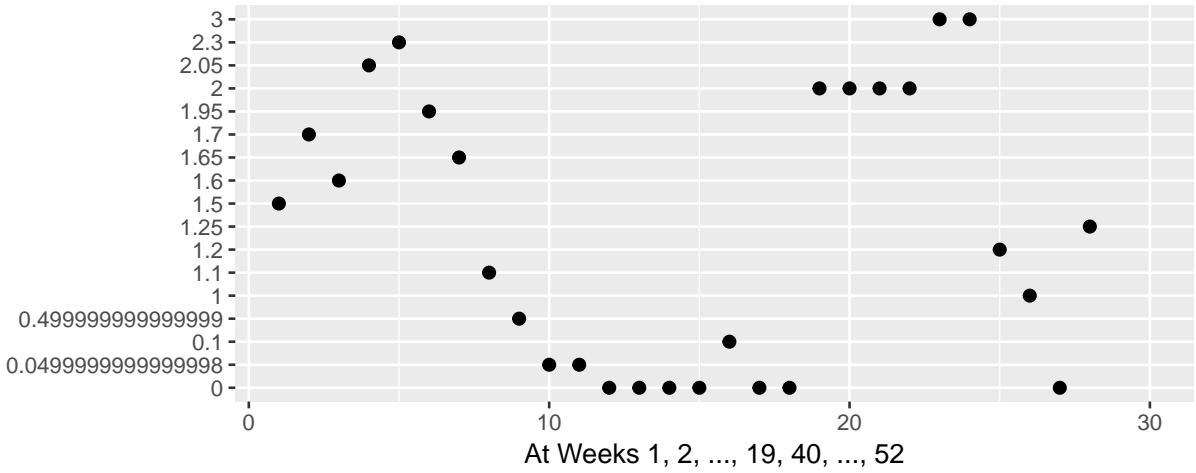


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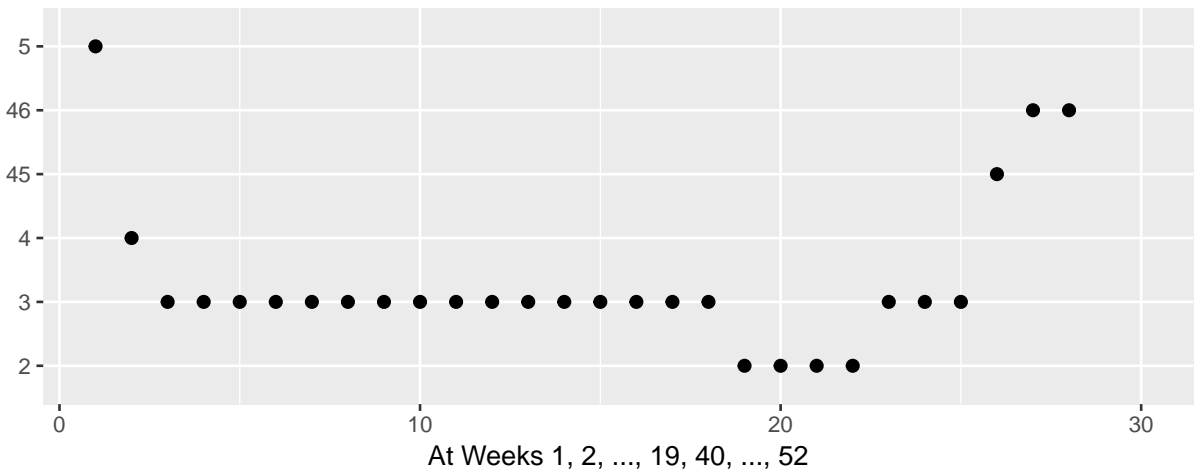


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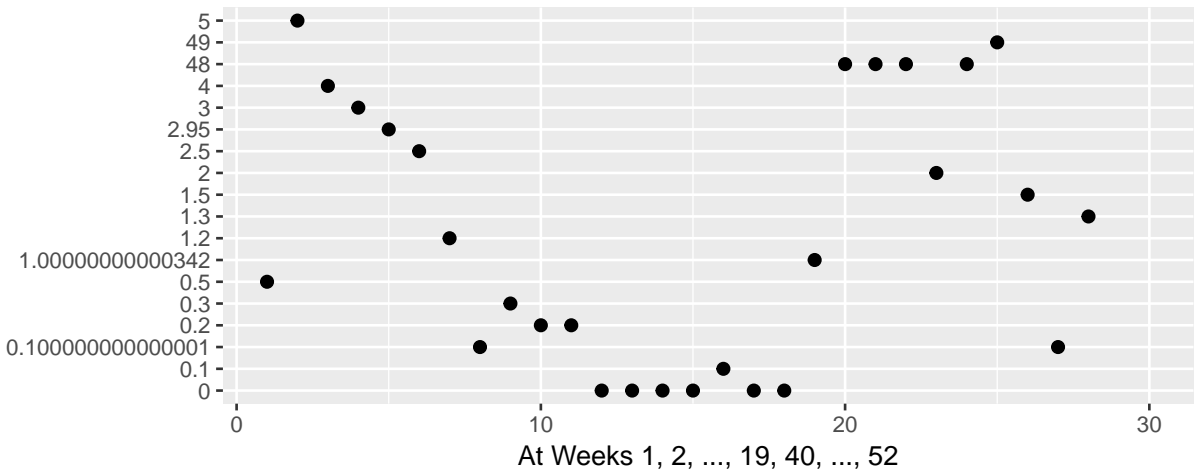
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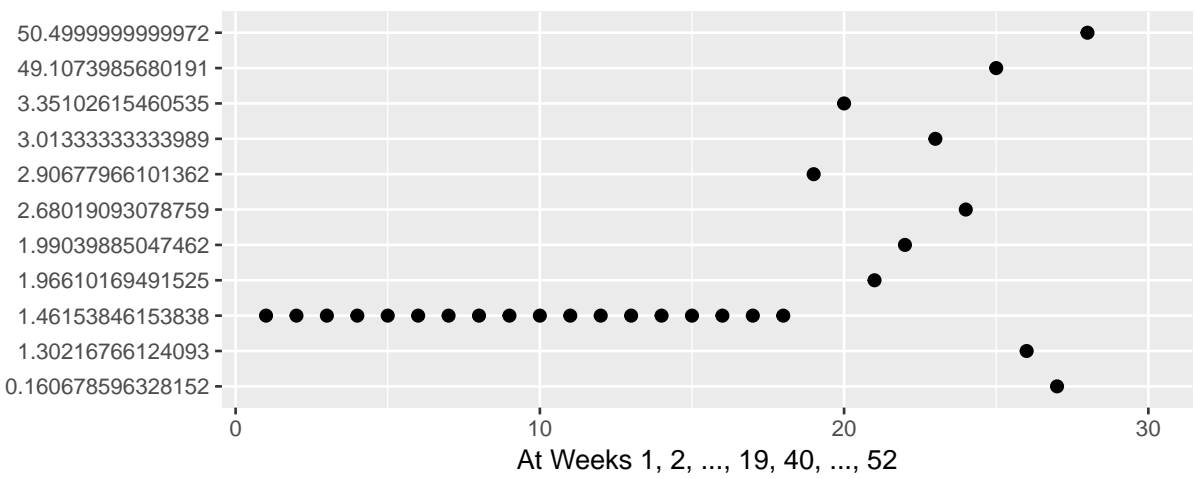


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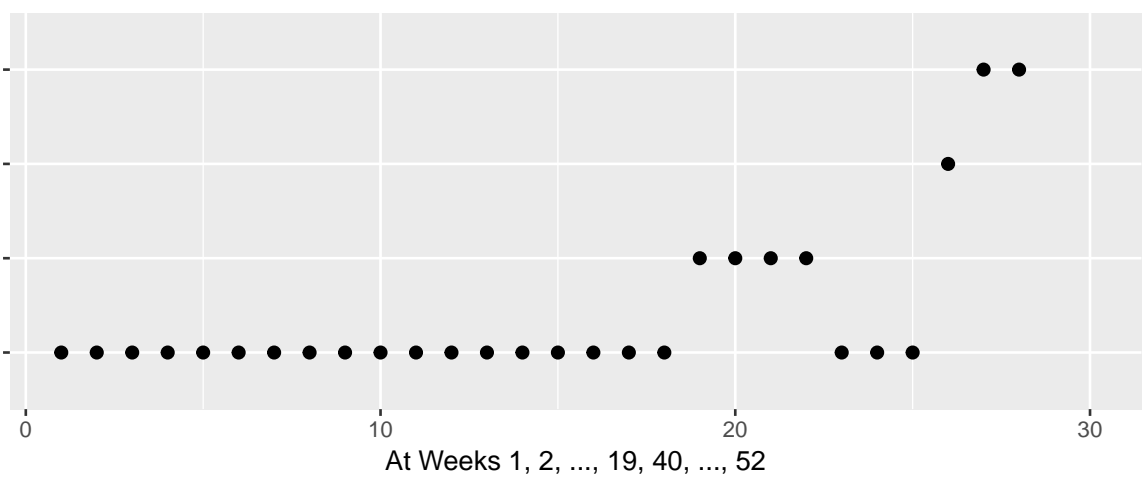


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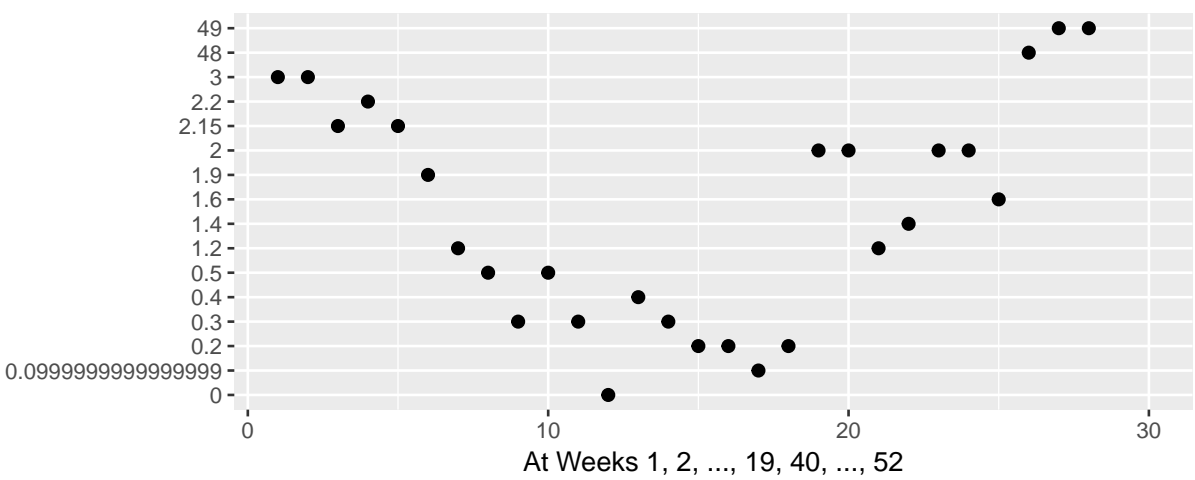
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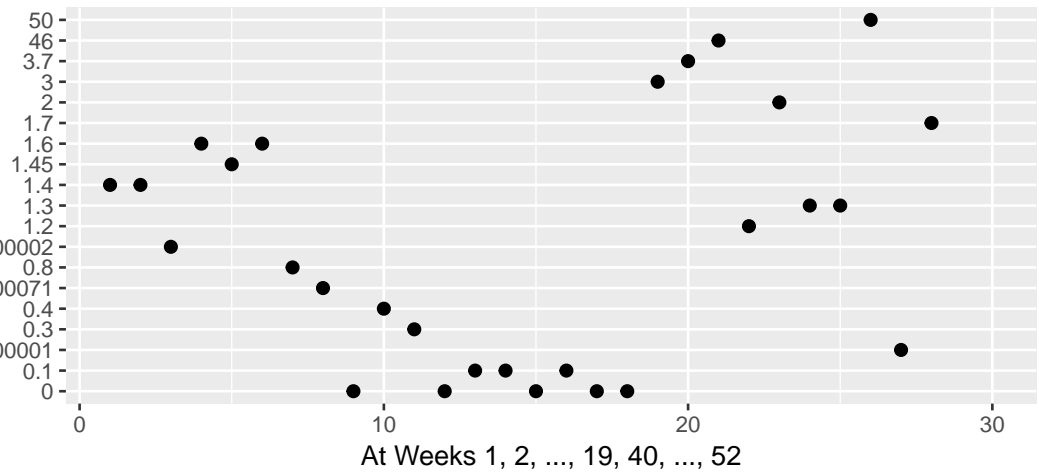


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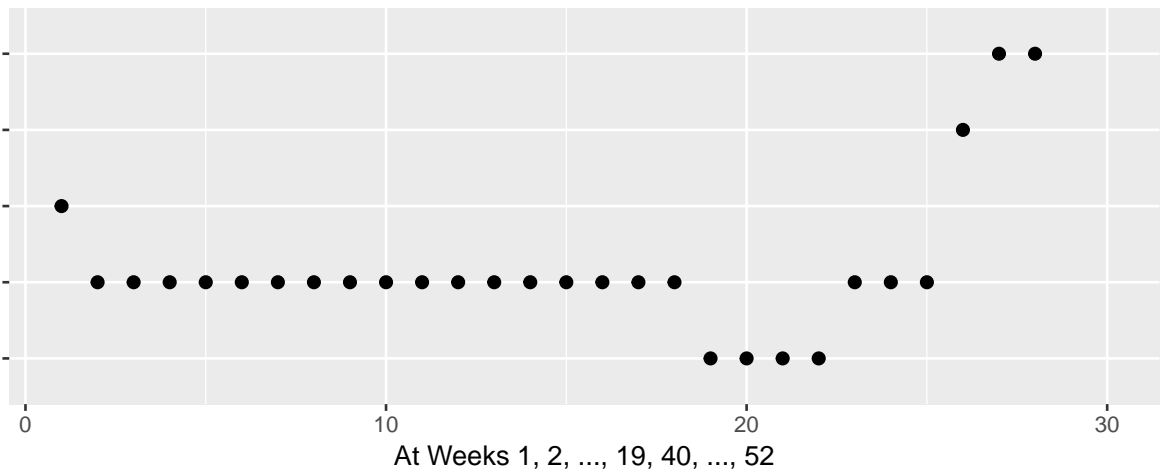


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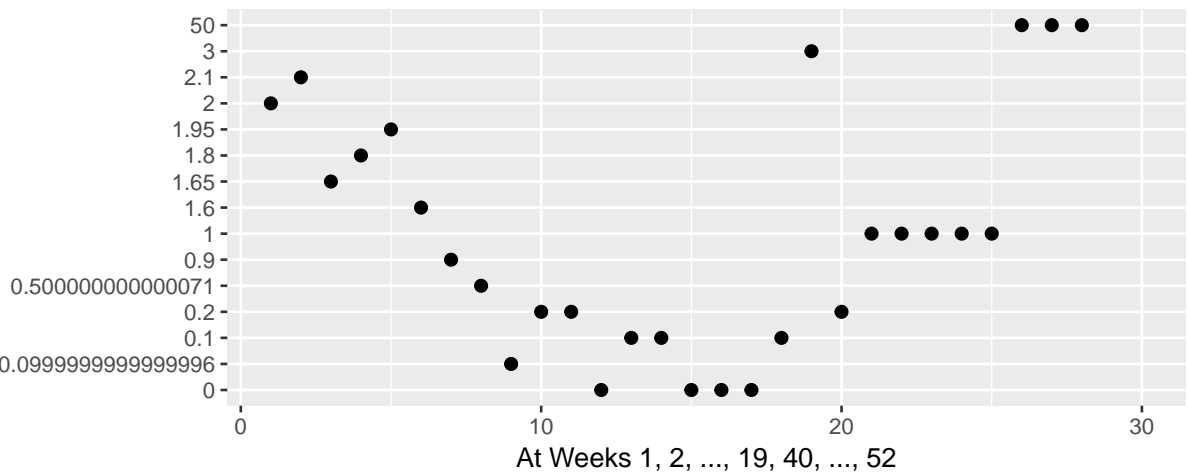
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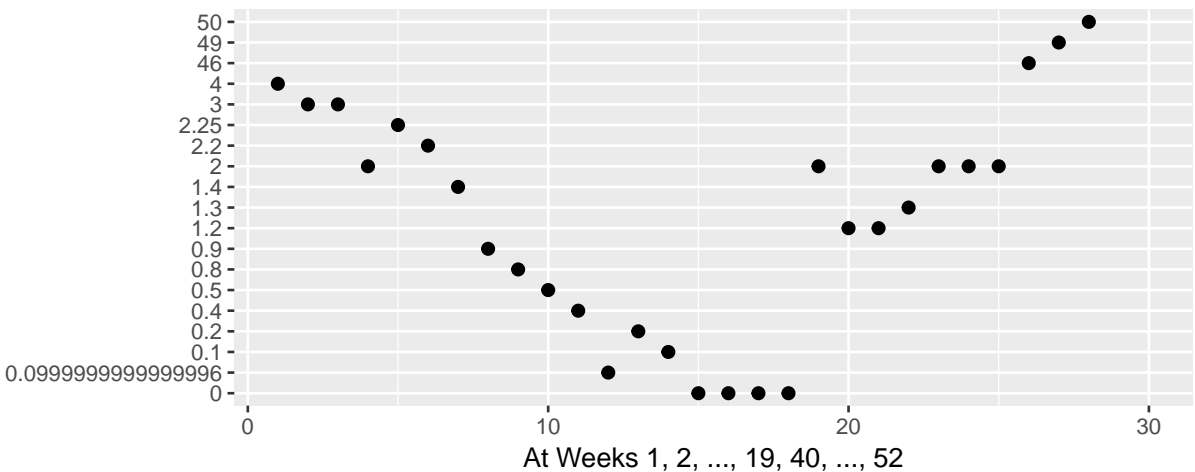


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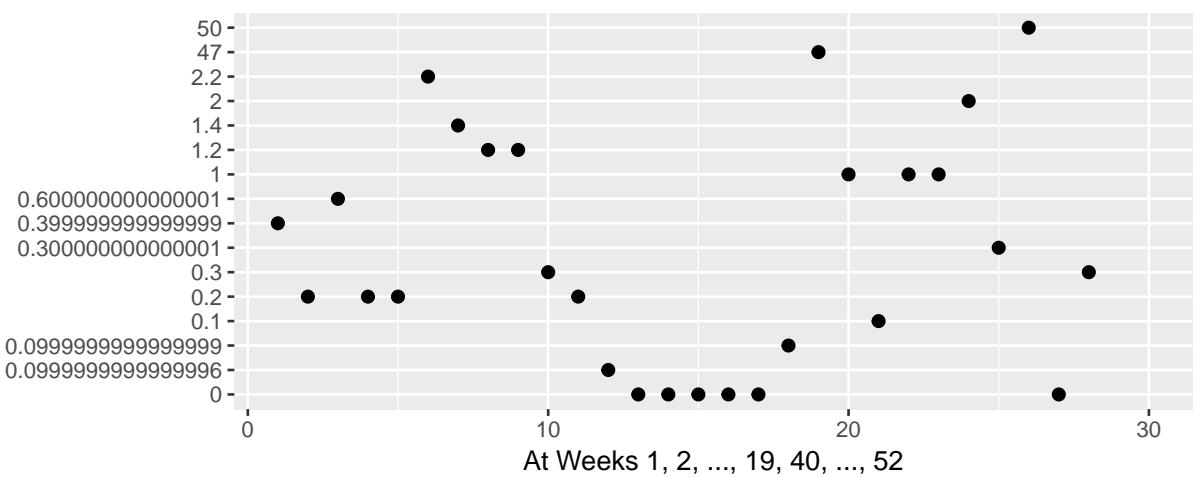


