Geometric mean

```r
library(dplyr)
library(ggplot2)
library(tidyr)
library(knitr)

load("data/HDA_dc.RData")
load("data/first_matches.RData")

HDA = HDA_dc %>%
  anti_join(first_matches)

nrow(HDA)
```

```
## [1] 1858
```

```r
HDA[,c(9:158)][which(HDA[,c(9:158)] == 0, arr.ind = TRUE)] = 10^-5
```

```r
results = tibble(GeoMean = apply(HDA[,c(99:128)], 2, EnvStats::geoMean),
                 Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                 Model = factor(c(rep("0", 6),
                                  rep("3", 6),
                                  rep("8", 6),
                                  rep("9", 6),
                                  rep("10", 6))))
results %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches") +
  ylab("Geometric mean for the results")
```
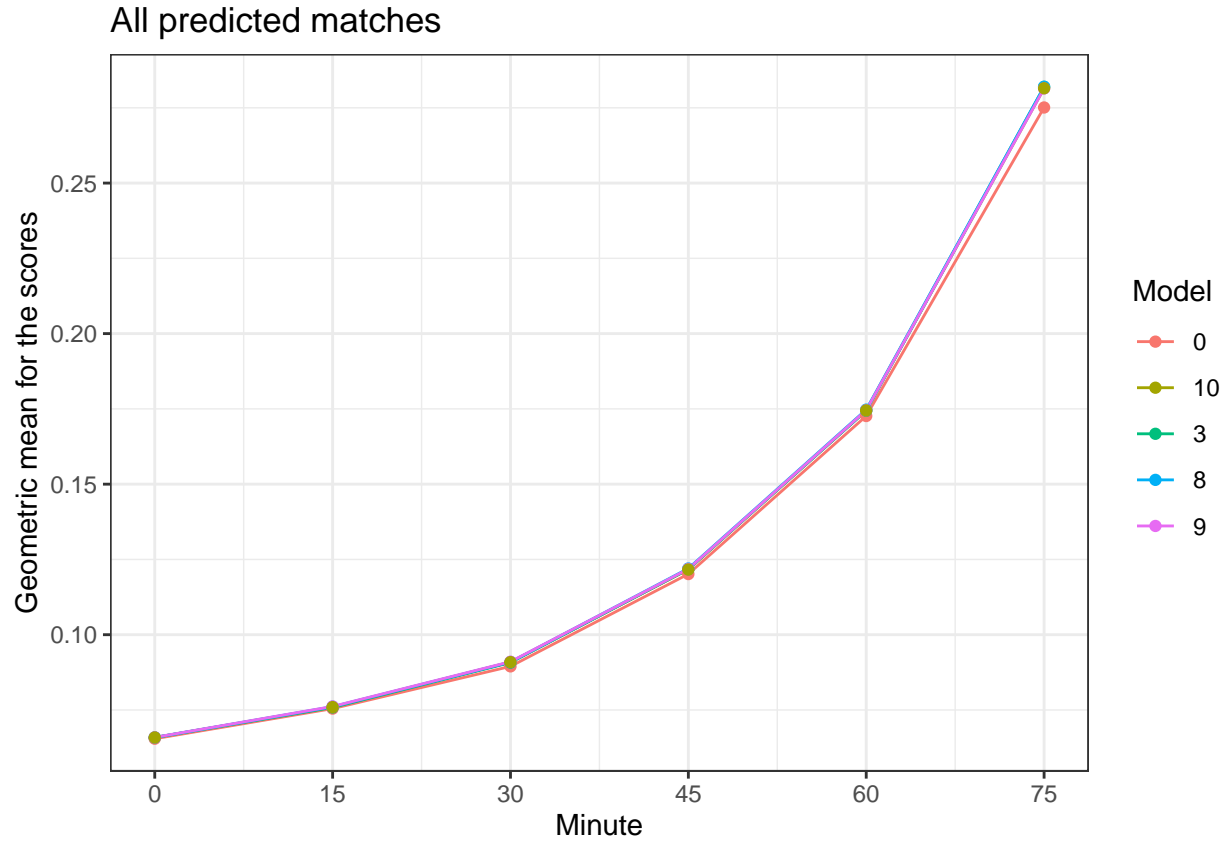
All predicted matches
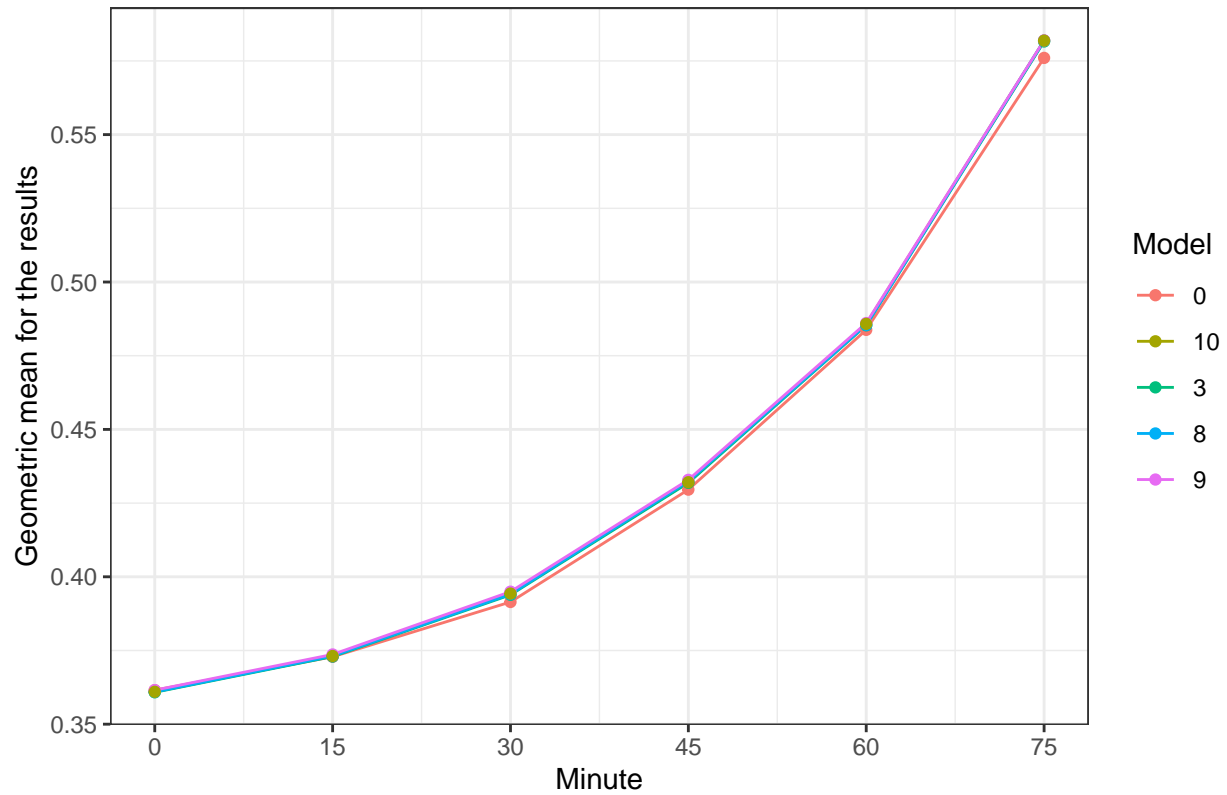

```
results %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.3615542	0.3728595	0.3914571	0.4295694	0.4837697	0.5760223
3	0.3608178	0.3729549	0.3938743	0.4318778	0.4853132	0.5815989
8	0.3609456	0.3731334	0.3941103	0.4323616	0.4854227	0.5818806
9	0.3615477	0.3736587	0.3949527	0.4328925	0.4860716	0.5819846
10	0.3609909	0.3731260	0.3943112	0.4320811	0.4858109	0.5818832

```
scores = tibble(GeoMean = apply(HDA[,c(129:158)], 2, EnvStats::geoMean),
                Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                Model = factor(c(rep("0", 6),
                                 rep("3", 6),
                                 rep("8", 6),
                                 rep("9", 6),
                                 rep("10", 6))))
scores %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
```

```
scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
theme_bw() +
ggtitle("All predicted matches") +
ylab("Geometric mean for the scores")
```

All predicted matches