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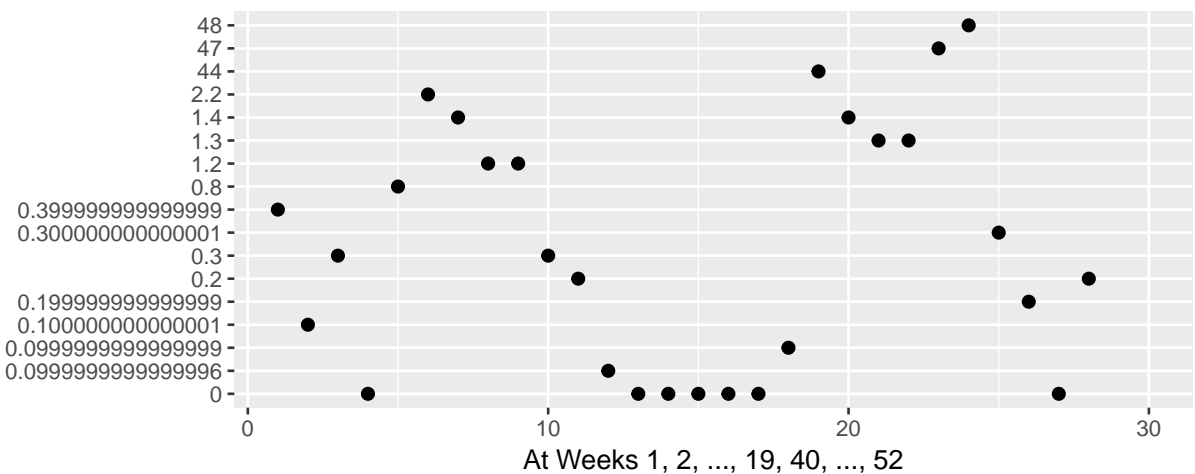
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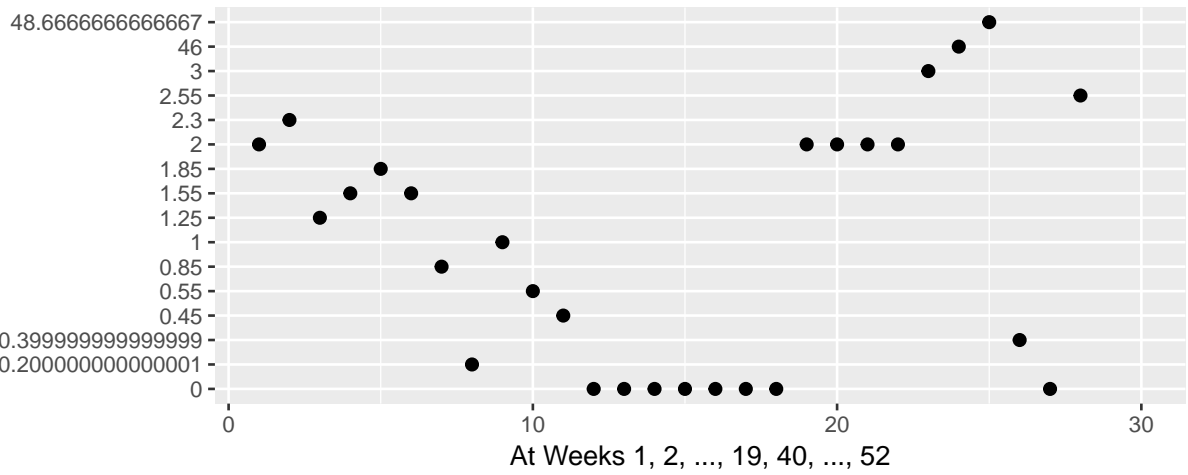


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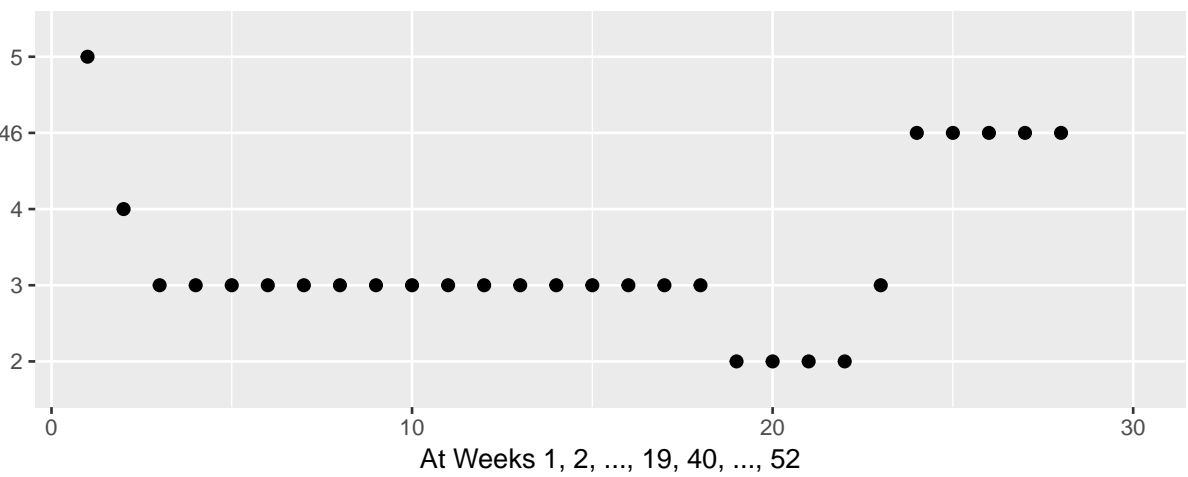


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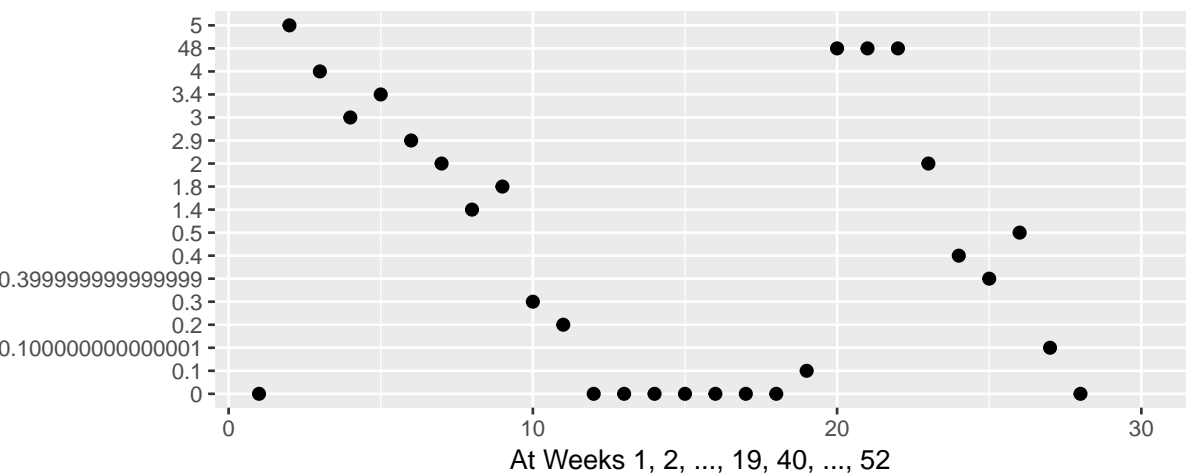
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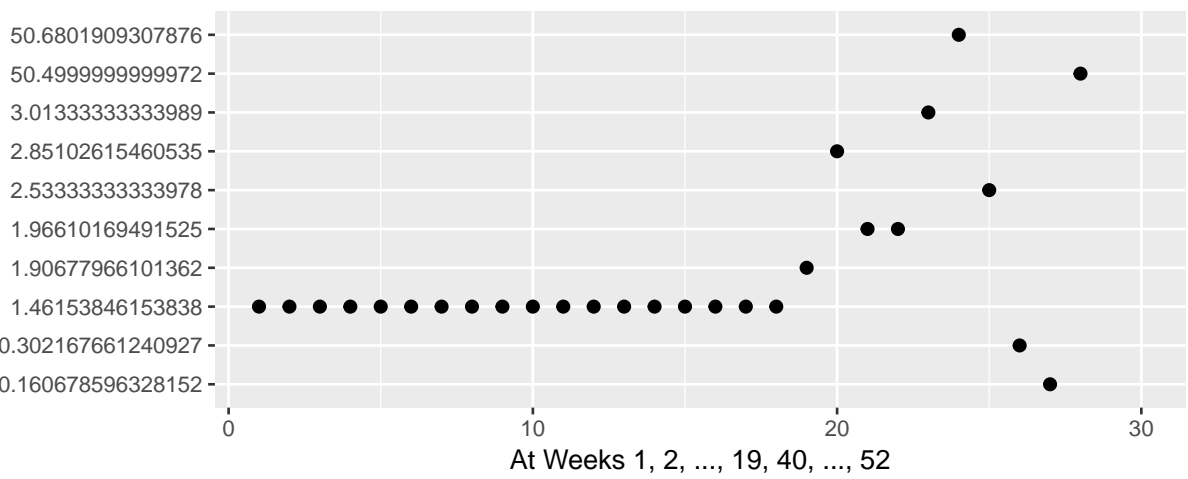


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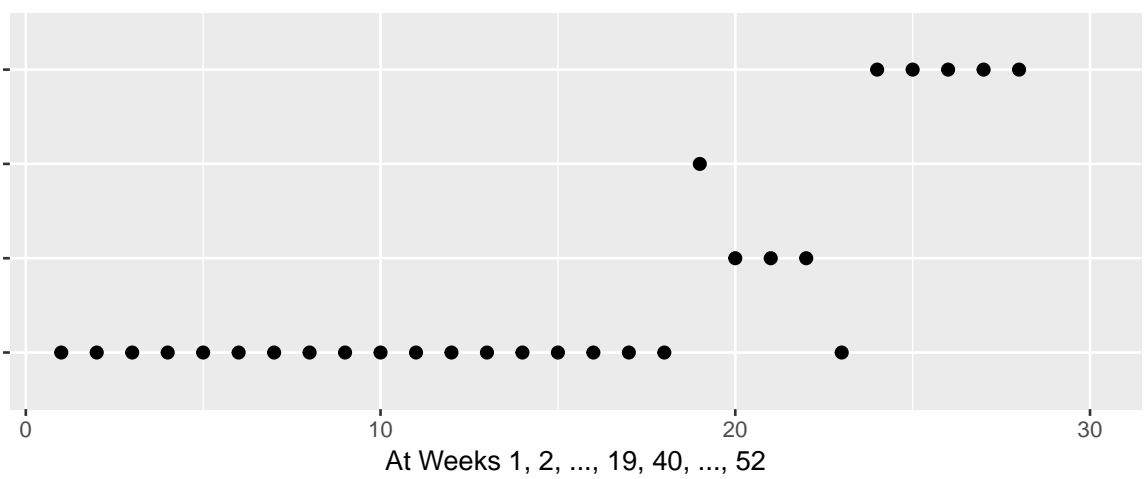


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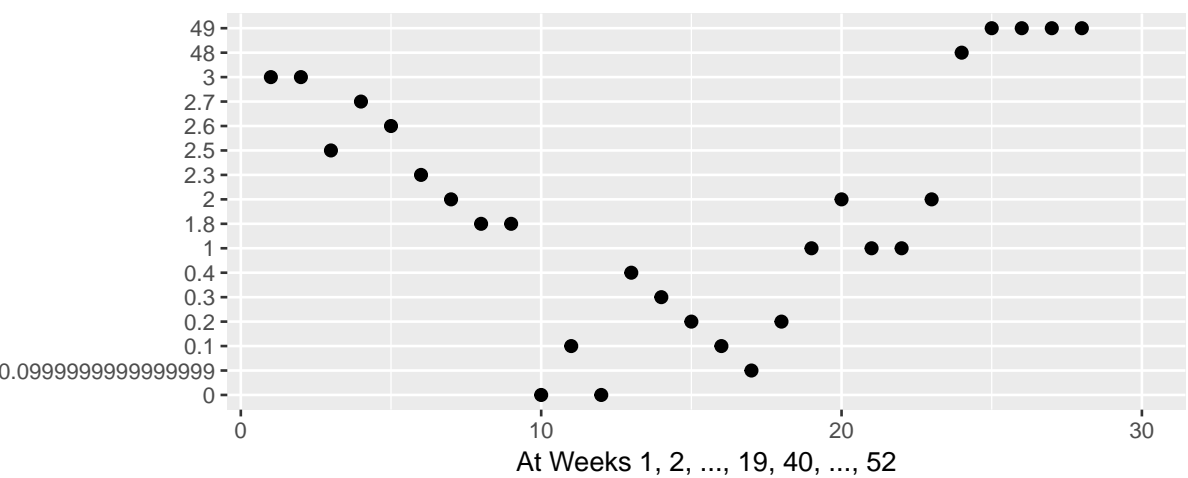
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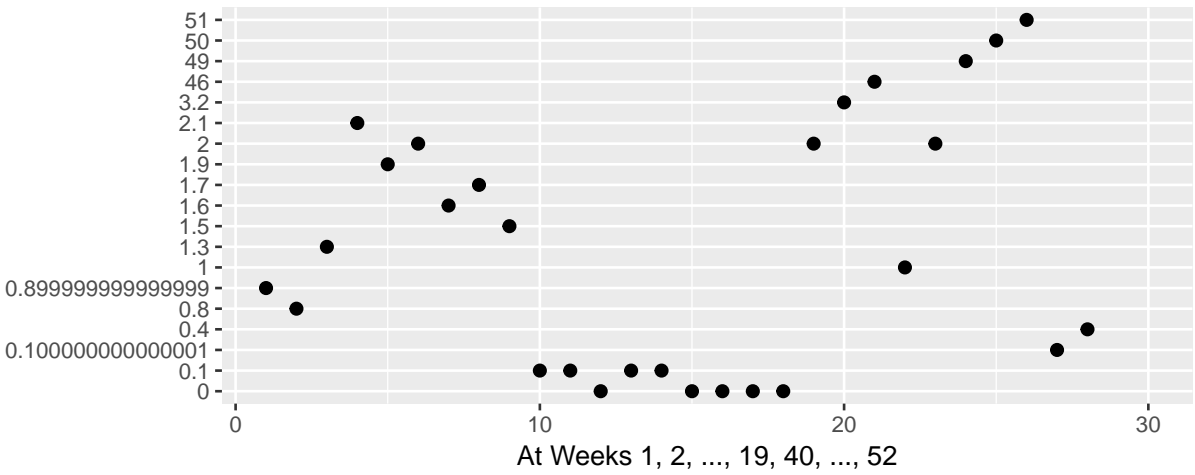


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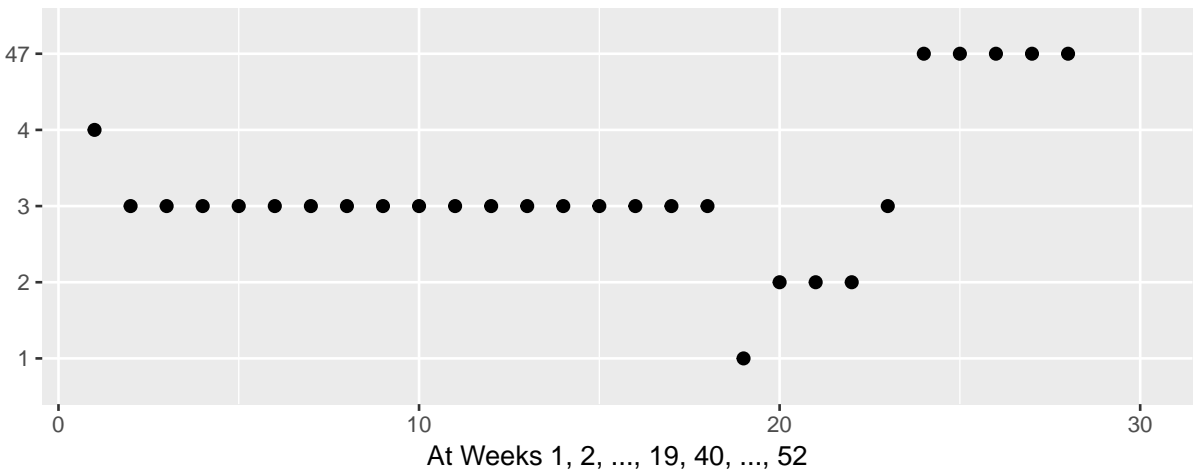


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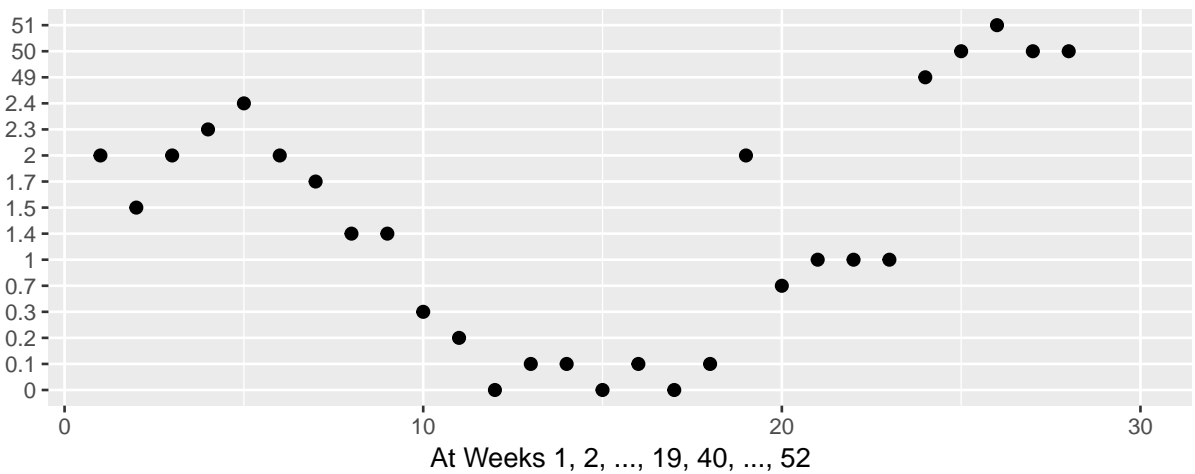
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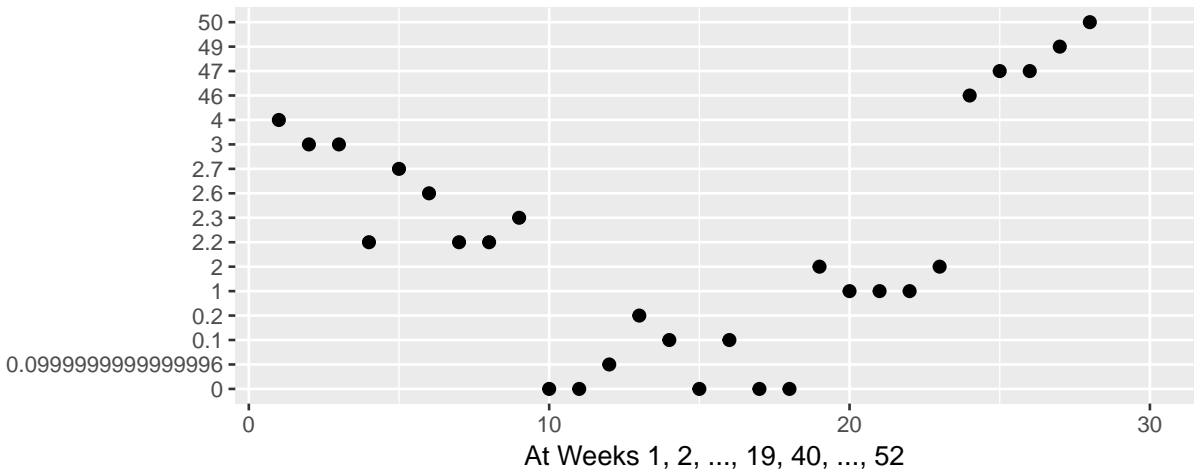