```
scores %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
          names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.0654583	0.0754529	0.0894830	0.1201492	0.1726362	0.2751038
3	0.0658623	0.0758537	0.0907471	0.1217557	0.1743915	0.2819345
8	0.0658657	0.0760945	0.0909170	0.1219899	0.1747439	0.2819894
9	0.0659121	0.0761694	0.0910340	0.1218418	0.1745554	0.2814298
10	0.0658640	0.0759538	0.0909011	0.1216556	0.1744875	0.2814881

```
load("~/GitHub/soccer-live-predictions/soccer-live-predictions/scrape/data/reds.RData")

matches = reds %>%
  filter(Season > 2015, Half == 1) %>%
  select(Season, Match)
```

```
HDA_reds = HDA %>%
  inner_join(matches)
```

```
## Joining, by = c("Season", "Match")
```
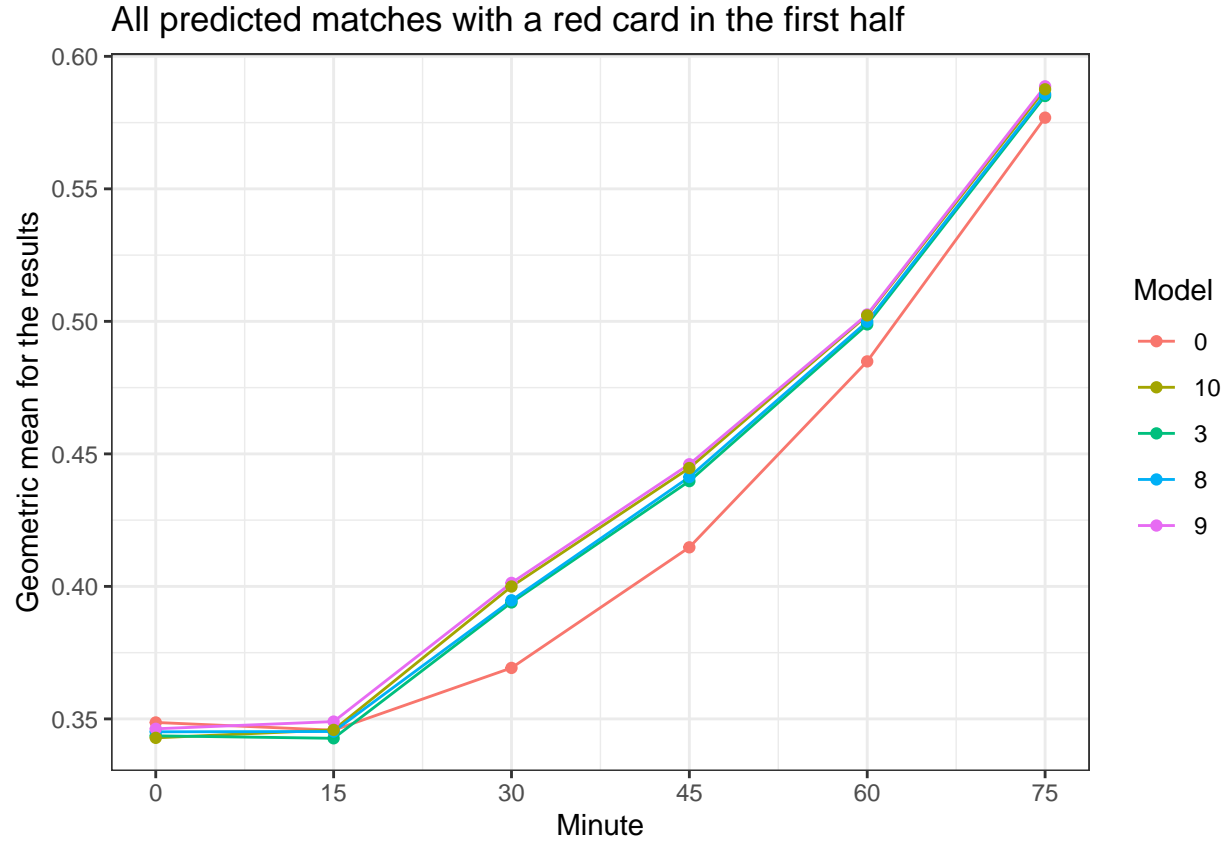
```
HDA_no_reds = HDA %>%
  anti_join(matches)
```

```
## Joining, by = c("Season", "Match")
```

```
nrow(HDA_reds)
```

```
## [1] 82
```

```
results_reds = tibble(GeoMean = apply(HDA_reds[,c(99:128)], 2, EnvStats::geoMean),
                      Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                      Model = factor(c(rep("0", 6),
                                       rep("3", 6),
                                       rep("8", 6),
                                       rep("9", 6),
                                       rep("10", 6))))
results_reds %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches with a red card in the first half") +
  ylab("Geometric mean for the results")
```
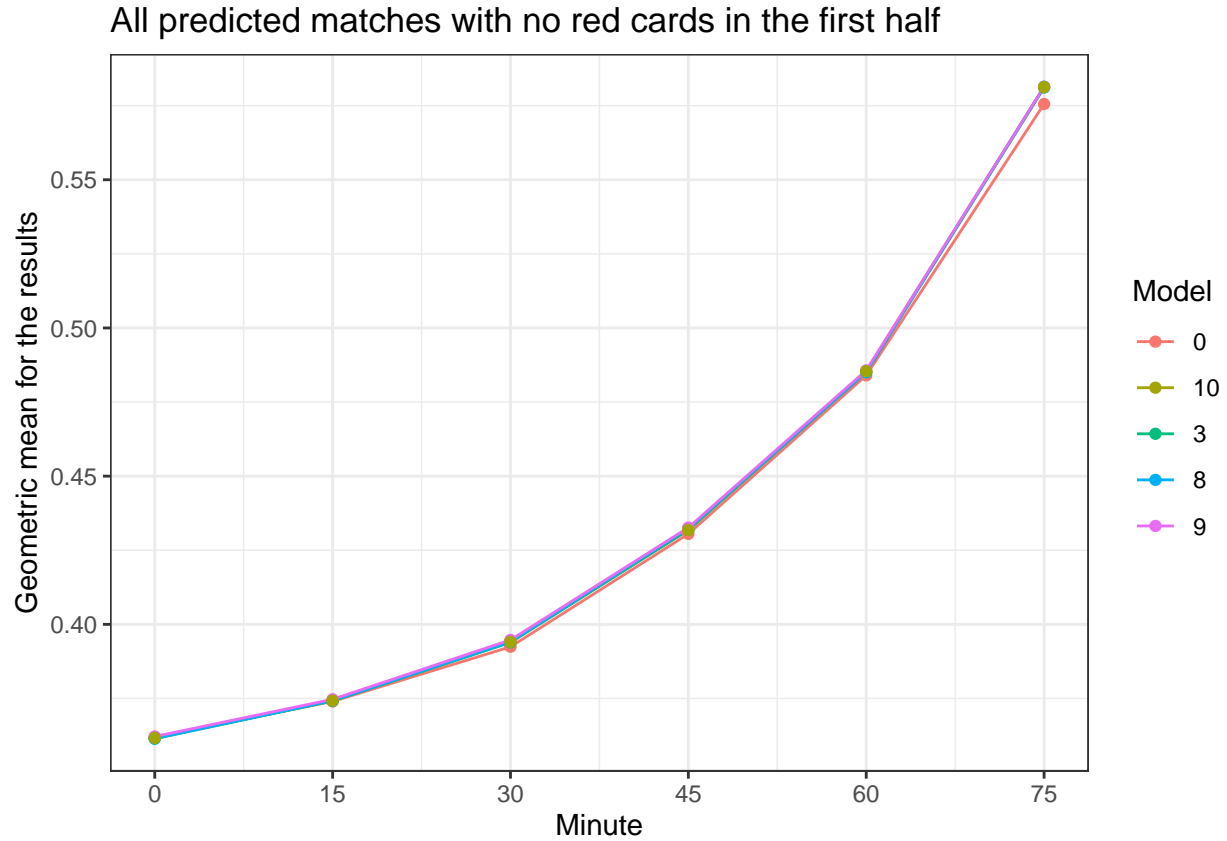
All predicted matches with a red card in the first half


```
results_reds %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.3486645	0.3457368	0.3692382	0.4147450	0.4848982	0.5768597
3	0.3436144	0.3426827	0.3939457	0.4397161	0.4988566	0.5850398
8	0.3451358	0.3452399	0.3947515	0.4412706	0.4999056	0.5857873
9	0.3462648	0.3489937	0.4013211	0.4460890	0.5026022	0.5886829
10	0.3428540	0.3458487	0.3999577	0.4446570	0.5022518	0.5875590

```
results_no_reds = tibble(GeoMean = apply(HDA_no_reds[,c(99:128)], 2, EnvStats::geoMean),
                         Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                         Model = factor(c(rep("0", 6),
                                          rep("3", 6),
                                          rep("8", 6),
                                          rep("9", 6),
                                          rep("10", 6))))
results_no_reds %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
```

```
scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
theme_bw() +
ggtitle("All predicted matches with no red cards in the first half") +
ylab("Geometric mean for the results")
```

All predicted matches with no red cards in the first half


```
results_no_reds %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```
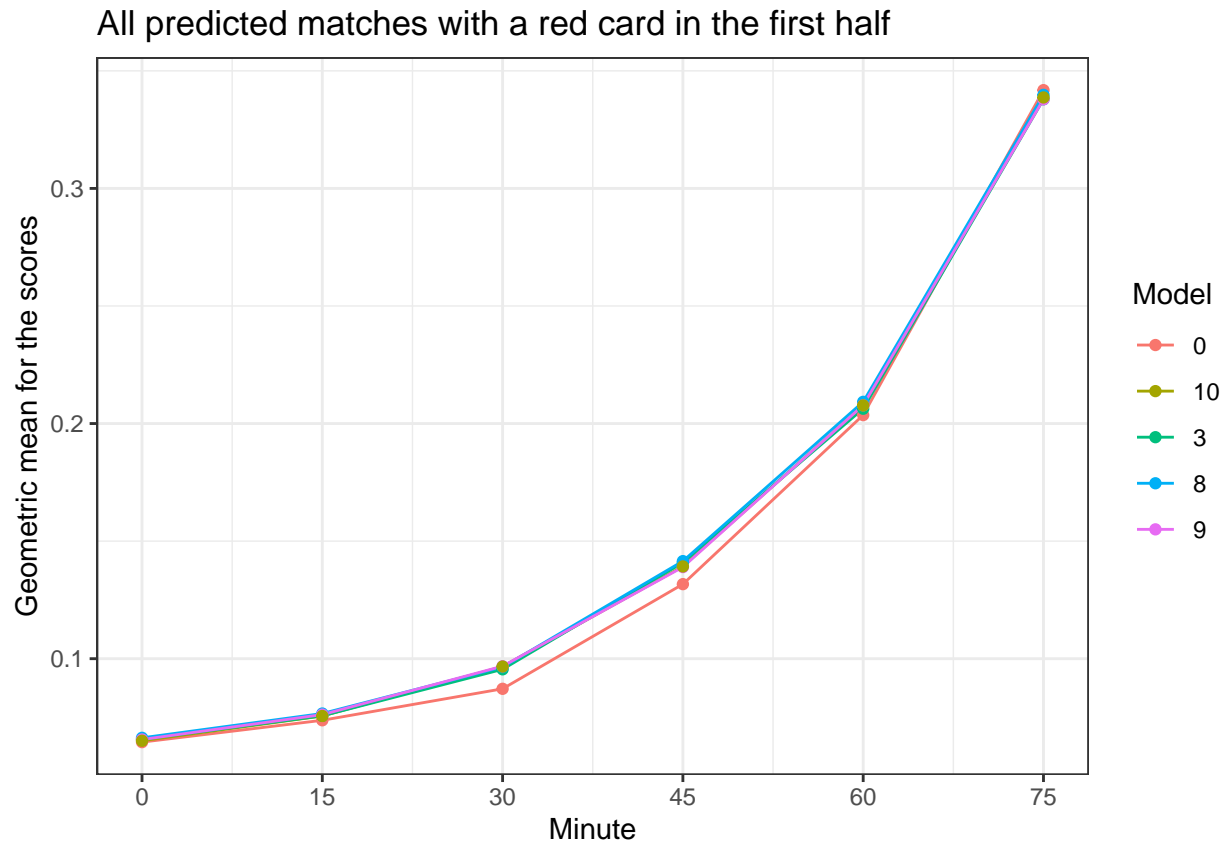
Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.3620003	0.3739905	0.3924370	0.4305123	0.4840060	0.5755491
3	0.3614173	0.3741974	0.3939049	0.4318678	0.4850609	0.5811073
8	0.3615027	0.3742770	0.3941192	0.4322963	0.4851196	0.5813781
9	0.3621520	0.3747131	0.3947361	0.4326389	0.4856804	0.5813375
10	0.3616768	0.3742568	0.3941040	0.4318446	0.4854164	0.5812775

```
scores_reds = tibble(GeoMean = apply(HDA_reds[,c(129:158)], 2, EnvStats::geoMean),
                     Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                     Model = factor(c(rep("0", 6),
                                      rep("3", 6),
                                      rep("8", 6),
                                      rep("9", 6),
```

```
                              rep("10", 6))))
scores_reds %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches with a red card in the first half") +
  ylab("Geometric mean for the scores")
```
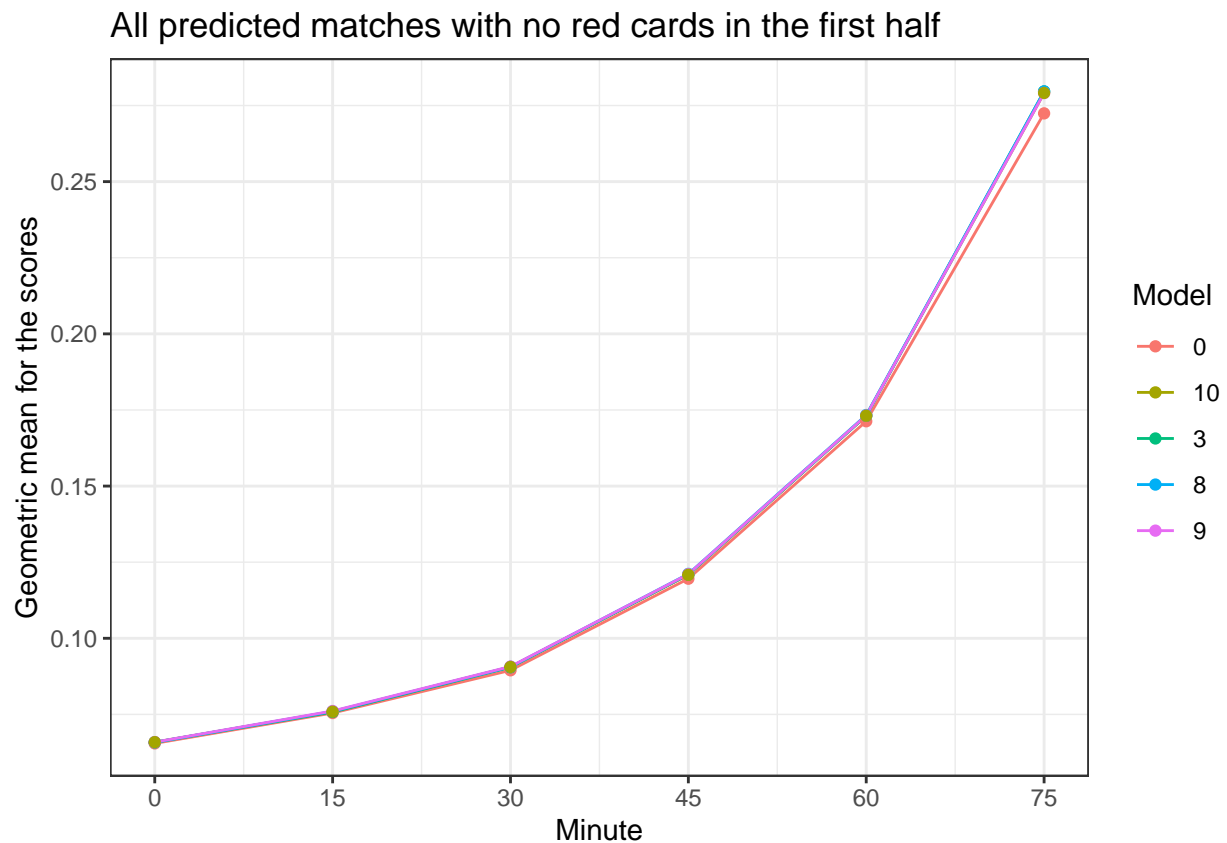