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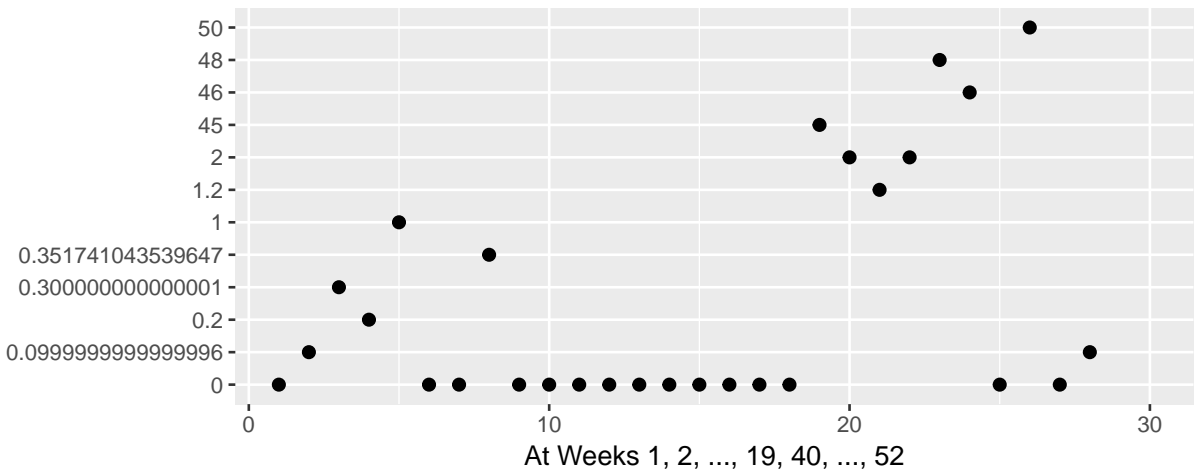


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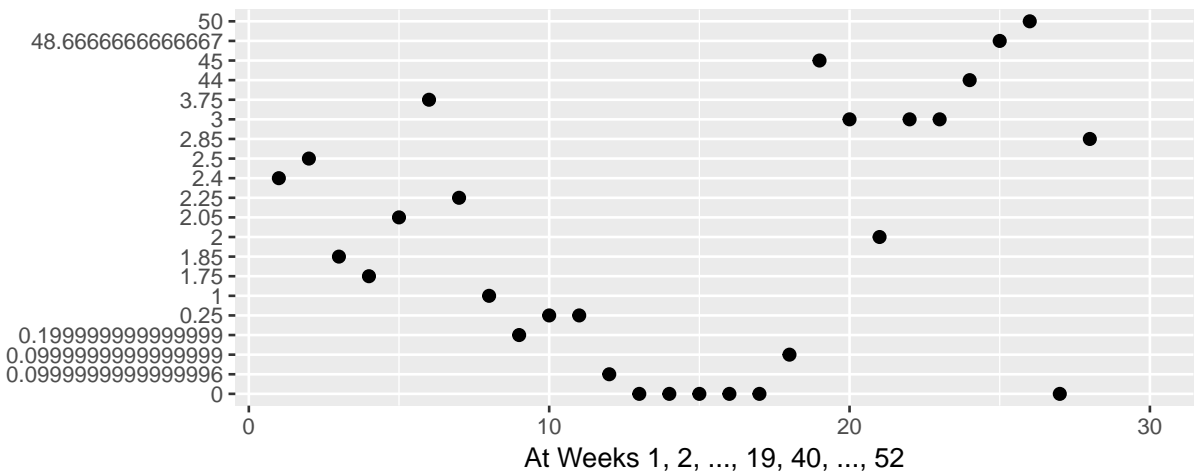
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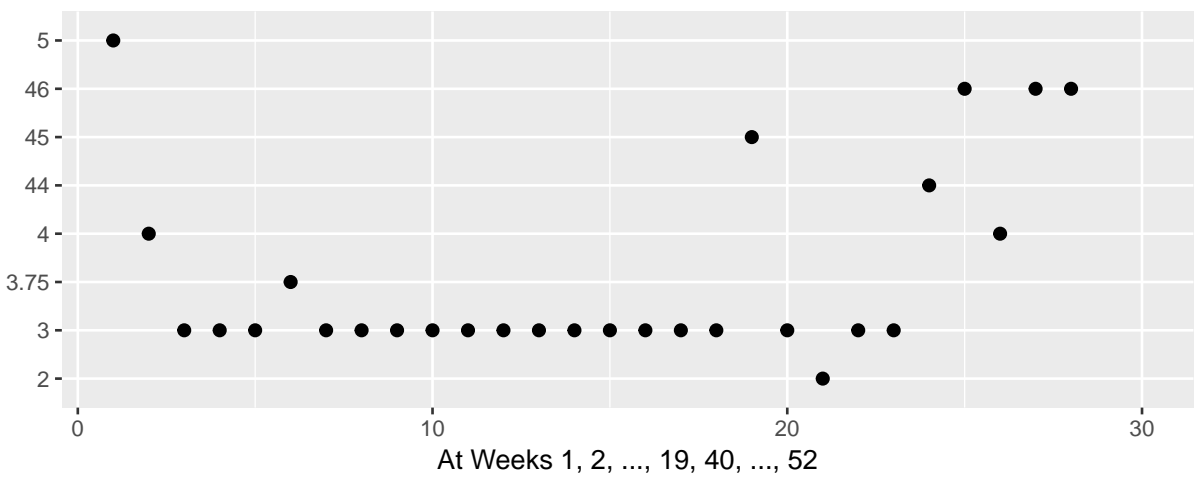


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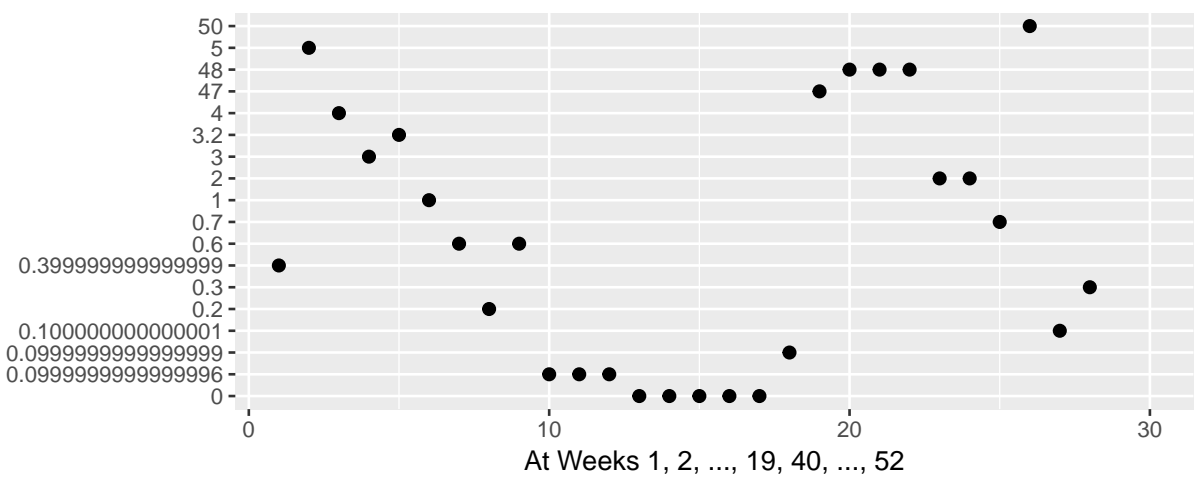


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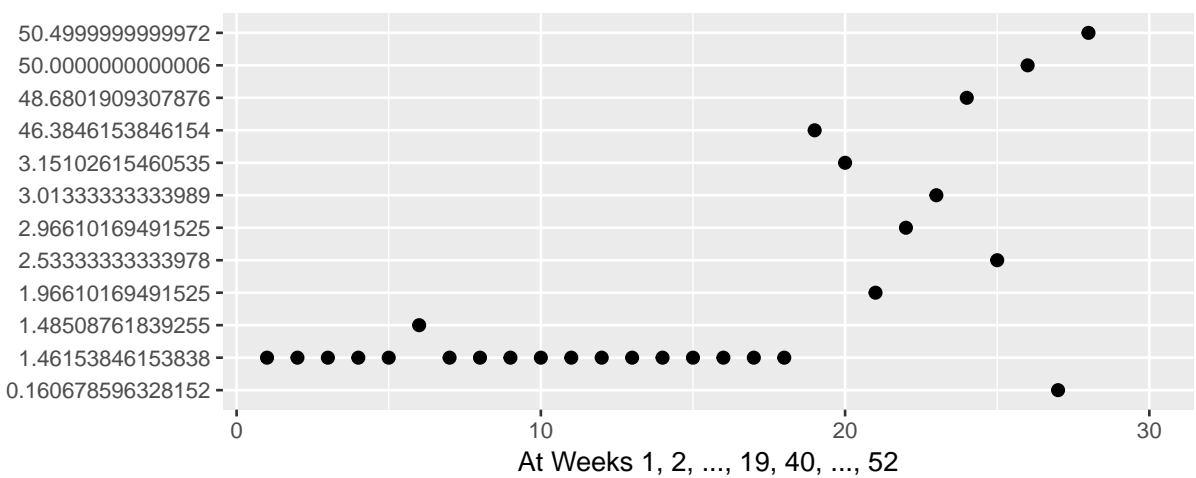
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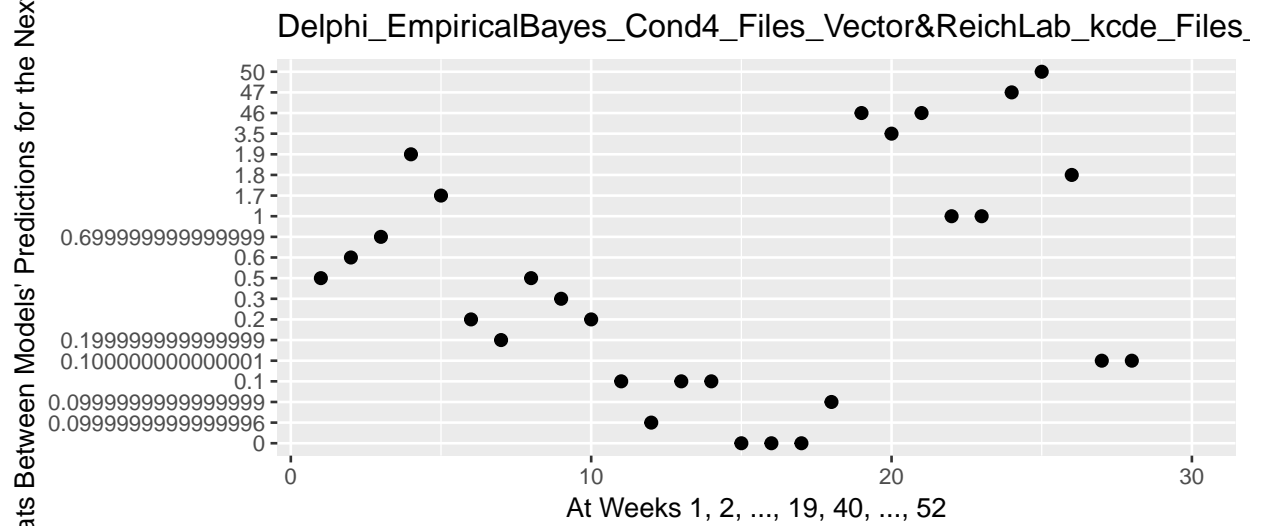
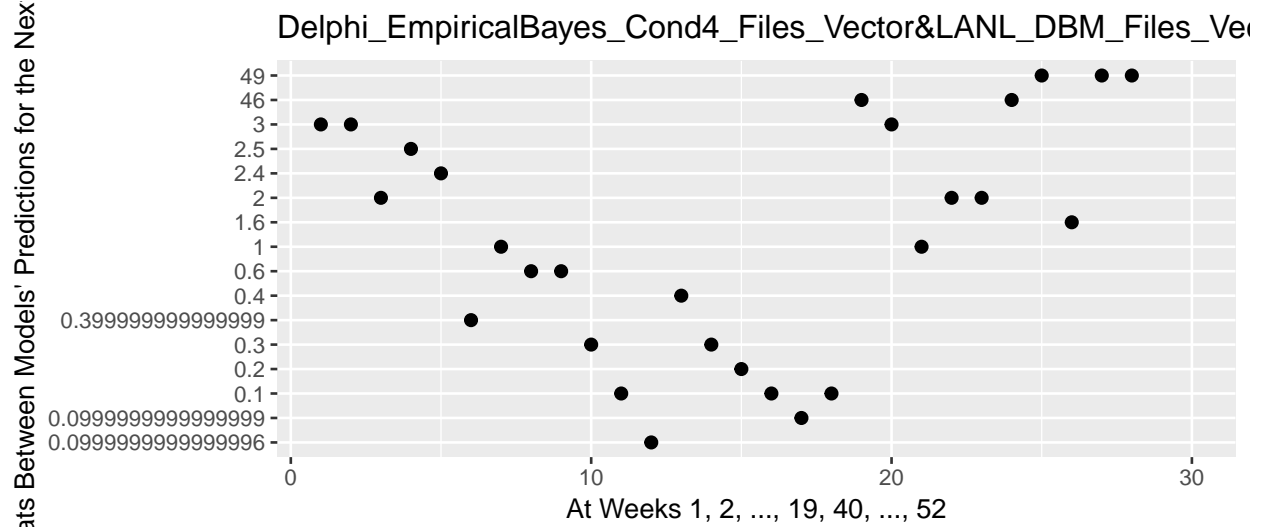
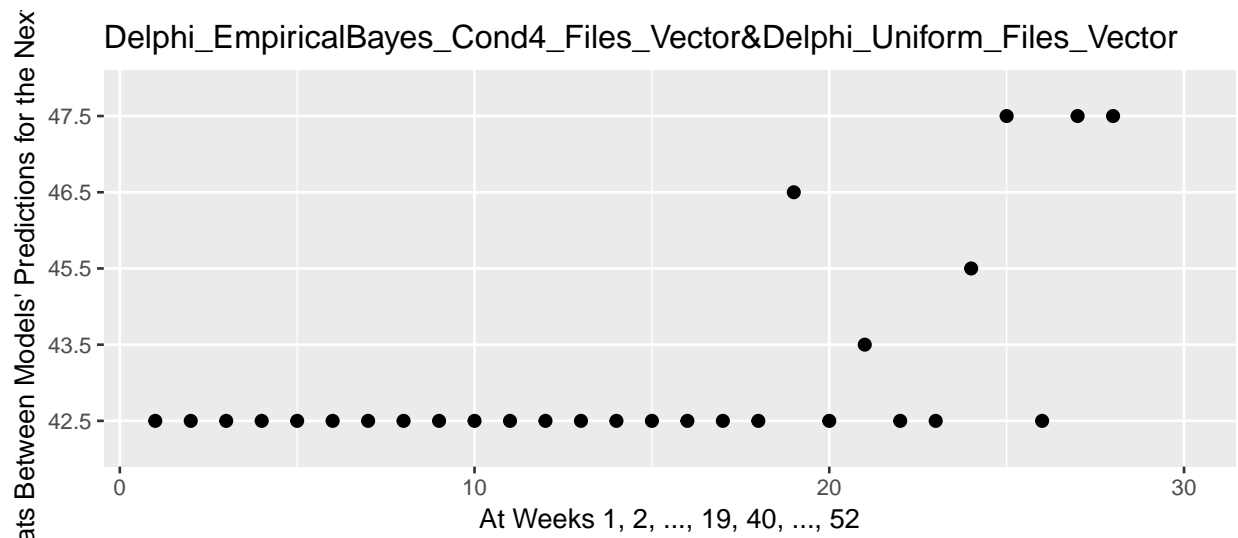


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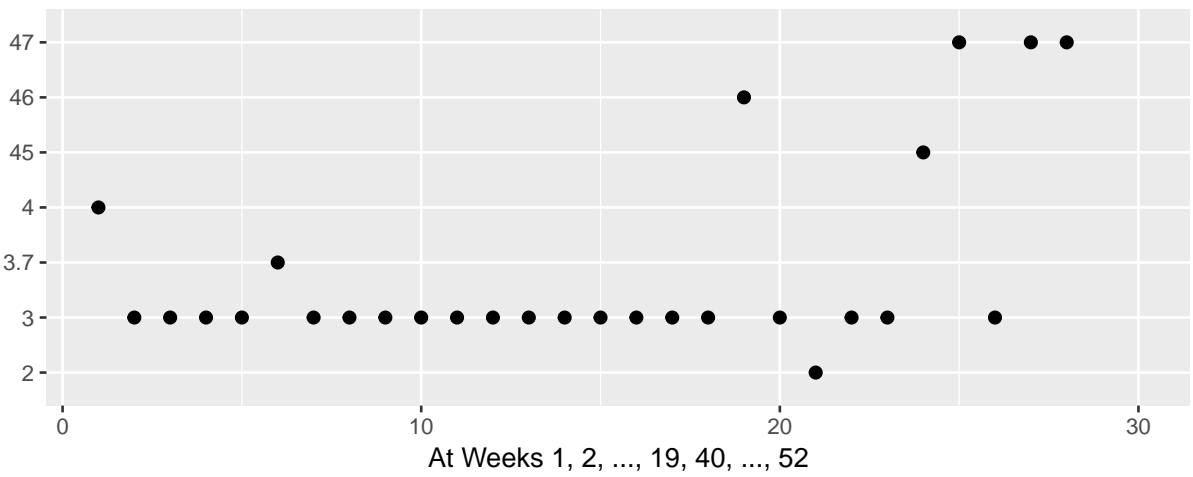
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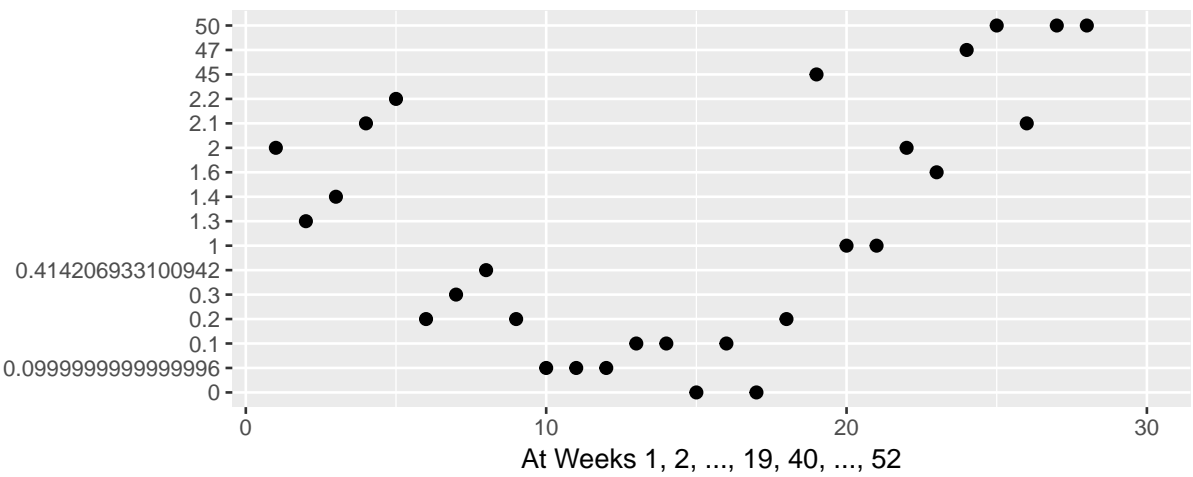


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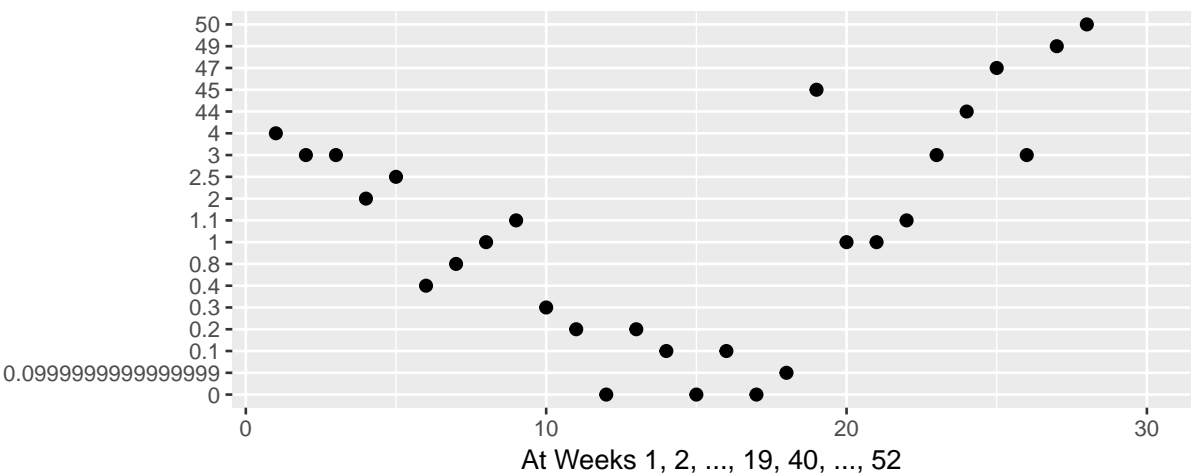
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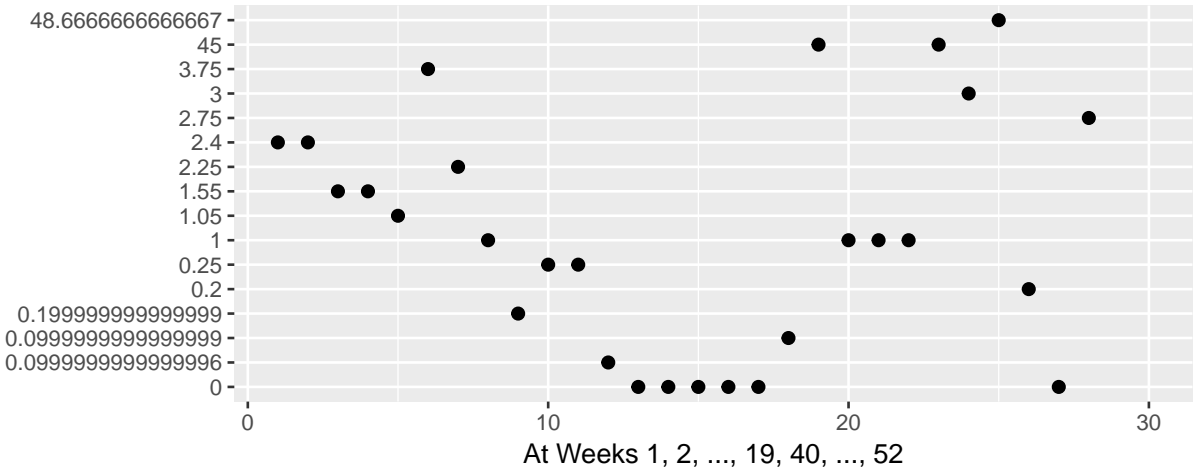


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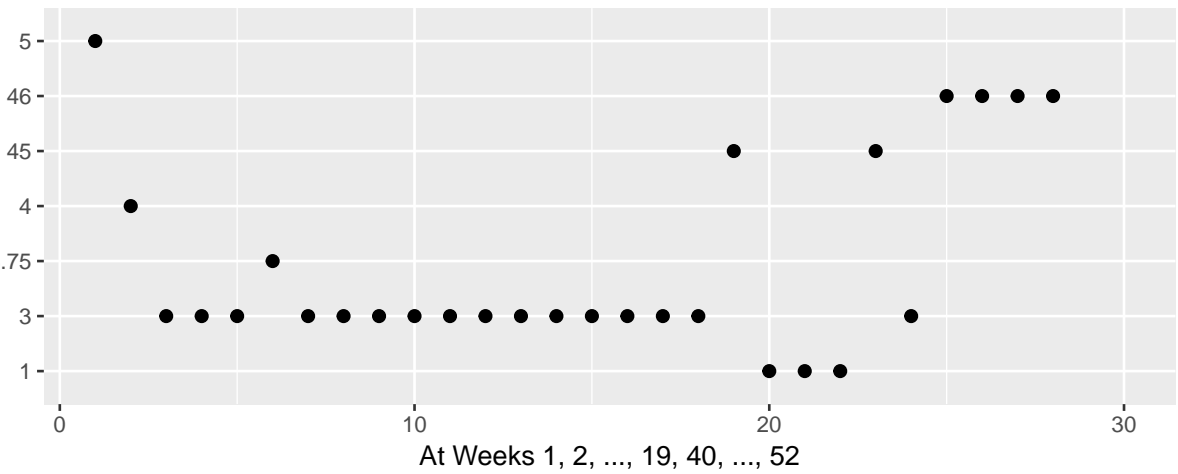


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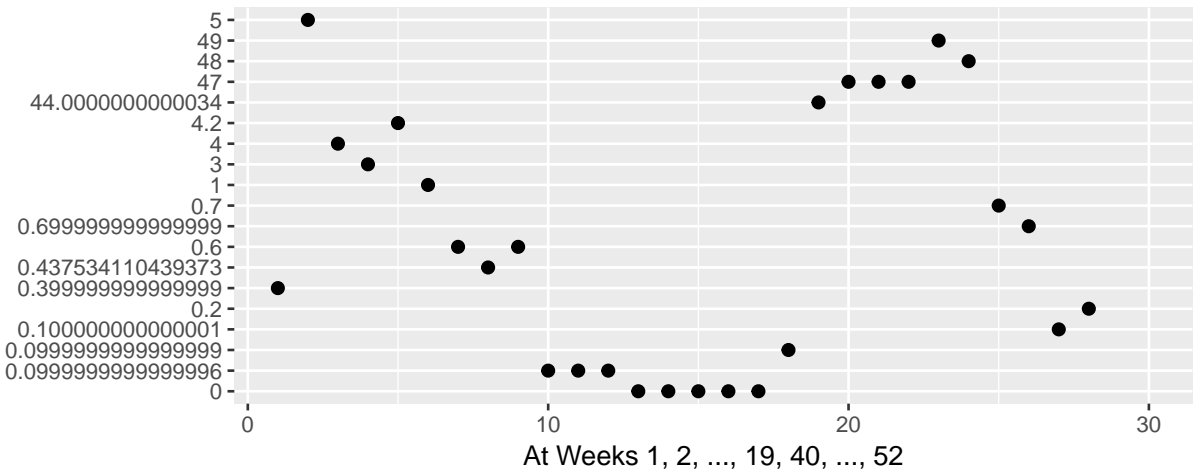
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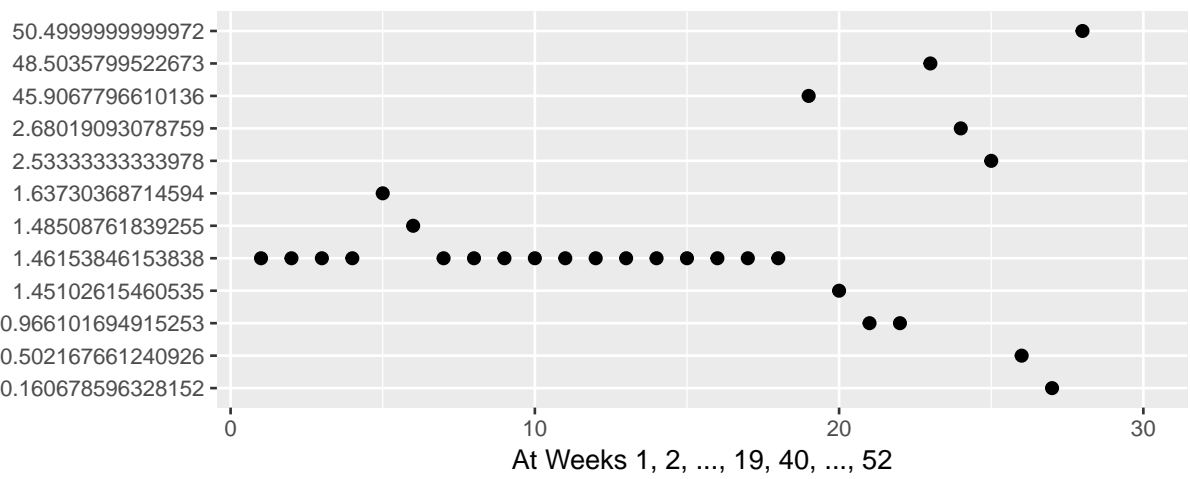


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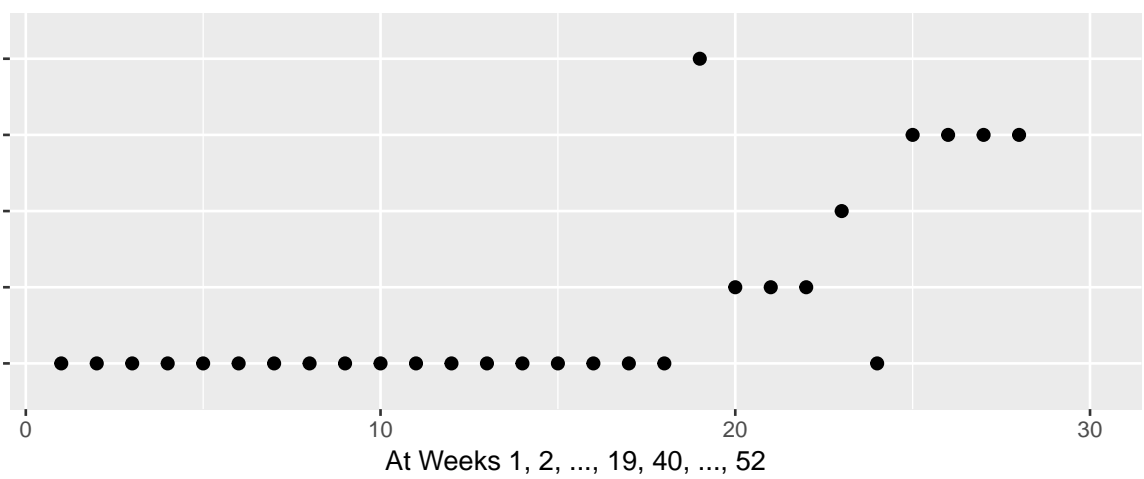


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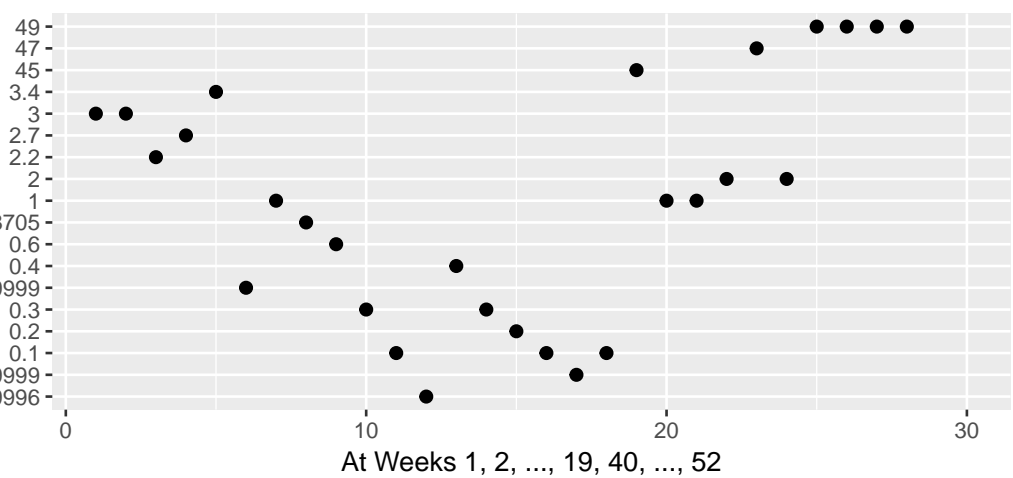
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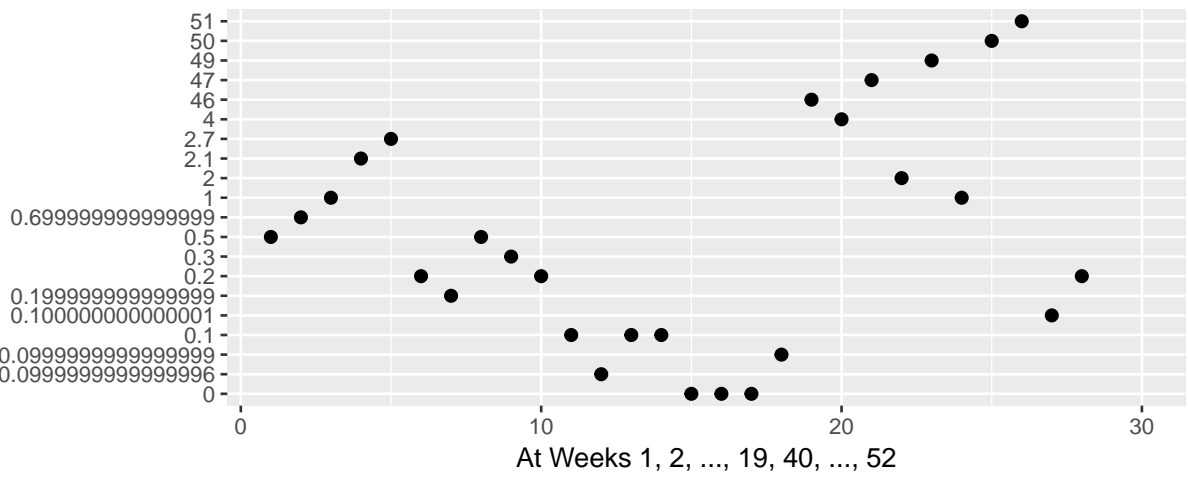


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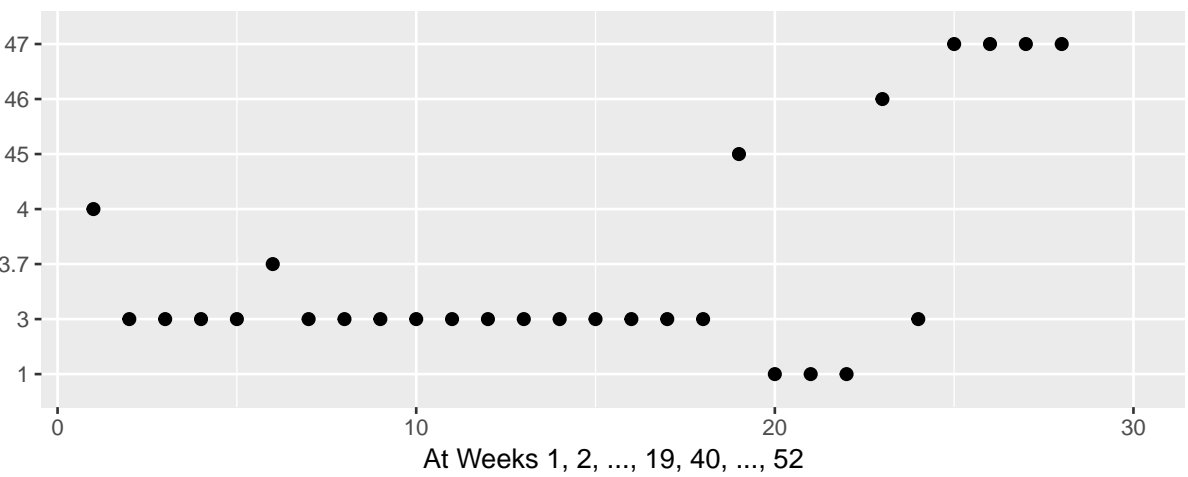