All predicted matches with a red card in the first half

```
scores_reds %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.0645187	0.0738059	0.0871930	0.1316973	0.2036072	0.3417896
3	0.0656550	0.0756983	0.0954845	0.1408456	0.2063144	0.3379100
8	0.0663443	0.0766767	0.0964263	0.1414901	0.2092313	0.3397818
9	0.0656274	0.0762135	0.0968066	0.1389604	0.2077563	0.3379015
10	0.0650997	0.0756375	0.0966566	0.1392363	0.2077157	0.3386854

```
scores_no_reds = tibble(GeoMean = apply(HDA_no_reds[,c(129:158)], 2, EnvStats::geoMean),
                        Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                        Model = factor(c(rep("0", 6),
                                         rep("3", 6),
                                         rep("8", 6),
                                         rep("9", 6),
                                         rep("10", 6))))
scores_no_reds %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches with no red cards in the first half") +
  ylab("Geometric mean for the scores")
```


All predicted matches with no red cards in the first half

```
scores_no_reds %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.0654788	0.0754585	0.0894830	0.1195775	0.1712945	0.2724196
3	0.0658462	0.0757965	0.0904839	0.1209245	0.1730690	0.2796281

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
8	0.0658215	0.0760032	0.0906152	0.1211394	0.1733257	0.2796183
9	0.0659148	0.0761164	0.0907243	0.1210673	0.1731812	0.2790952
10	0.0658780	0.0759064	0.0905906	0.1208649	0.1731067	0.2791367

```r
HDA_2020 = HDA %>%
  filter(Season == 2020)

nrow(HDA_2020)
```

```
## [1] 376
```

```r
results_2020 = tibble(GeoMean = apply(HDA_2020[,c(99:128)], 2, EnvStats::geoMean),
                  Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                  Model = factor(c(rep("0", 6),
                                   rep("3", 6),
                                   rep("8", 6),
                                   rep("9", 6),
                                   rep("10", 6))))
results_2020 %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches in the 2020 season") +
  ylab("Geometric mean for the results")
```

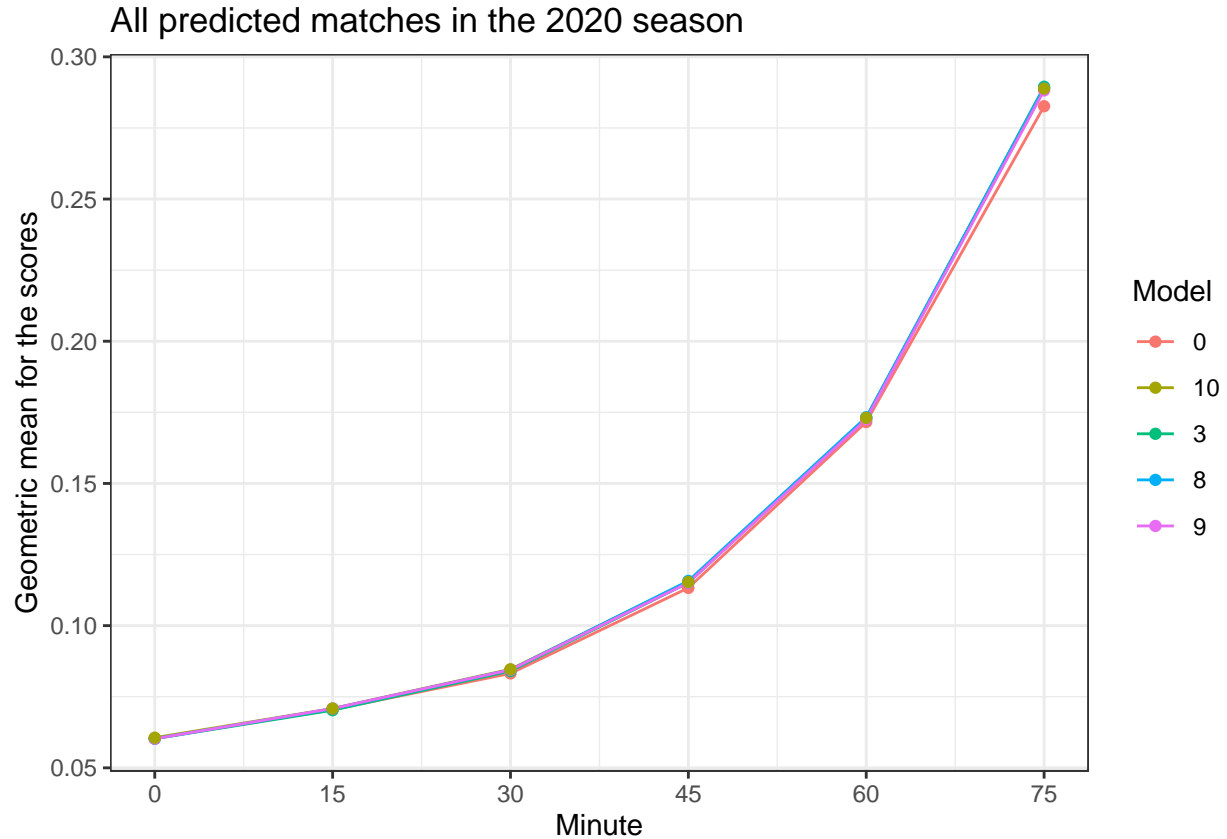## All predicted matches in the 2020 season
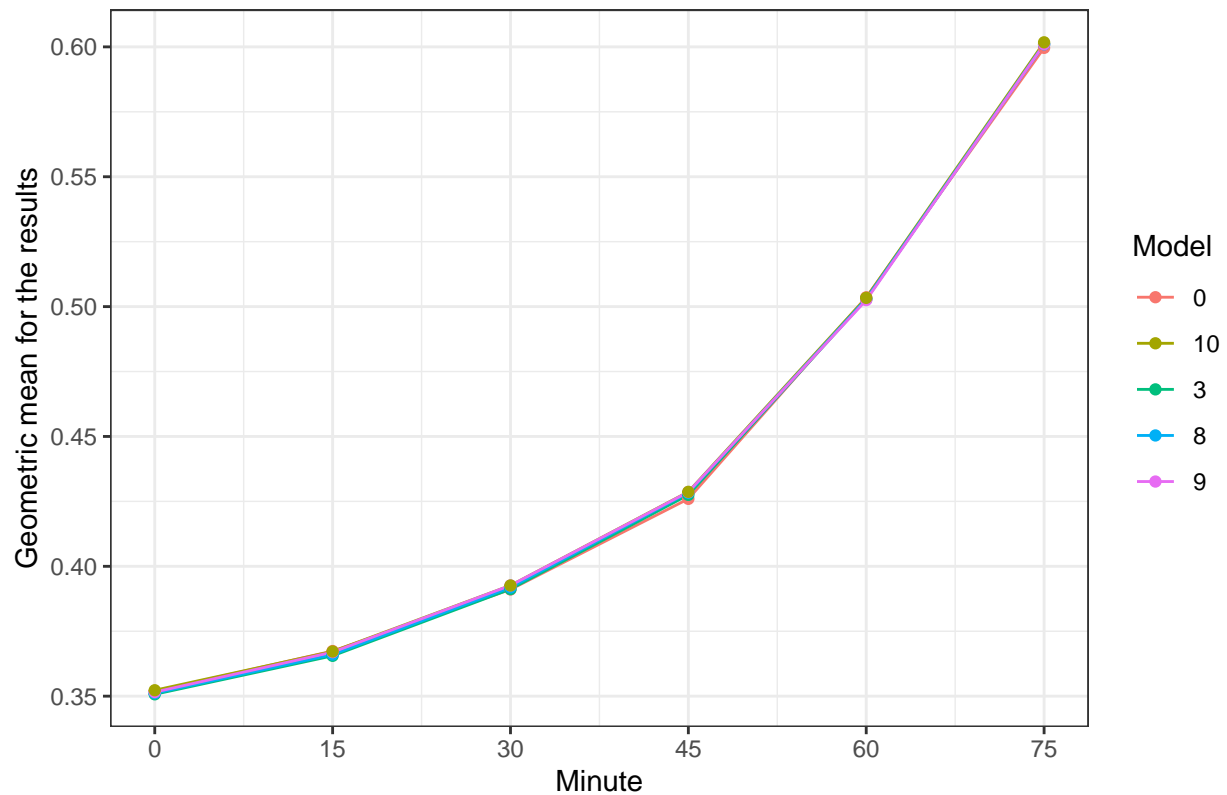

```
results_2020 %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.3518546	0.3673683	0.3910833	0.4259717	0.5035654	0.5996244
3	0.3507179	0.3655351	0.3912212	0.4275058	0.5028590	0.6010051
8	0.3511148	0.3660320	0.3918488	0.4283029	0.5029385	0.6010540
9	0.3515661	0.3669565	0.3926273	0.4285824	0.5024999	0.6009942
10	0.3522781	0.3672113	0.3926244	0.4286733	0.5033719	0.6017509