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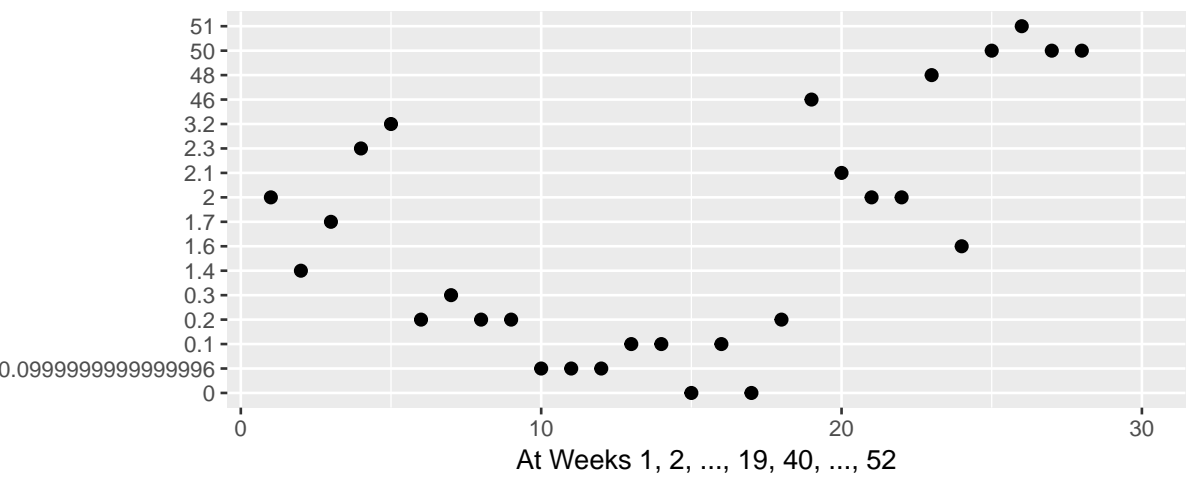
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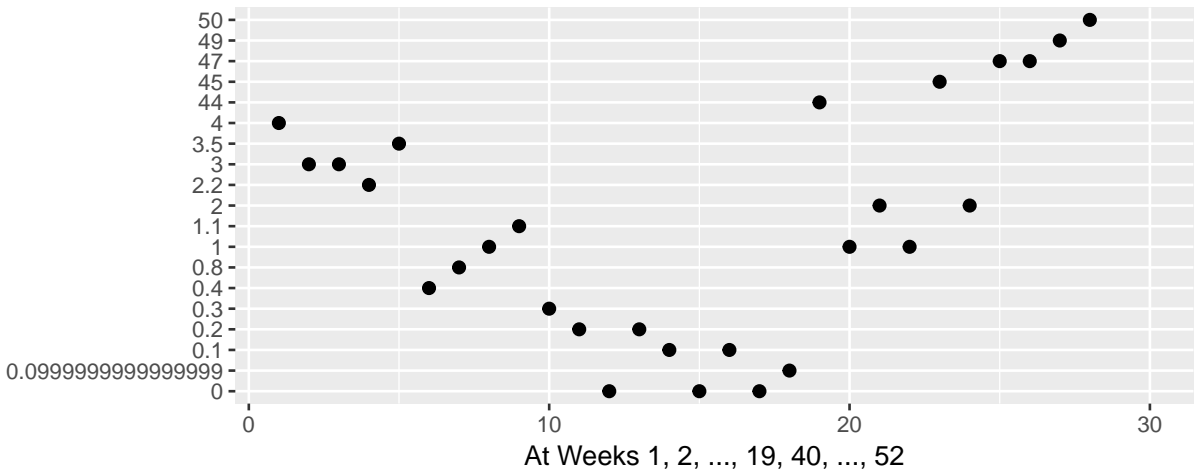


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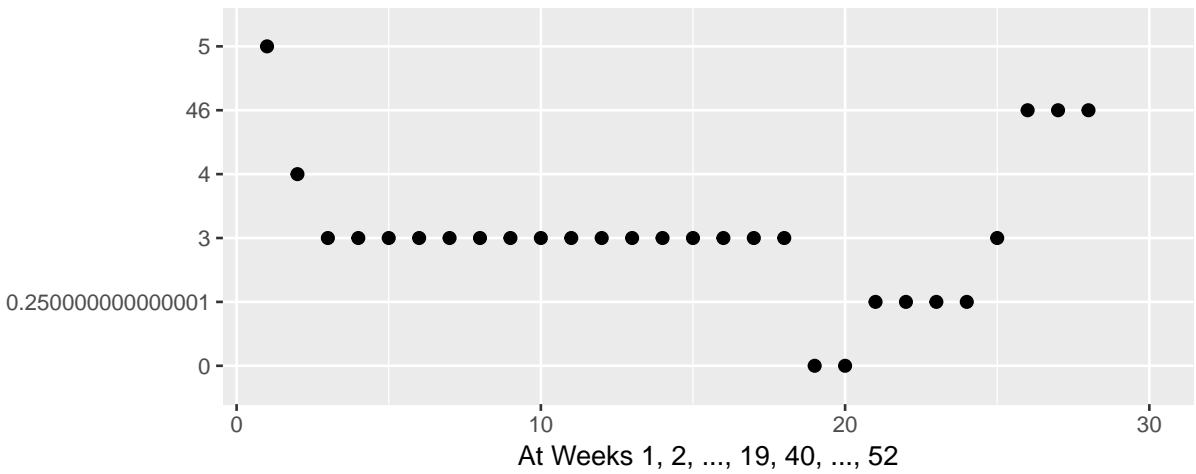


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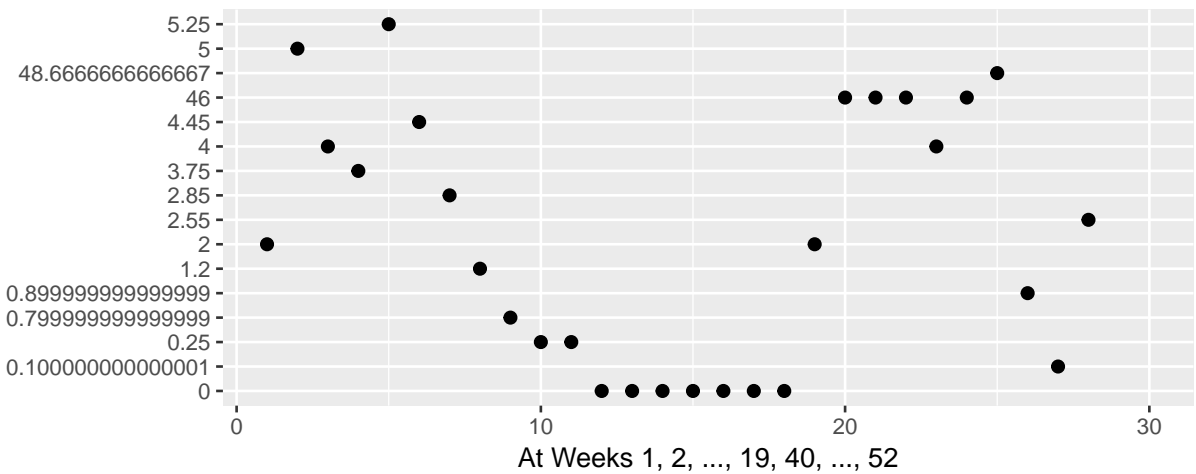
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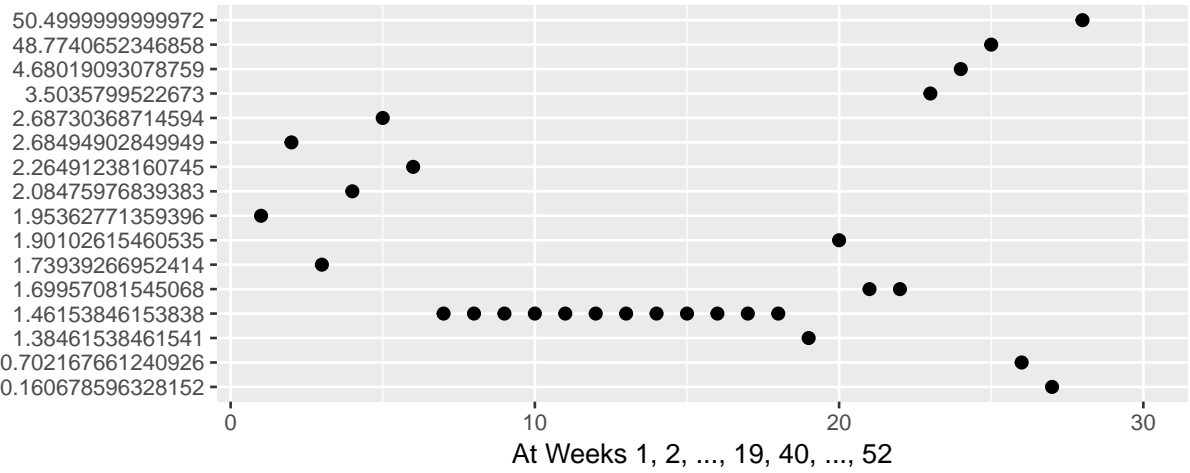


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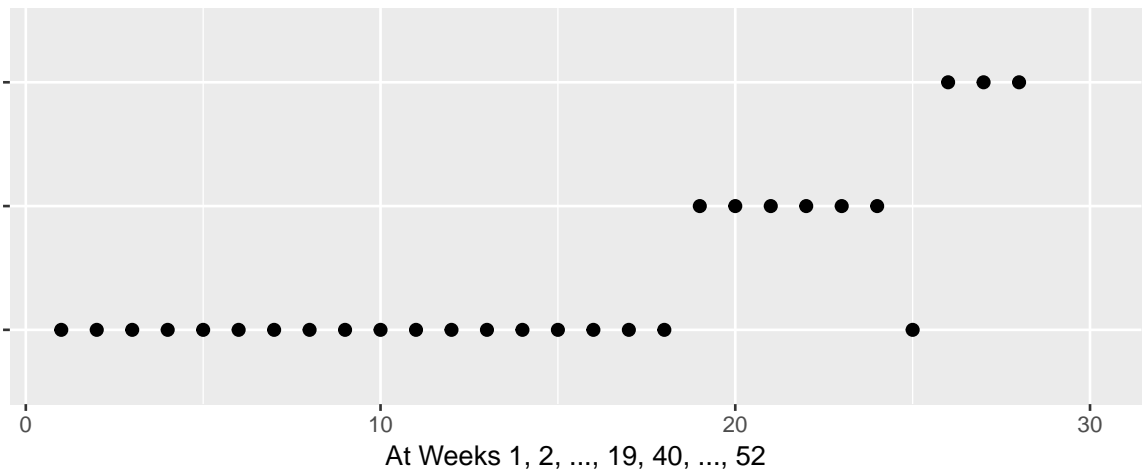


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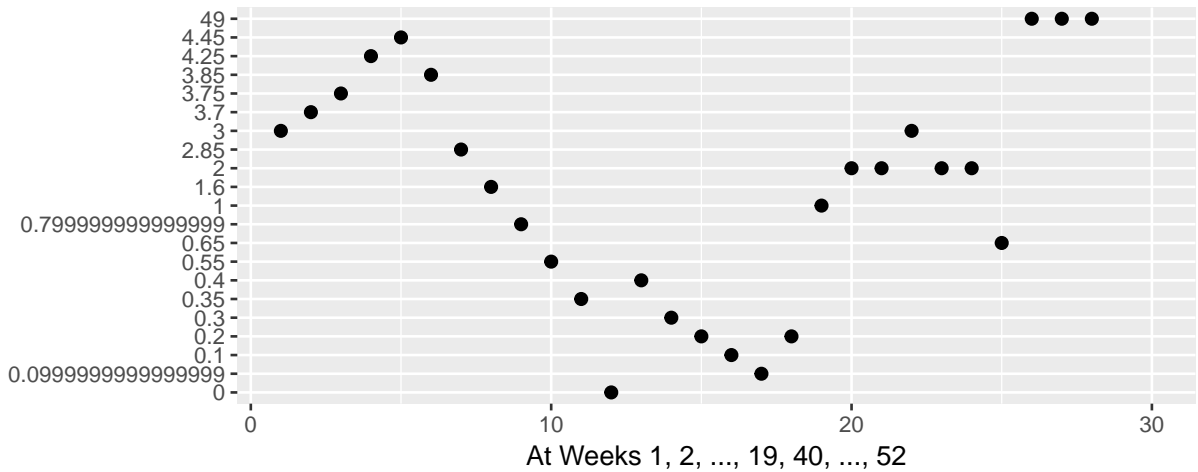
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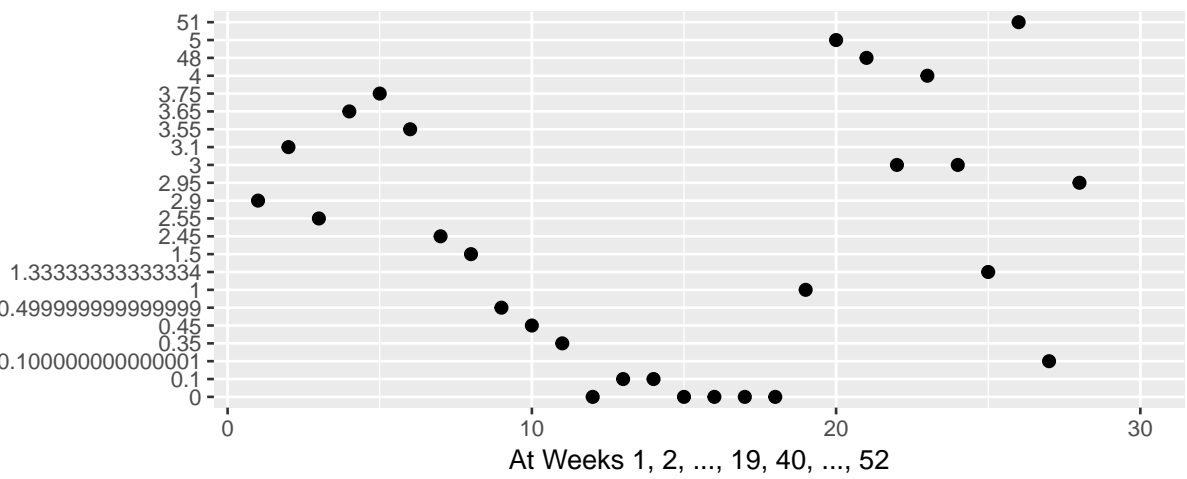


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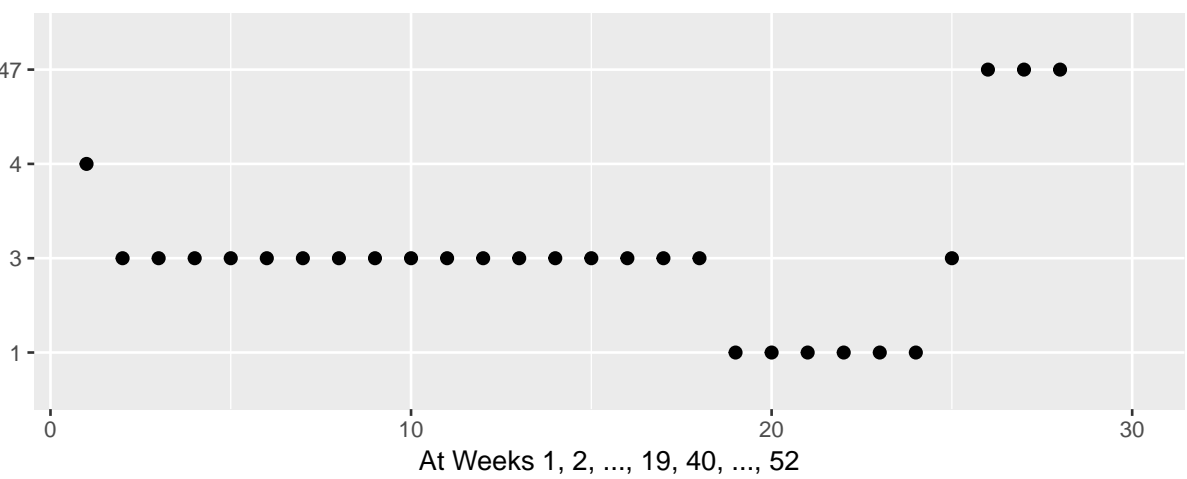


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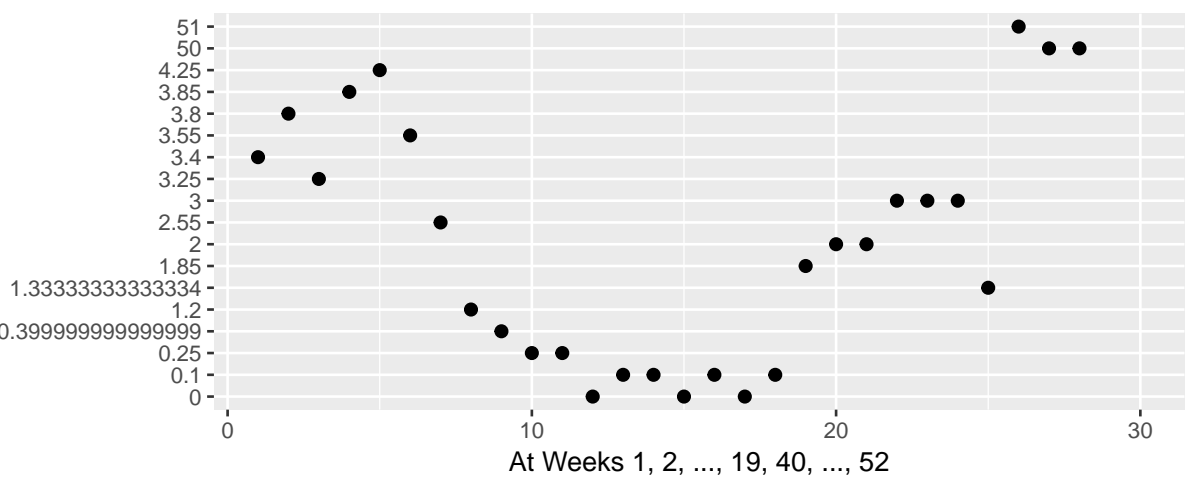
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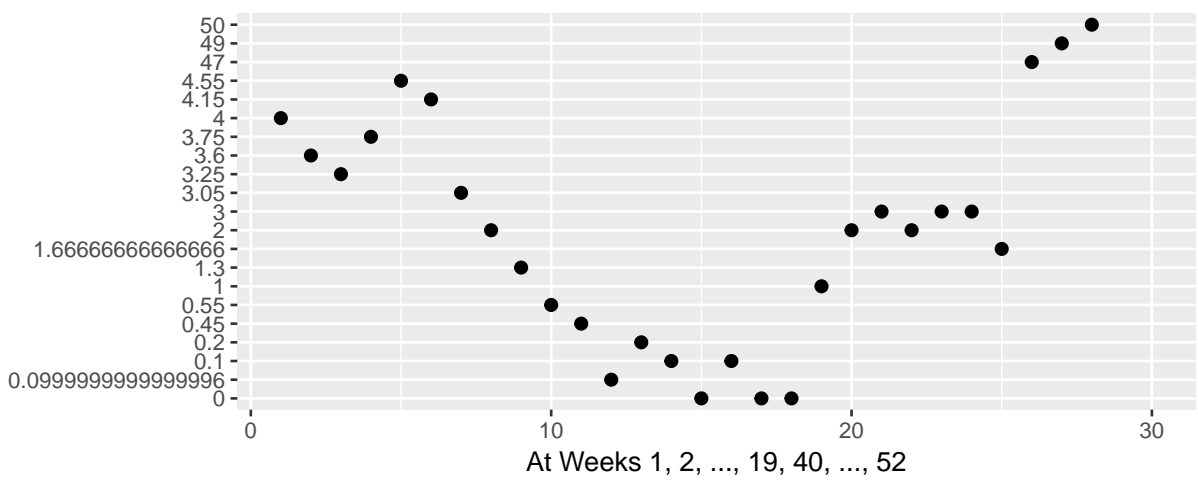


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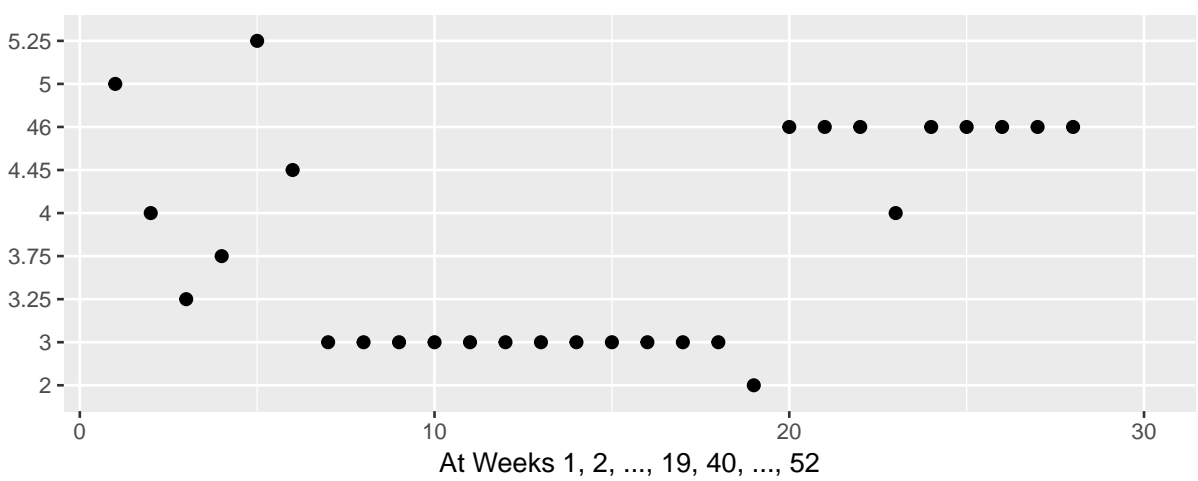


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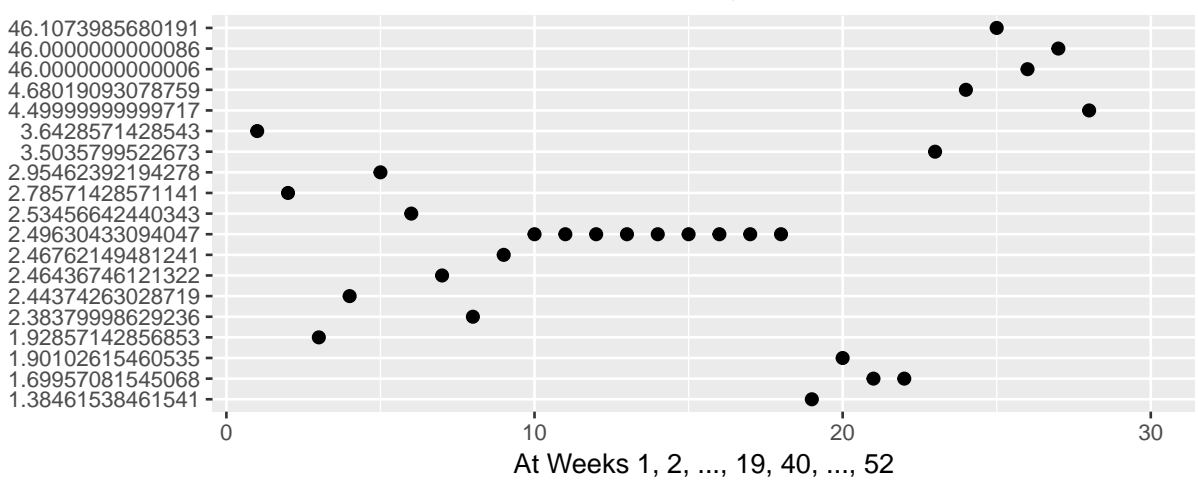
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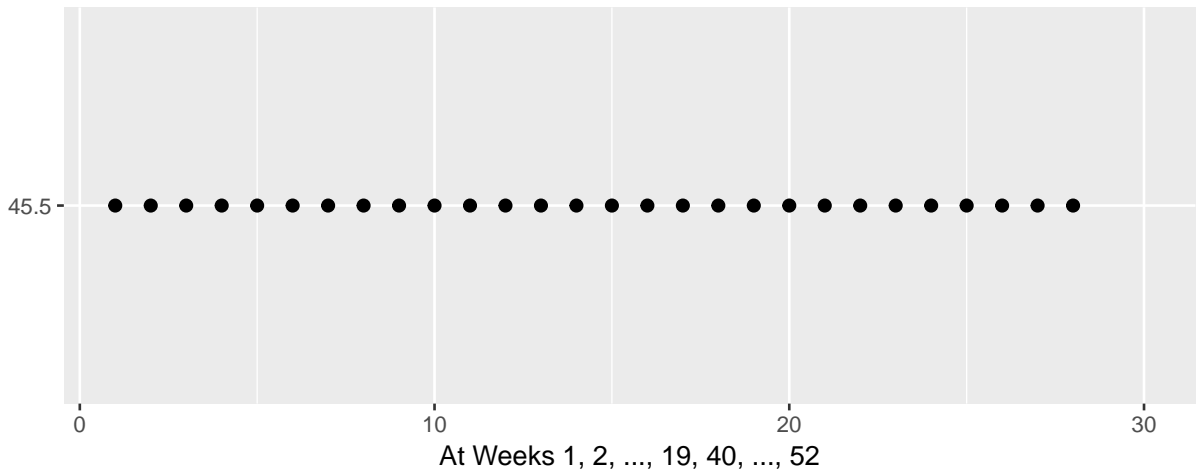


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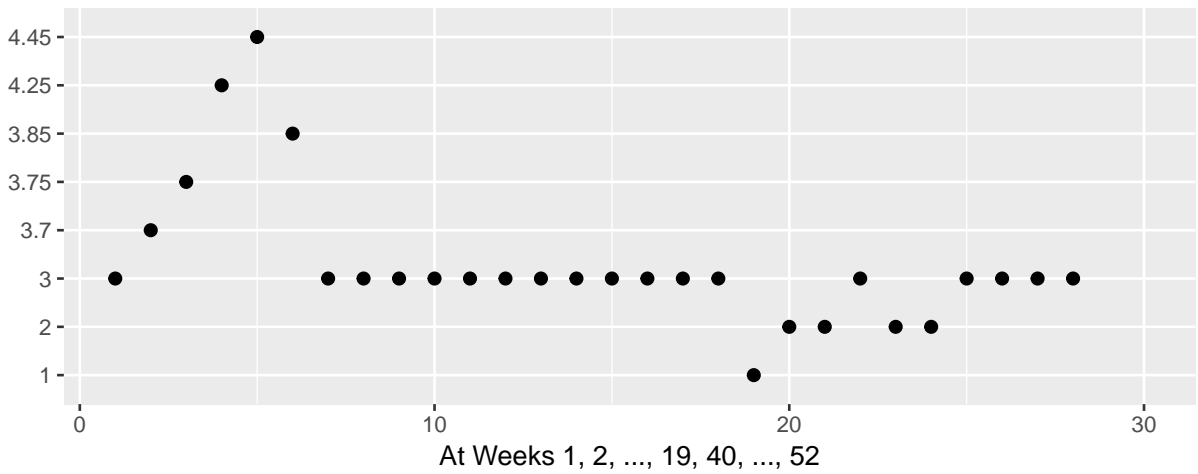


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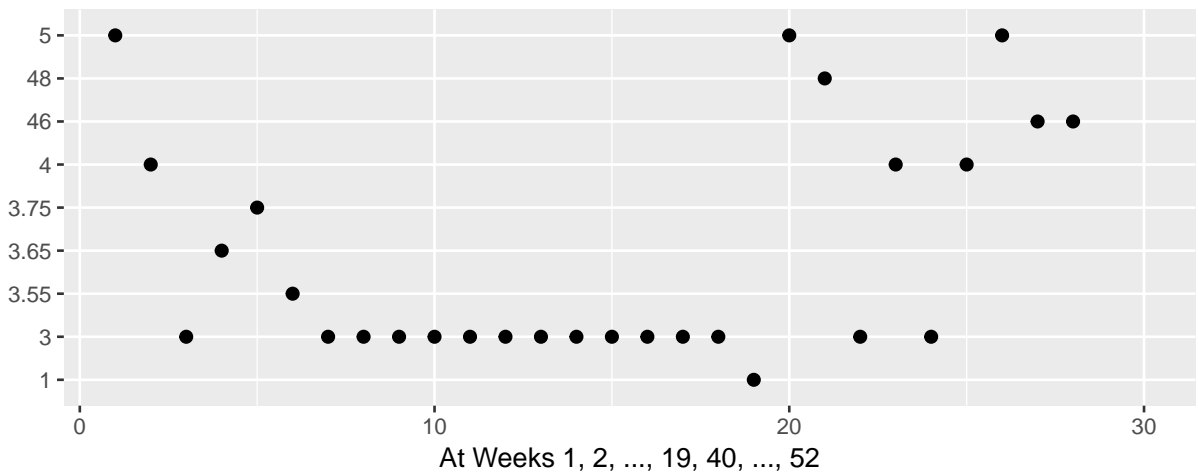
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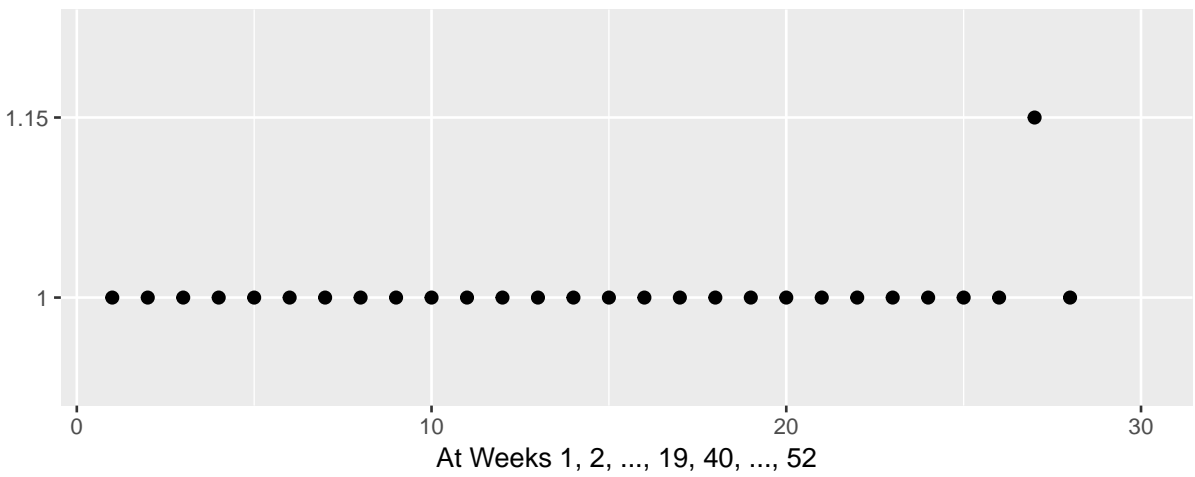


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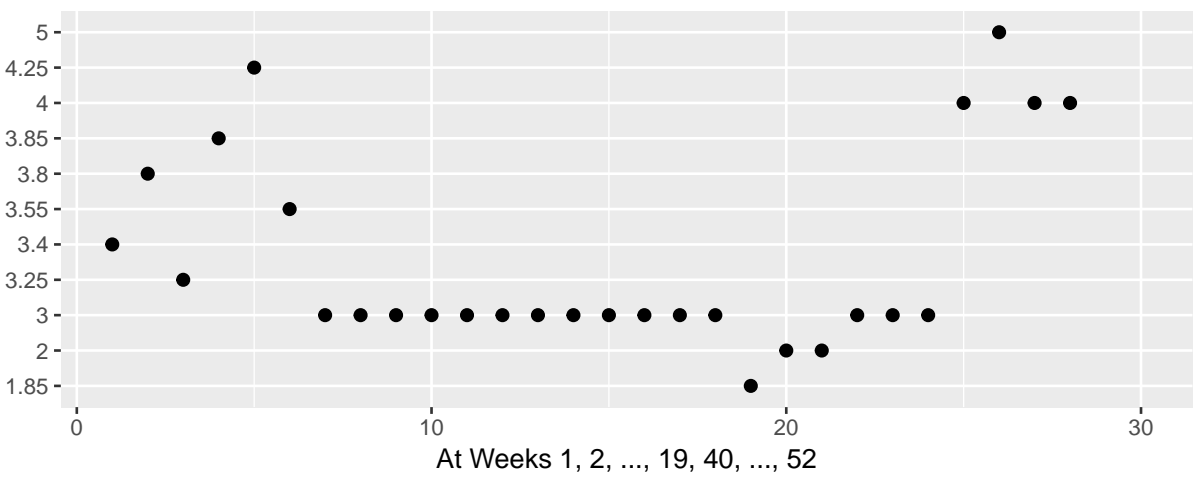


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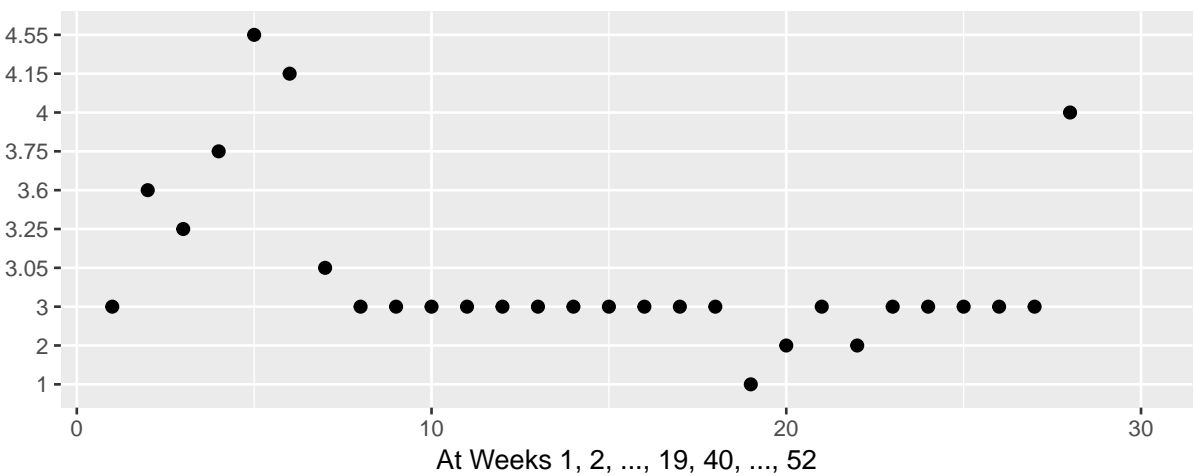
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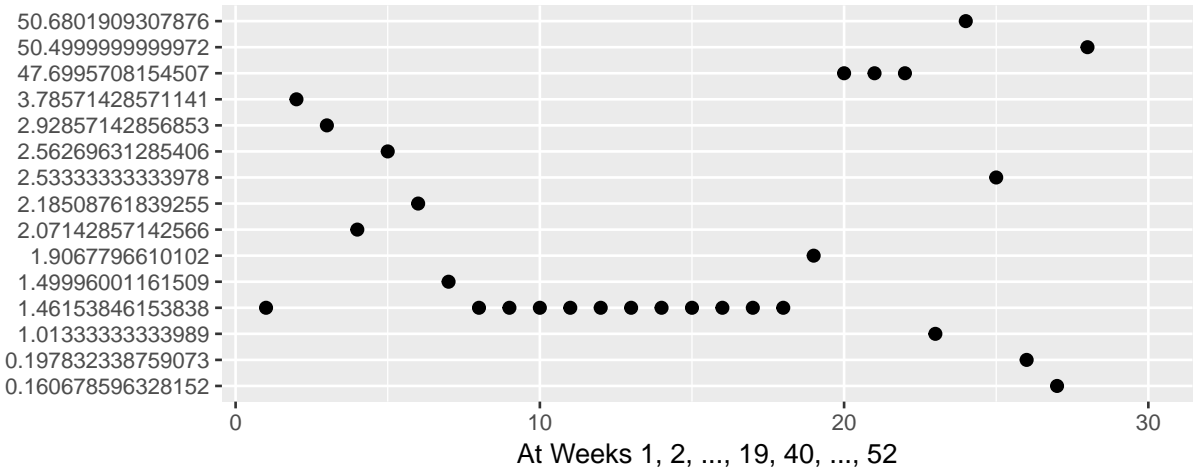


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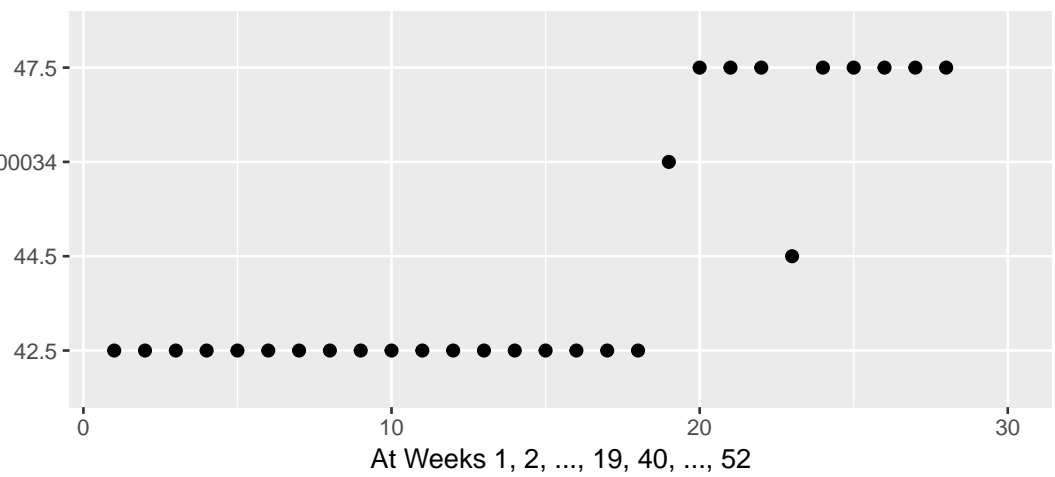


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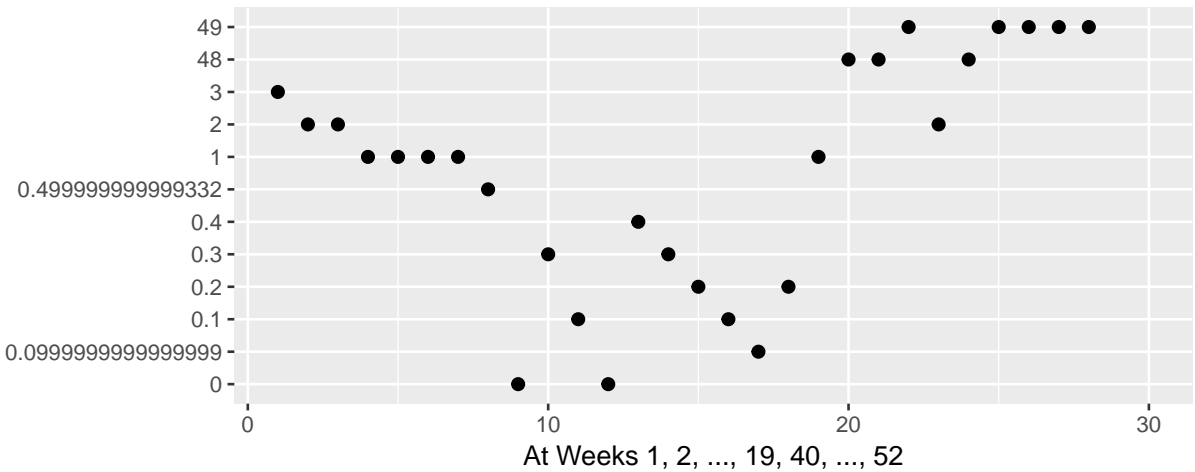
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Delphi_MarkovianDeltaDensity_PackageDefaults_Files_Vector&Delphi