```
scores_2020 = tibble(GeoMean = apply(HDA_2020[,c(129:158)], 2, EnvStats::geoMean),
                     Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                     Model = factor(c(rep("0", 6),
                                      rep("3", 6),
                                      rep("8", 6),
                                      rep("9", 6),
                                      rep("10", 6))))
scores_2020 %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
```

```
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches in the 2020 season") +
  ylab("Geometric mean for the scores")
```



```
scores_2020 %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.0603763	0.0704758	0.0831918	0.1132685	0.1715947	0.2826407
3	0.0602509	0.0702607	0.0840340	0.1151168	0.1728721	0.2894863
8	0.0602494	0.0707715	0.0844645	0.1157232	0.1732687	0.2891548
9	0.0602406	0.0708495	0.0844681	0.1150881	0.1725393	0.2882044
10	0.0606019	0.0708590	0.0846522	0.1153487	0.1730509	0.2888717

```
load("~/GitHub/soccer-live-predictions/soccer-live-predictions/scrape/data/results.RData")
load("~/GitHub/soccer-live-predictions/soccer-live-predictions/scrape/data/goals.RData")
```

```
at_45 = results %>%
  select(Season, Match) %>%
```

```r
    filter(Season > 2015)

home_score_at_45 <- function(season, match) {
  goals %>%
    filter(Season == season,
           Match == match,
           Team == 1,
           Half == 1) %>%
    nrow()
}

away_score_at_45 <- function(season, match) {
  goals %>%
    filter(Season == season,
           Match == match,
           Team == 2,
           Half == 1) %>%
    nrow()
}

at_45 = at_45 %>%
  rowwise() %>%
  mutate(Home_Score = home_score_at_45(Season, Match),
         Away_Score = away_score_at_45(Season, Match),
         abs_dif = abs(Home_Score - Away_Score))

tmp_00 = at_45 %>%
  filter(abs_dif == 0) %>%
  select(Season, Match)

HDA_00 = HDA %>%
  inner_join(tmp_00)
```

```
## Joining, by = c("Season", "Match")
```

```r
nrow(HDA_00)
```

```
## [1] 838
```

```r
results_00 = tibble(GeoMean = apply(HDA_00[,c(99:128)], 2, EnvStats::geoMean),
                    Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                    Model = factor(c(rep("0", 6),
                                     rep("3", 6),
                                     rep("8", 6),
                                     rep("9", 6),
                                     rep("10", 6))))
results_00 %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
```

```
  theme_bw() +
  ggtitle("All predicted matches with a draw at minute 45") +
  ylab("Geometric mean for the results")
```
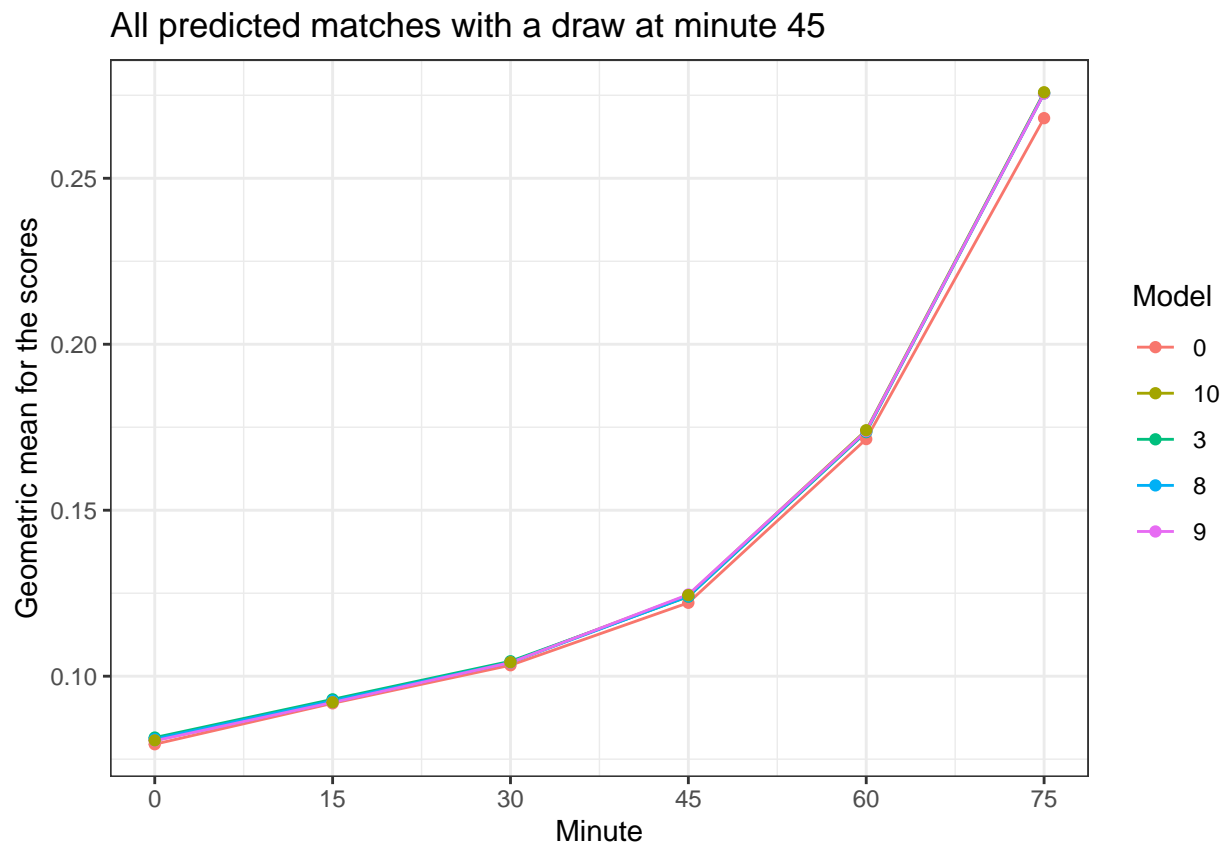
All predicted matches with a draw at minute 45
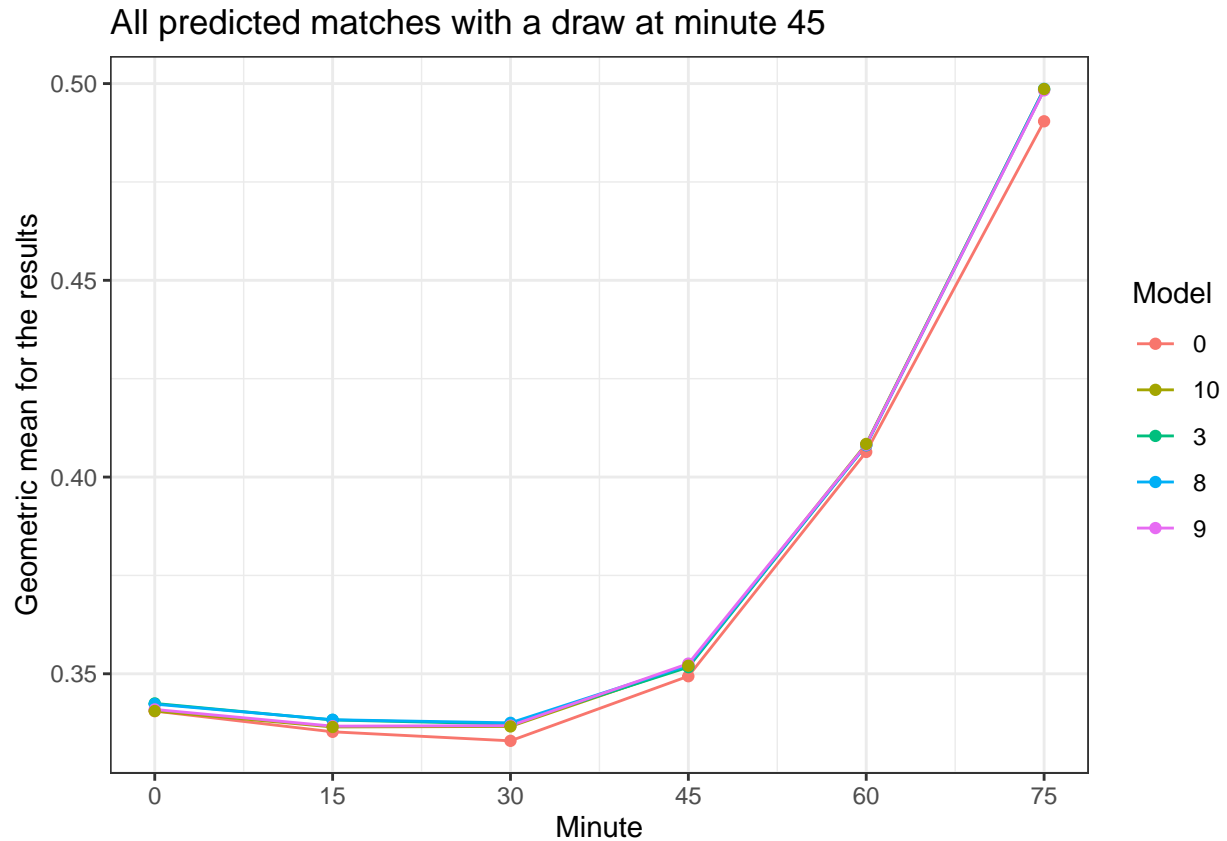

```
results_00 %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
            names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.3405184	0.3352532	0.3329615	0.3493841	0.4063878	0.4904210
3	0.3424718	0.3382645	0.3372412	0.3516865	0.4081422	0.4984660
8	0.3422894	0.3383228	0.3375331	0.3521376	0.4080746	0.4986579
9	0.3409425	0.3366901	0.3368290	0.3525857	0.4082245	0.4982893
10	0.3405477	0.3364875	0.3366199	0.3520409	0.4084204	0.4986198