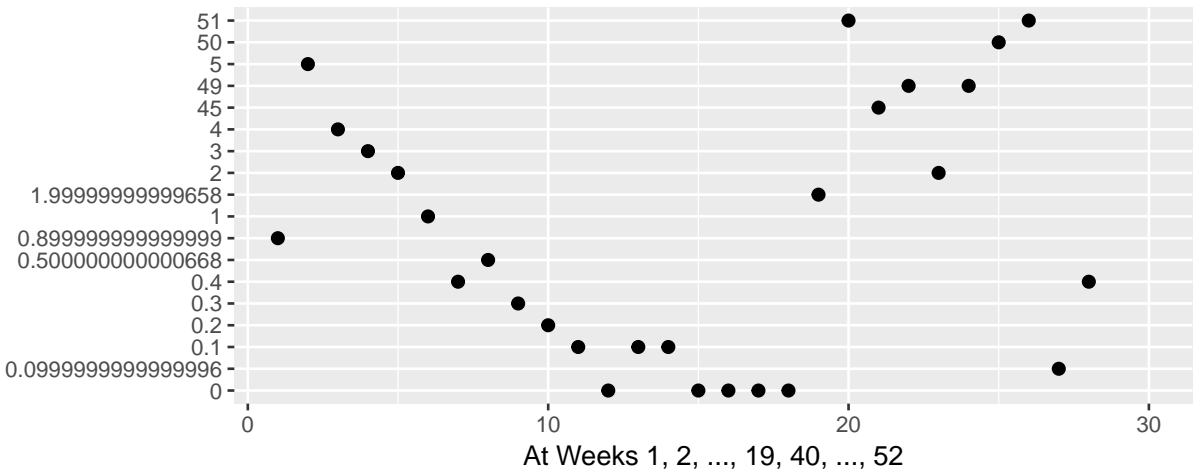


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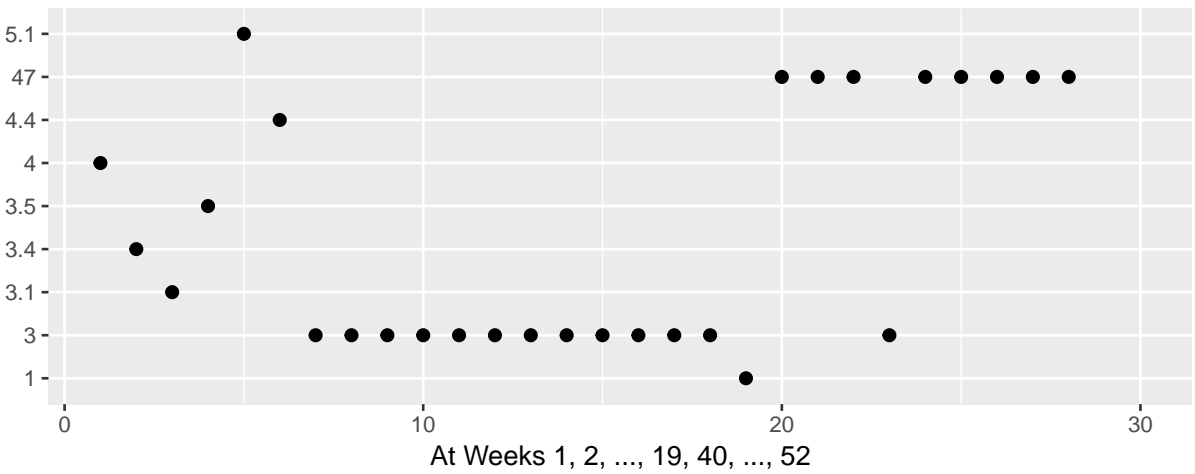


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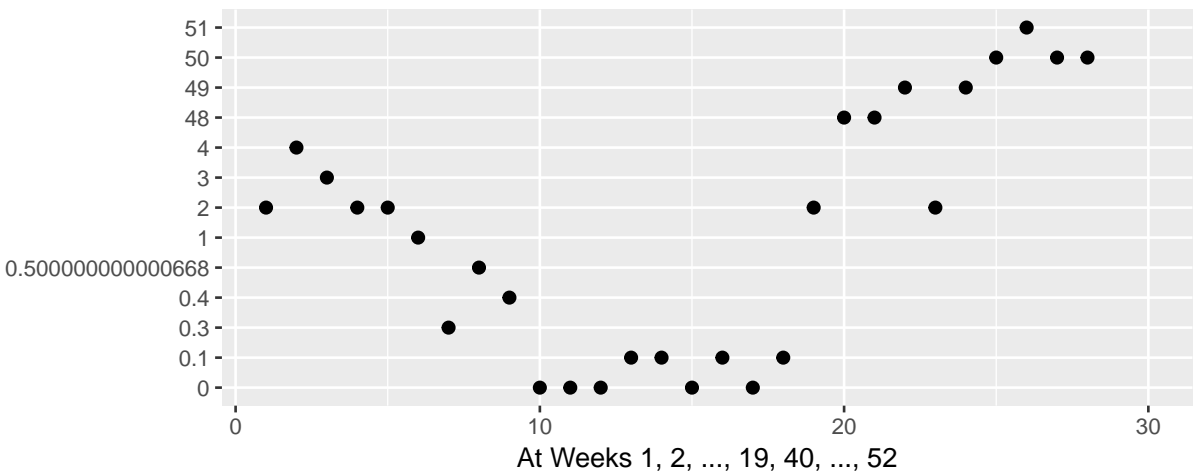
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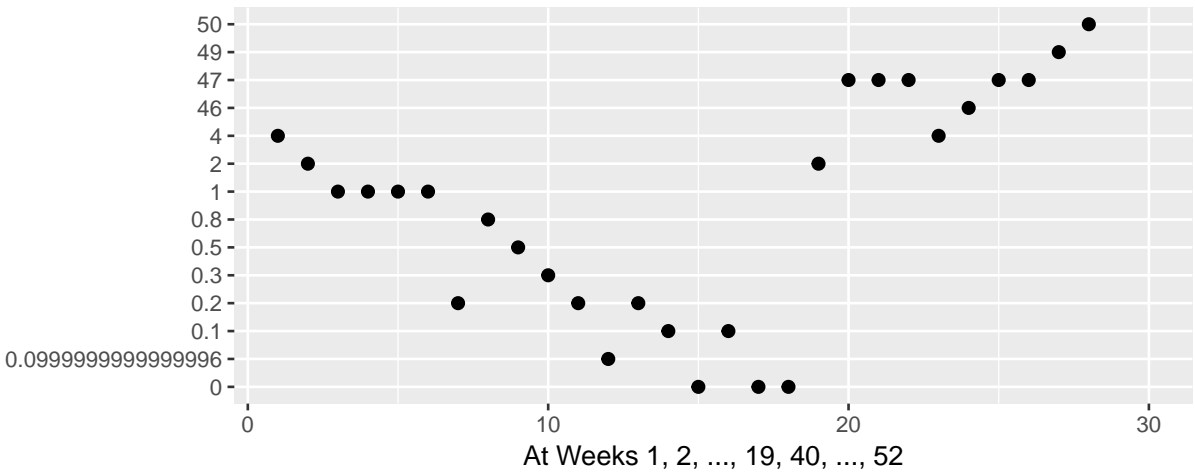


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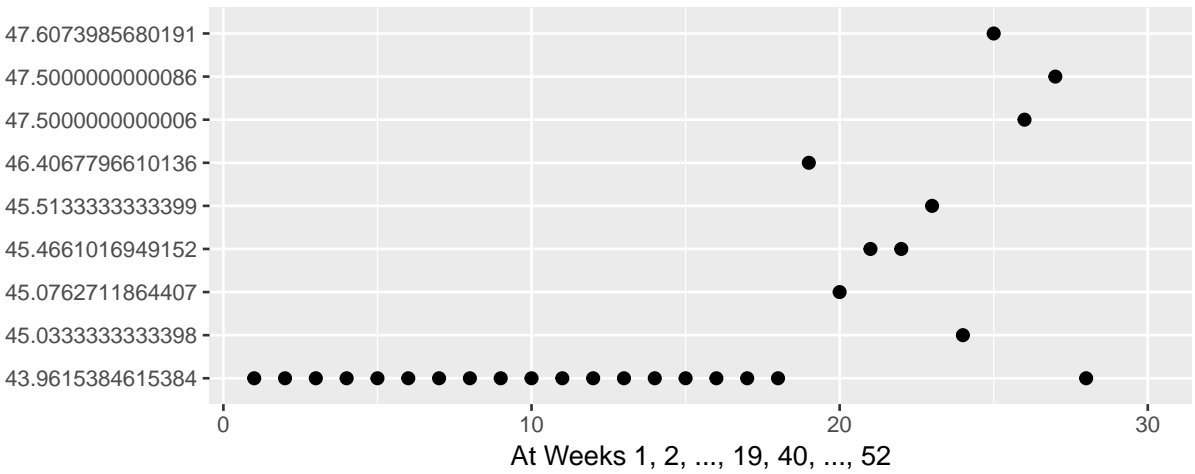


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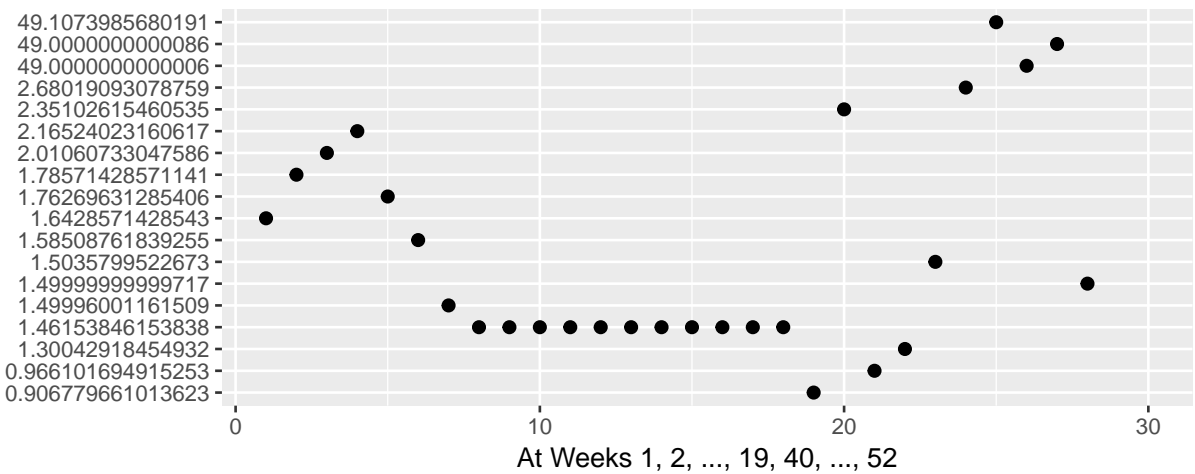
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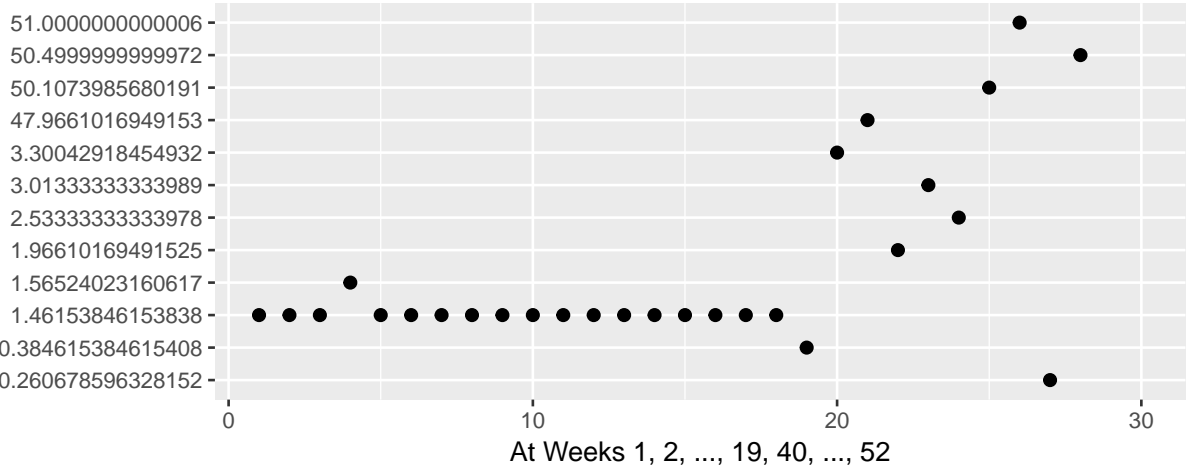


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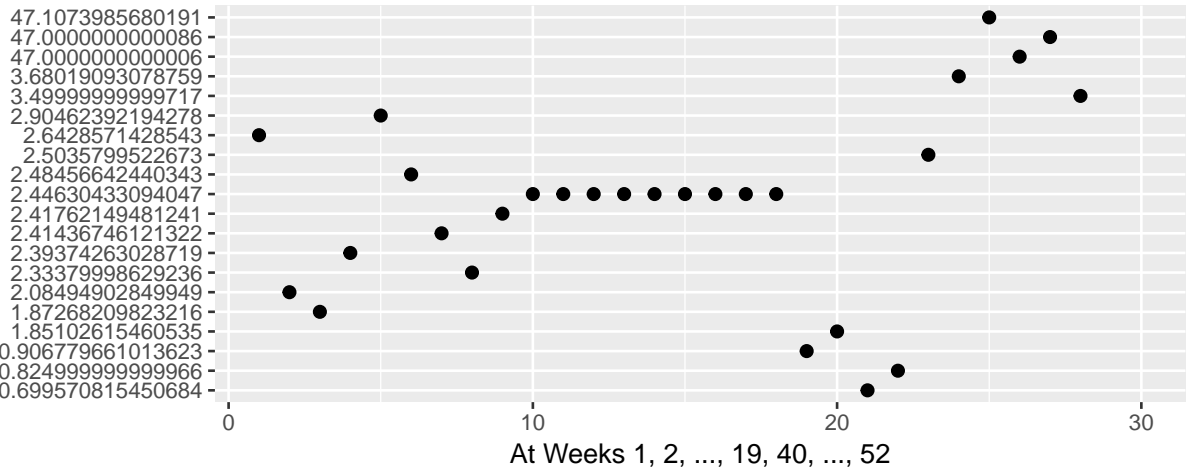


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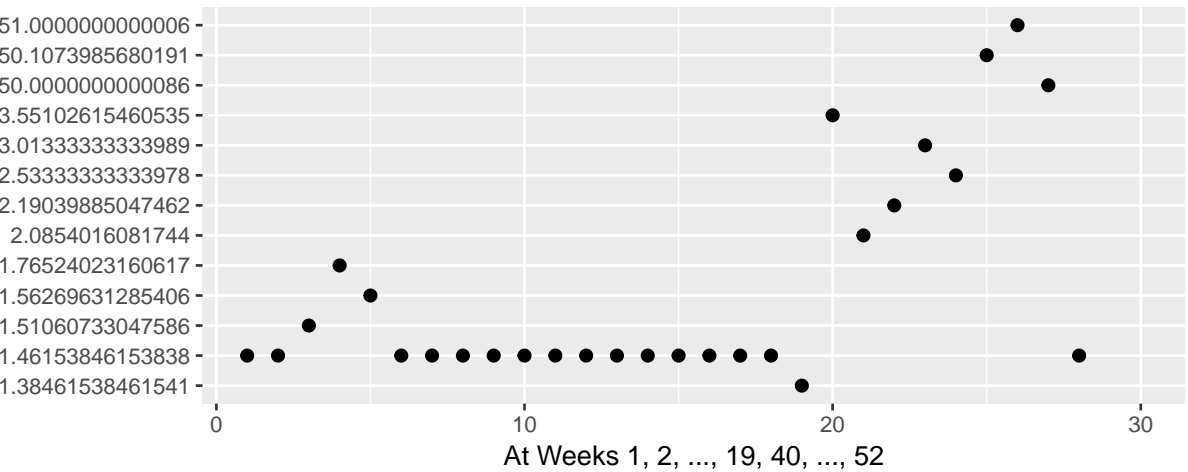
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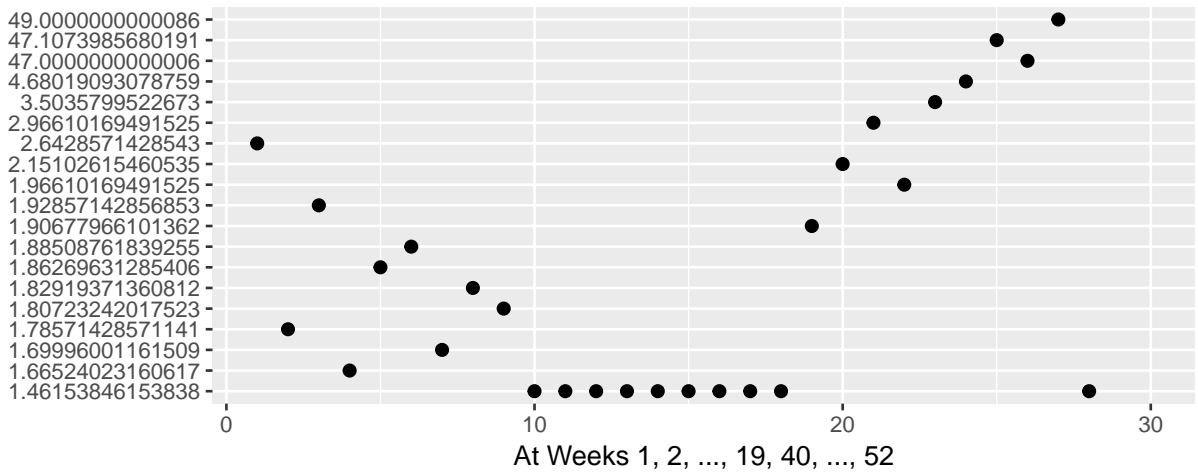


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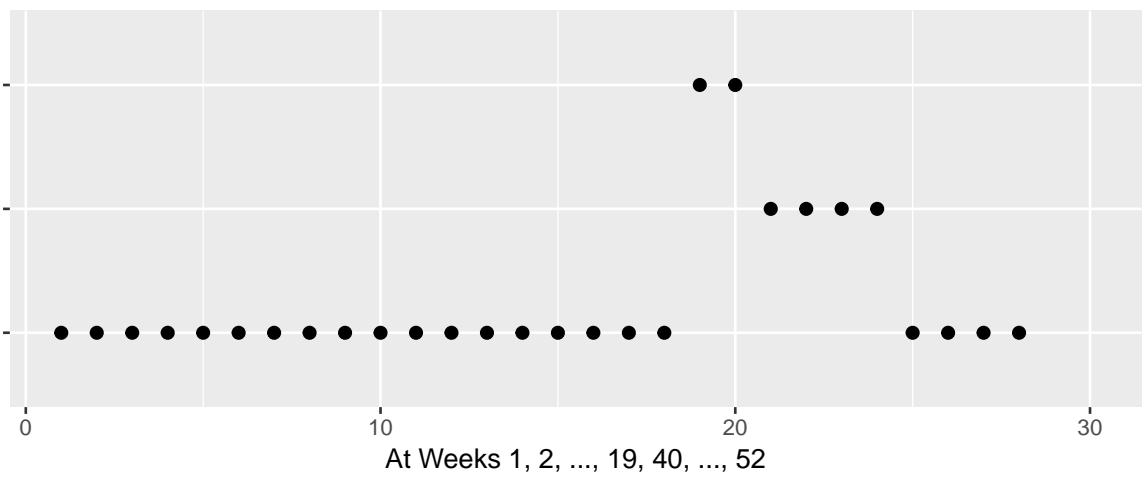