```
scores_00 = tibble(GeoMean = apply(HDA_00[,c(129:158)], 2, EnvStats::geoMean),
                   Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                   Model = factor(c(rep("0", 6),
                                    rep("3", 6),
                                    rep("8", 6),
                                    rep("9", 6),
                                    rep("10", 6))))
```

13

```
scores_00 %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches with a draw at minute 45") +
  ylab("Geometric mean for the scores")
```


All predicted matches with a draw at minute 45

```
scores_00 %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.0795046	0.0918301	0.1033027	0.1221252	0.1714369	0.2681104
3	0.0815104	0.0930254	0.1044979	0.1239824	0.1735399	0.2756050
8	0.0810795	0.0926119	0.1041446	0.1241021	0.1737373	0.2756520
9	0.0805531	0.0920956	0.1041057	0.1246024	0.1738499	0.2755312
10	0.0806622	0.0921428	0.1042062	0.1244158	0.1740986	0.2759112

```
tmp_20 = at_45 %>%
  filter(abs_dif >= 2) %>%
  select(Season, Match)

HDA_20 = HDA %>%
  inner_join(tmp_20)
```

```
## Joining, by = c("Season", "Match")
```

```
nrow(HDA_20)
```

```
## [1] 211
```

```
results_20 = tibble(GeoMean = apply(HDA_20[,c(99:128)], 2, EnvStats::geoMean),
                    Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                    Model = factor(c(rep("0", 6),
                                     rep("3", 6),
                                     rep("8", 6),
                                     rep("9", 6),
                                     rep("10", 6))))
results_20 %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches with a 2+ goal lead at minute 45") +
  ylab("Geometric mean for the results")
```

All predicted matches with a 2+ goal lead at minute 45
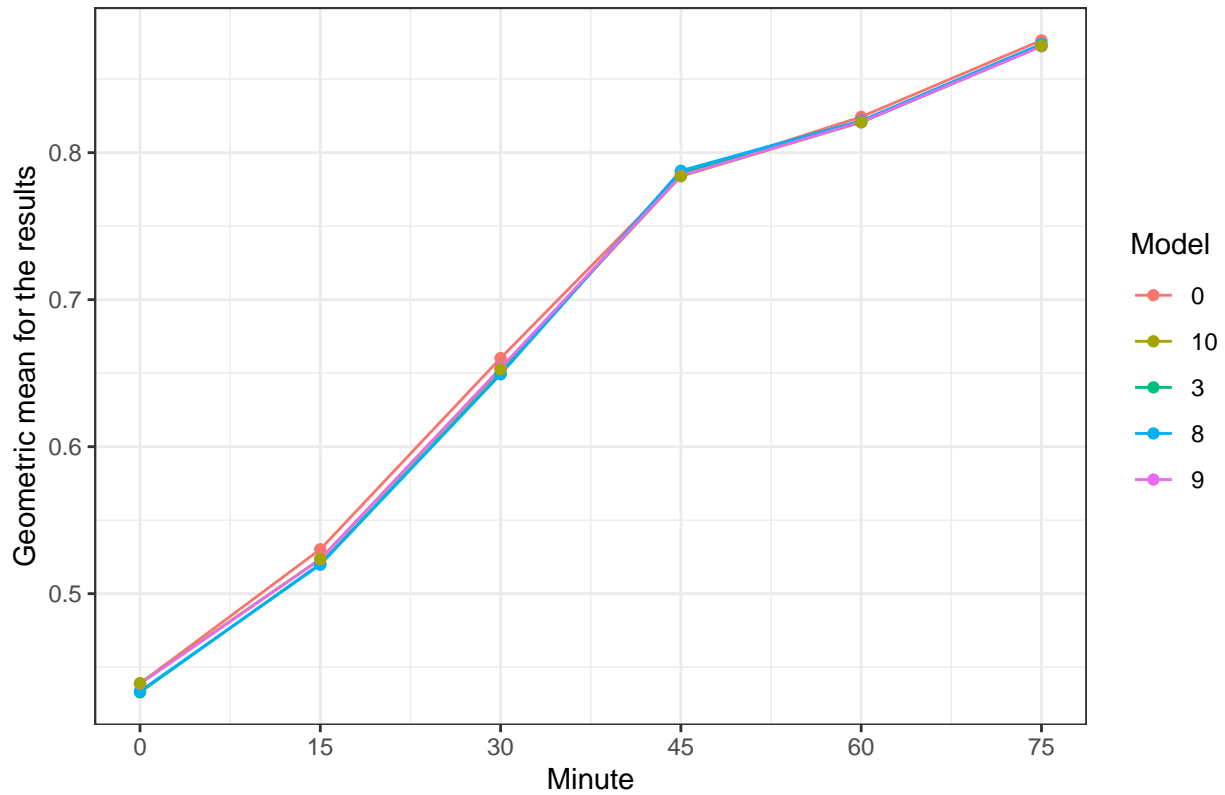

```
results_20 %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```
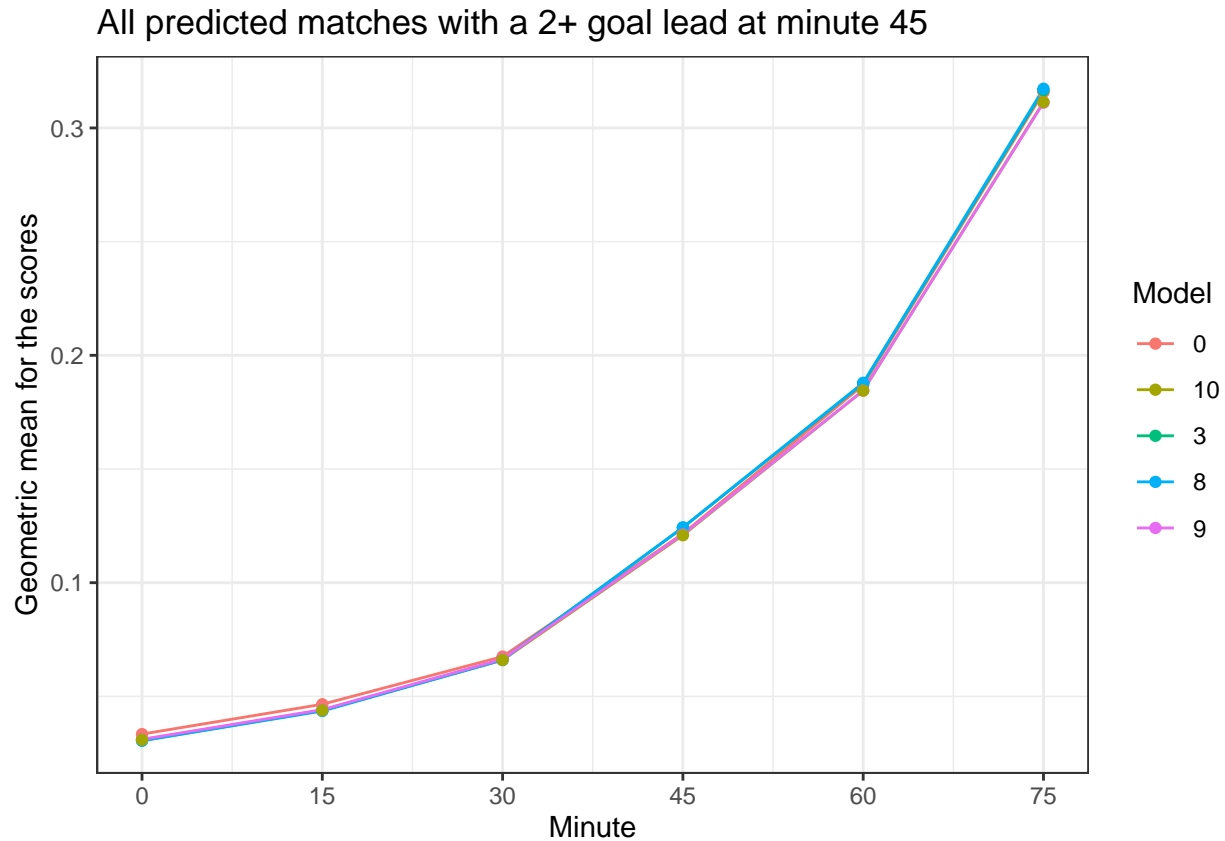
Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.4389412	0.5302146	0.6602535	0.7848906	0.8243508	0.8764061
3	0.4329183	0.5203485	0.6498265	0.7865919	0.8207394	0.8725380
8	0.4337269	0.5197316	0.6492730	0.7876867	0.8217482	0.8738818
9	0.4387283	0.5233723	0.6534491	0.7843683	0.8208538	0.8723773
10	0.4390975	0.5235471	0.6525027	0.7839516	0.8207161	0.8725506

```
scores_20 = tibble(GeoMean = apply(HDA_20[,c(129:158)], 2, EnvStats::geoMean),
                   Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                   Model = factor(c(rep("0", 6),
                                    rep("3", 6),
                                    rep("8", 6),
                                    rep("9", 6),
                                    rep("10", 6))))
scores_20 %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
```

```
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches with a 2+ goal lead at minute 45") +
  ylab("Geometric mean for the scores")
```


All predicted matches with a 2+ goal lead at minute 45

```
scores_20 %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.0334097	0.0465290	0.0675163	0.1215685	0.1868990	0.3156954
3	0.0305472	0.0438189	0.0662227	0.1241918	0.1876758	0.3165560
8	0.0304989	0.0435676	0.0659792	0.1243353	0.1878899	0.3172397
9	0.0310973	0.0441598	0.0663760	0.1211883	0.1844935	0.3111123
10	0.0309408	0.0439092	0.0659951	0.1208660	0.1844703	0.3113697

```
tmp_10 = at_45 %>%
  filter(Home_Score == 1, Away_Score == 0) %>%
  select(Season, Match)

HDA_10 = HDA %>%
  inner_join(tmp_10)
```

```
## Joining, by = c("Season", "Match")
```

```
nrow(HDA_10)
```

```
## [1] 435
```

```
results_10 = tibble(GeoMean = apply(HDA_10[,c(99:128)], 2, EnvStats::geoMean),
                    Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                    Model = factor(c(rep("0", 6),
                                     rep("3", 6),
                                     rep("8", 6),
                                     rep("9", 6),
                                     rep("10", 6))))
results_10 %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches with score 1-0 lead at minute 45") +
  ylab("Geometric mean for the results")
```

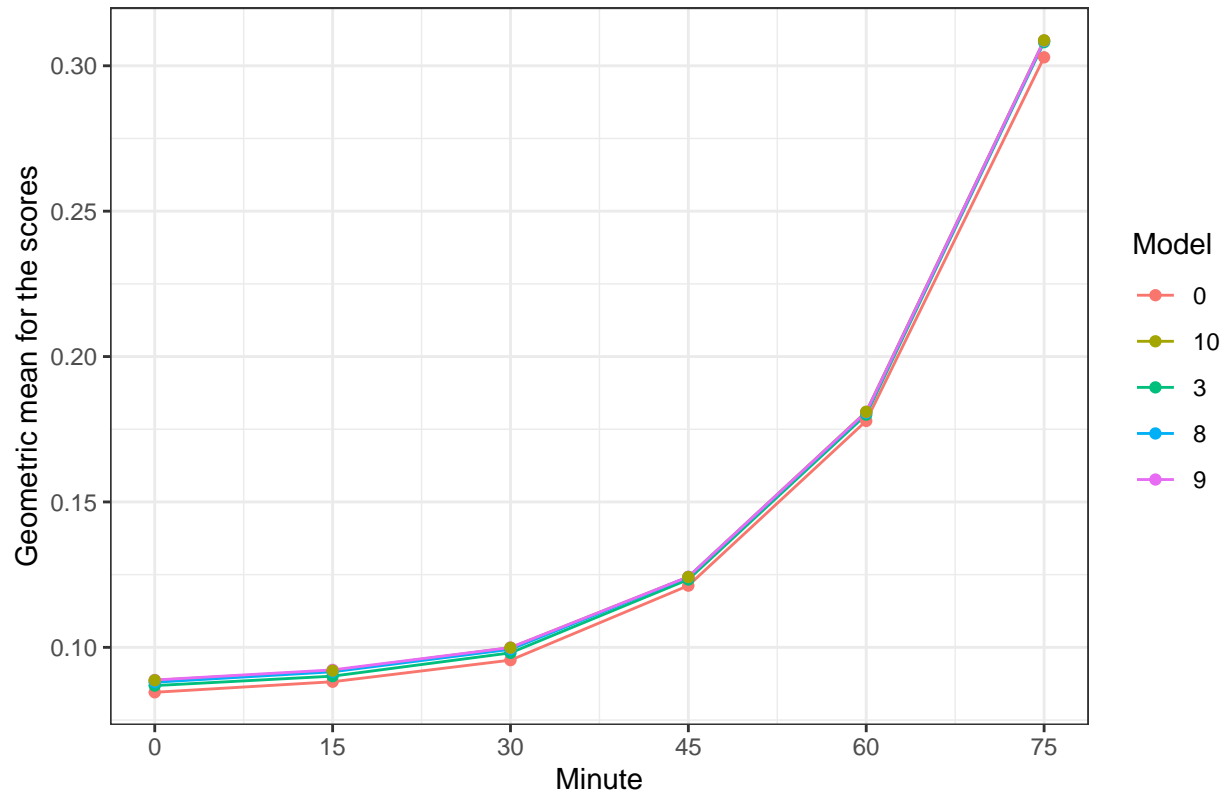All predicted matches with score 1−0 lead at minute 45
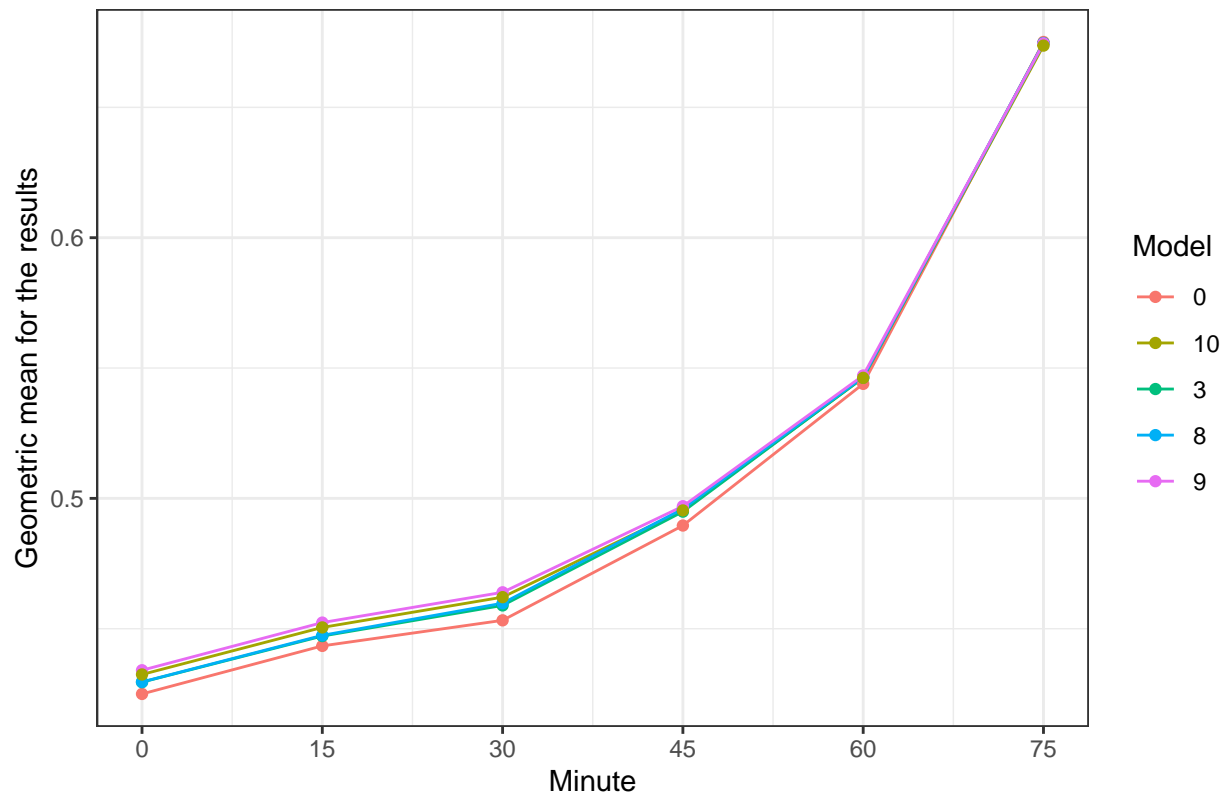
```
results_10 %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.4249727	0.4434106	0.4532144	0.4895783	0.5439249	0.6750752
3	0.4295074	0.4471846	0.4589346	0.4949138	0.5463074	0.6747006
8	0.4295761	0.4474475	0.4597788	0.4959886	0.5465142	0.6745871
9	0.4340706	0.4523494	0.4639639	0.4969877	0.5471415	0.6745461
10	0.4324488	0.4504932	0.4621066	0.4953716	0.5462329	0.6736847