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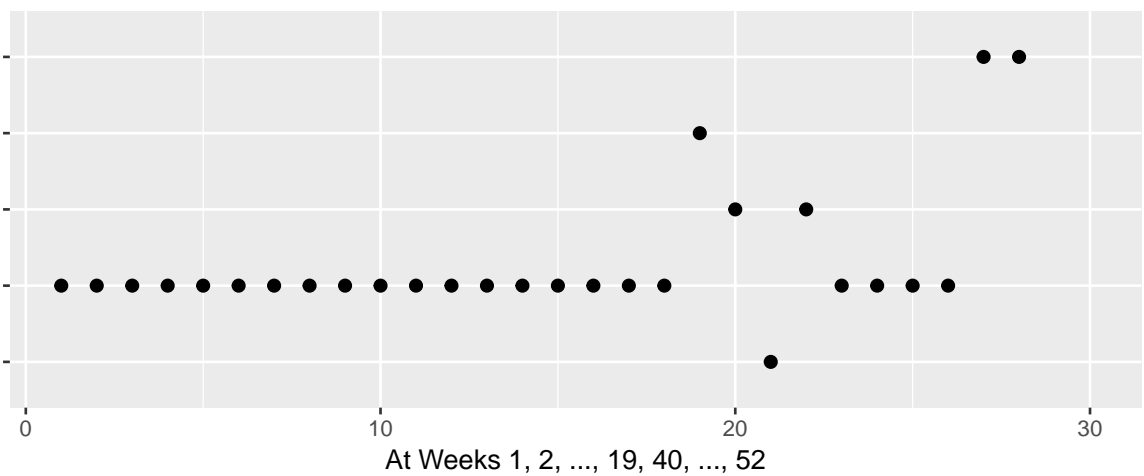
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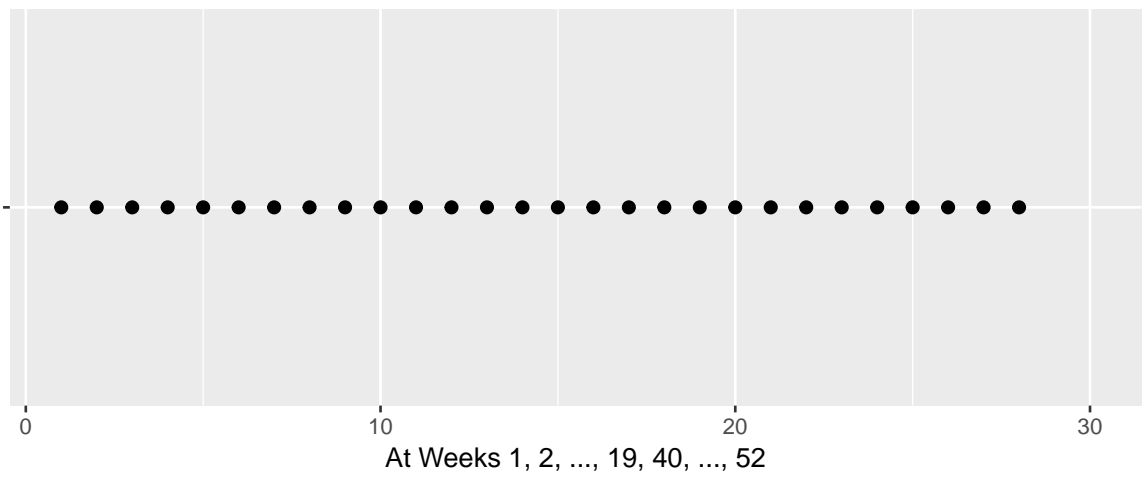


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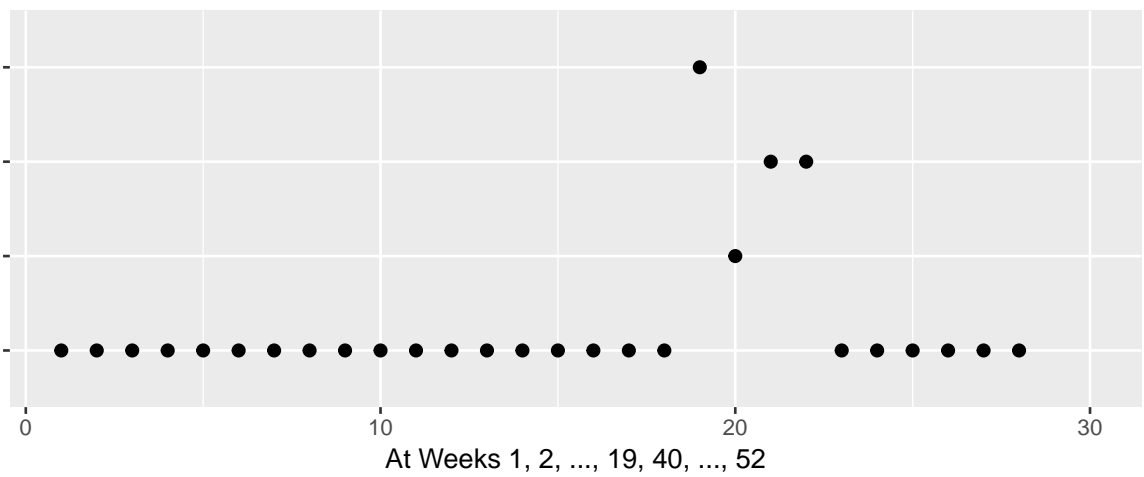


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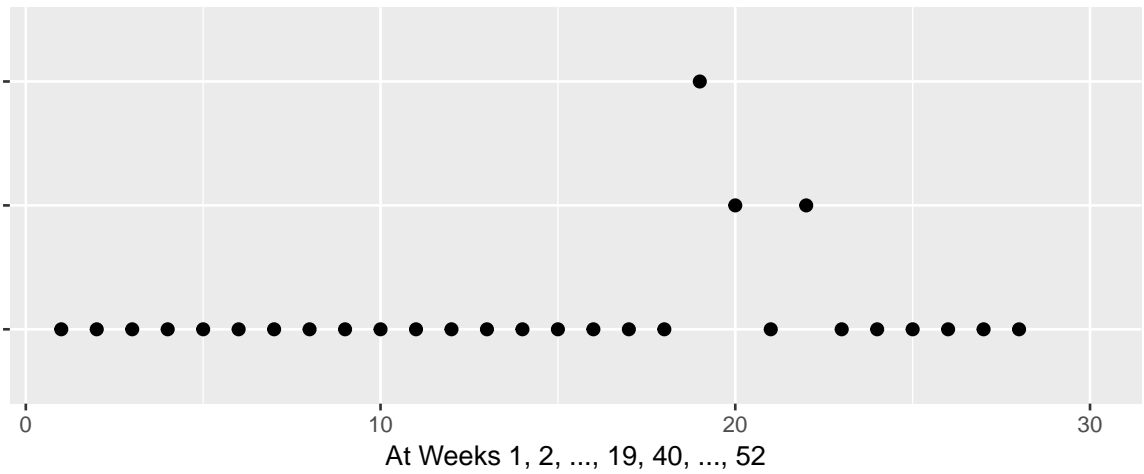
Delphi_Uniform_Files_Vector&ReichLab_kde_Files_Vector



Delphi_Uniform_Files_Vector&ReichLab_sarima_seasonal_difference_FALSE_F



Delphi_Uniform_Files_Vector&ReichLab_sarima_seasonal_difference_TRUE_Fil

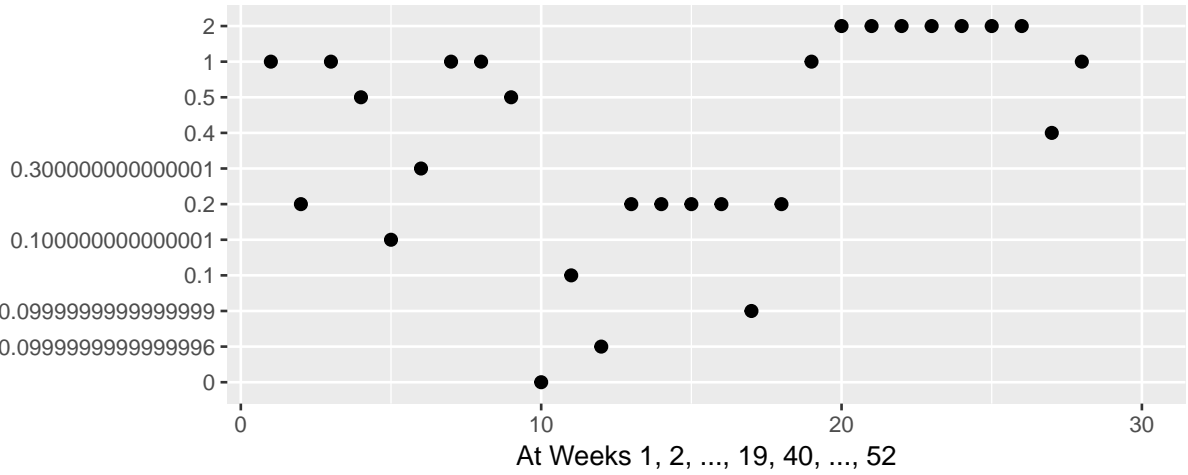


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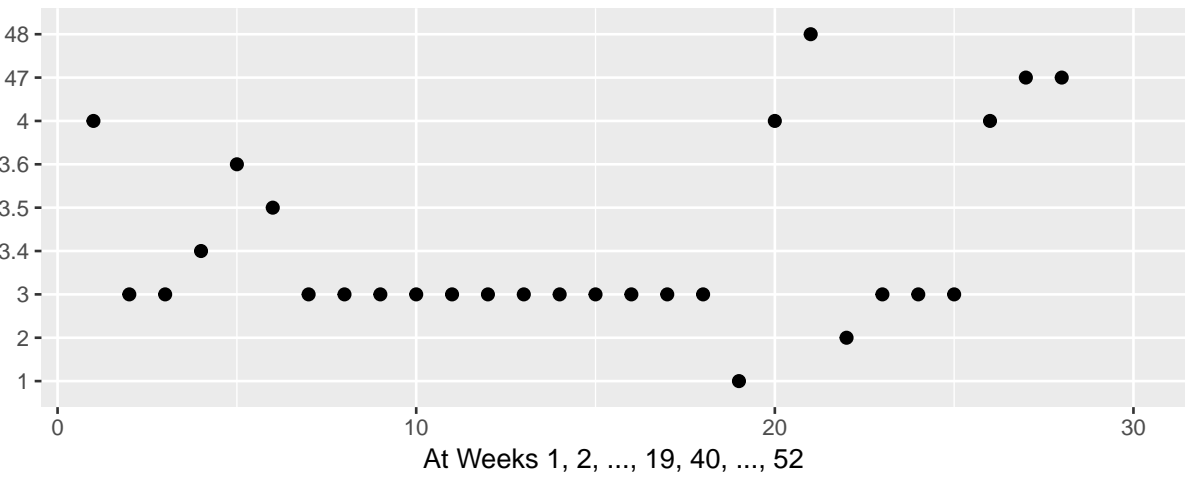


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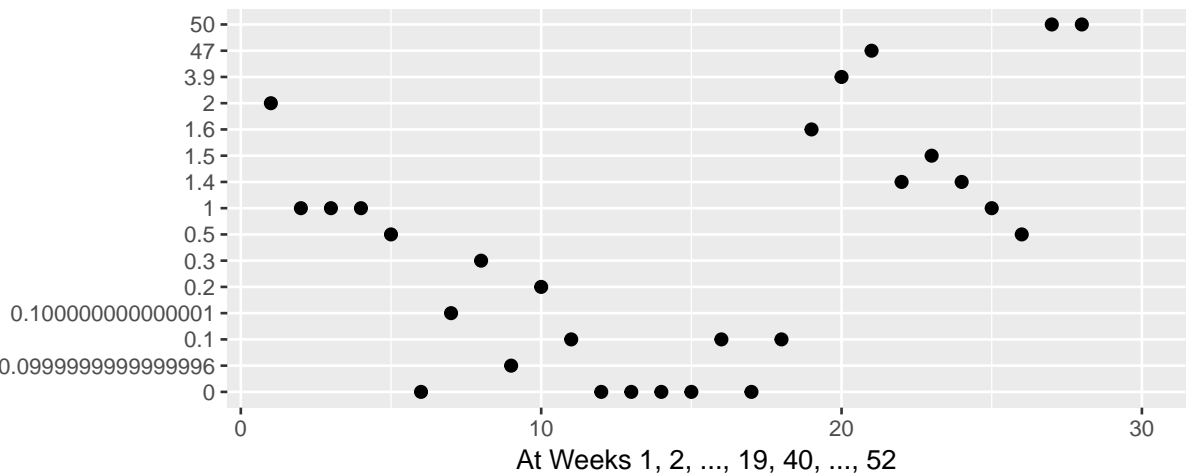
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ReichLab_kcde_Files_Vector&ReichLab_kde_Files_Vector

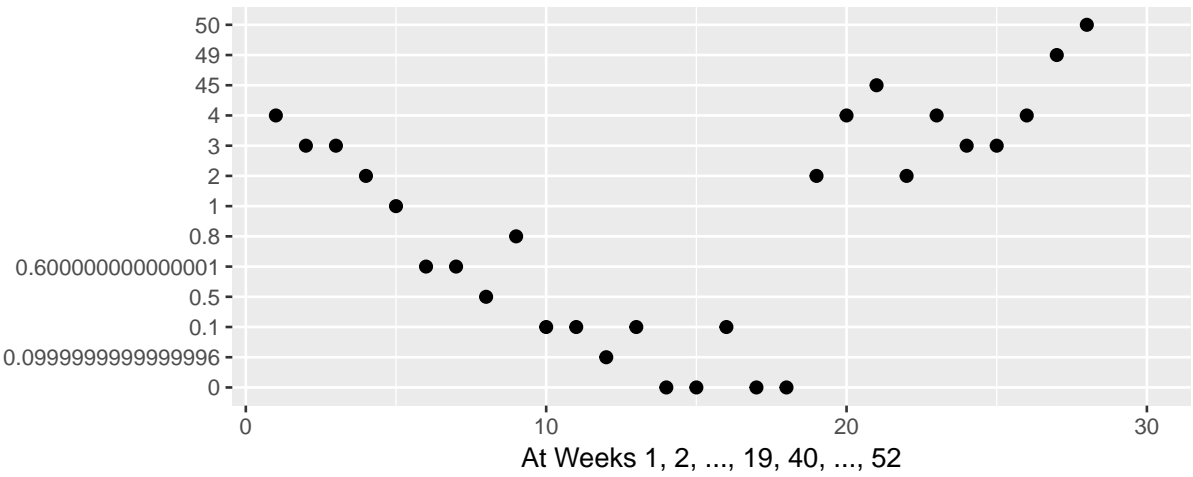


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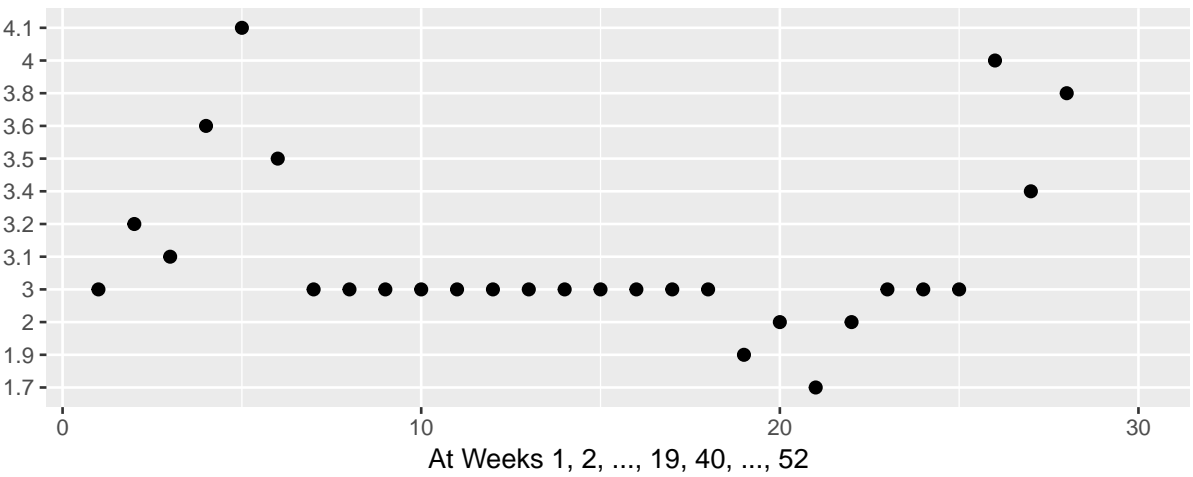


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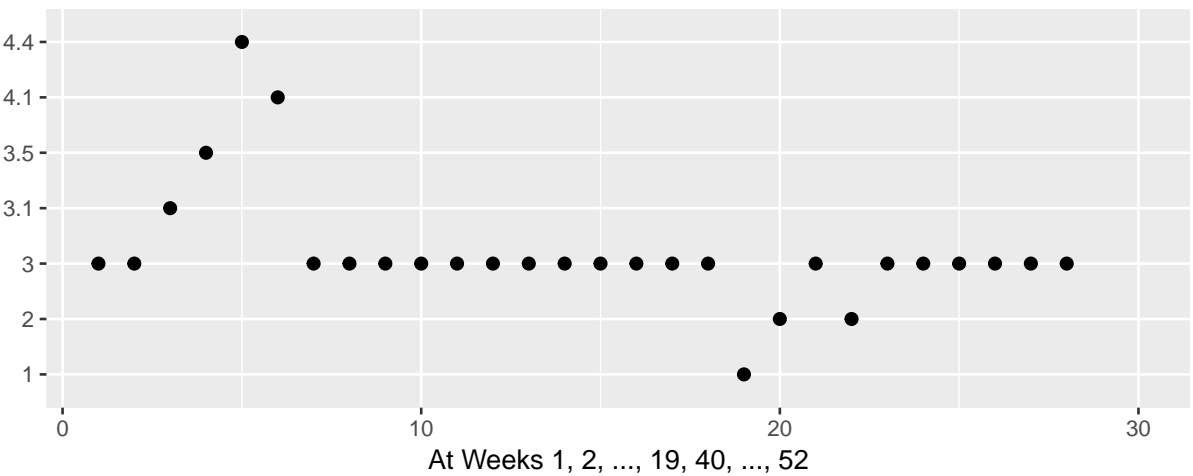
ReichLab_kcde_Files_Vector&ReichLab_sarima_seasonal_difference



ReichLab_kde_Files_Vector&ReichLab_sarima_seasonal_difference_FALSE_File



ReichLab_kde_Files_Vector&ReichLab_sarima_seasonal_difference_TRUE_Files



Relationships Between Models' Predictions for the Next

ReichLab_sarima_seasonal_difference_FALSE_Files_Vector&Reich