```
scores_10 = tibble(GeoMean = apply(HDA_10[,c(129:158)], 2, EnvStats::geoMean),
                   Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                   Model = factor(c(rep("0", 6),
                                    rep("3", 6),
                                    rep("8", 6),
                                    rep("9", 6),
                                    rep("10", 6))))
scores_10 %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches with score 1-0 at minute 45") +
  ylab("Geometric mean for the scores")
```

All predicted matches with score 1–0 at minute 45


```
scores_10 %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.0845383	0.0881690	0.0955940	0.1212249	0.1778640	0.3029202
3	0.0868414	0.0900916	0.0981007	0.1233328	0.1800243	0.3081358
8	0.0879991	0.0915952	0.0993220	0.1241747	0.1806904	0.3084771
9	0.0887686	0.0922409	0.0999220	0.1242741	0.1809378	0.3086916
10	0.0886689	0.0919717	0.0998731	0.1241895	0.1810005	0.3087504

```
tmp_01 = at_45 %>%
  filter(Home_Score == 0, Away_Score == 1) %>%
  select(Season, Match)

HDA_01 = HDA %>%
  inner_join(tmp_01)
```

```
## Joining, by = c("Season", "Match")
```

```
nrow(HDA_01)
```

```
## [1] 275
```

```
results_01 = tibble(GeoMean = apply(HDA_01[,c(99:128)], 2, EnvStats::geoMean),
                    Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                    Model = factor(c(rep("0", 6),
                                     rep("3", 6),
                                     rep("8", 6),
                                     rep("9", 6),
                                     rep("10", 6))))
results_01 %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches with score 0-1 at minute 45") +
  ylab("Geometric mean for the results")
```
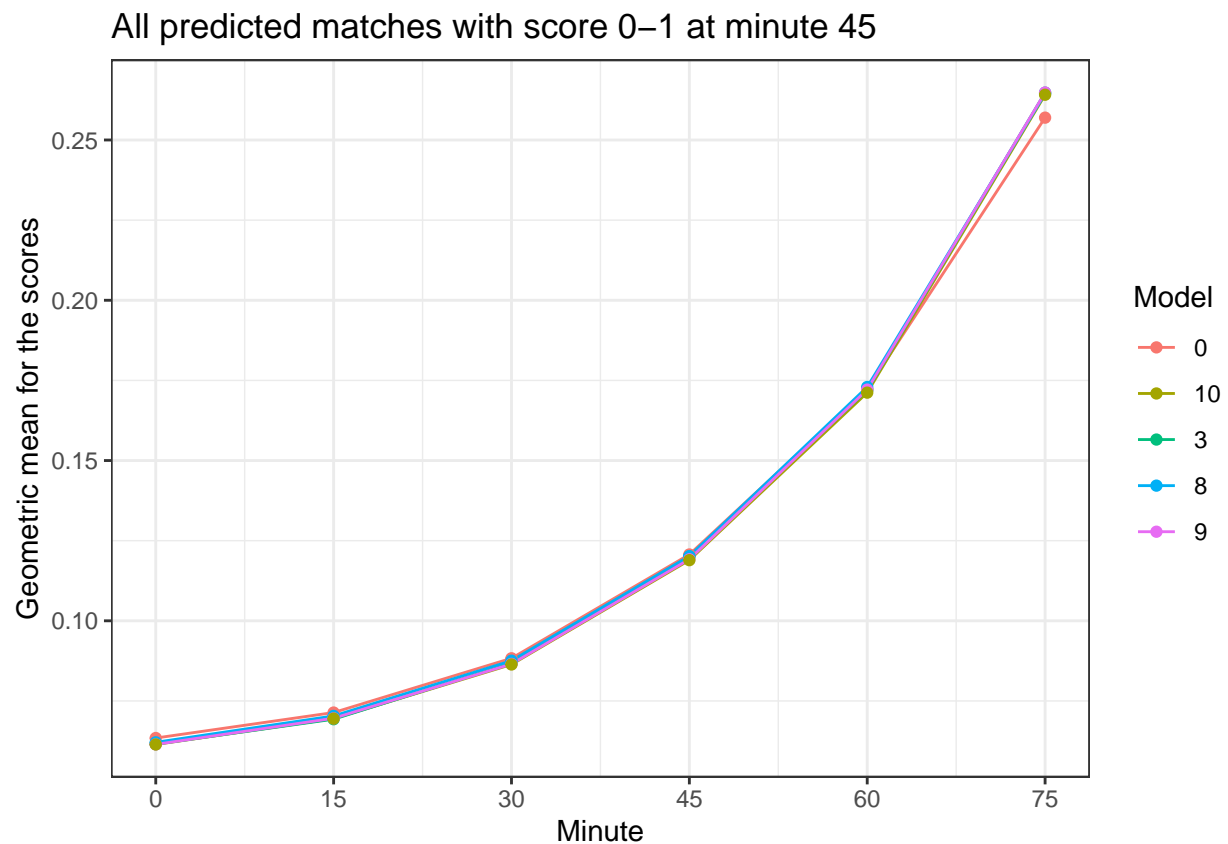

All predicted matches with score 0−1 at minute 45
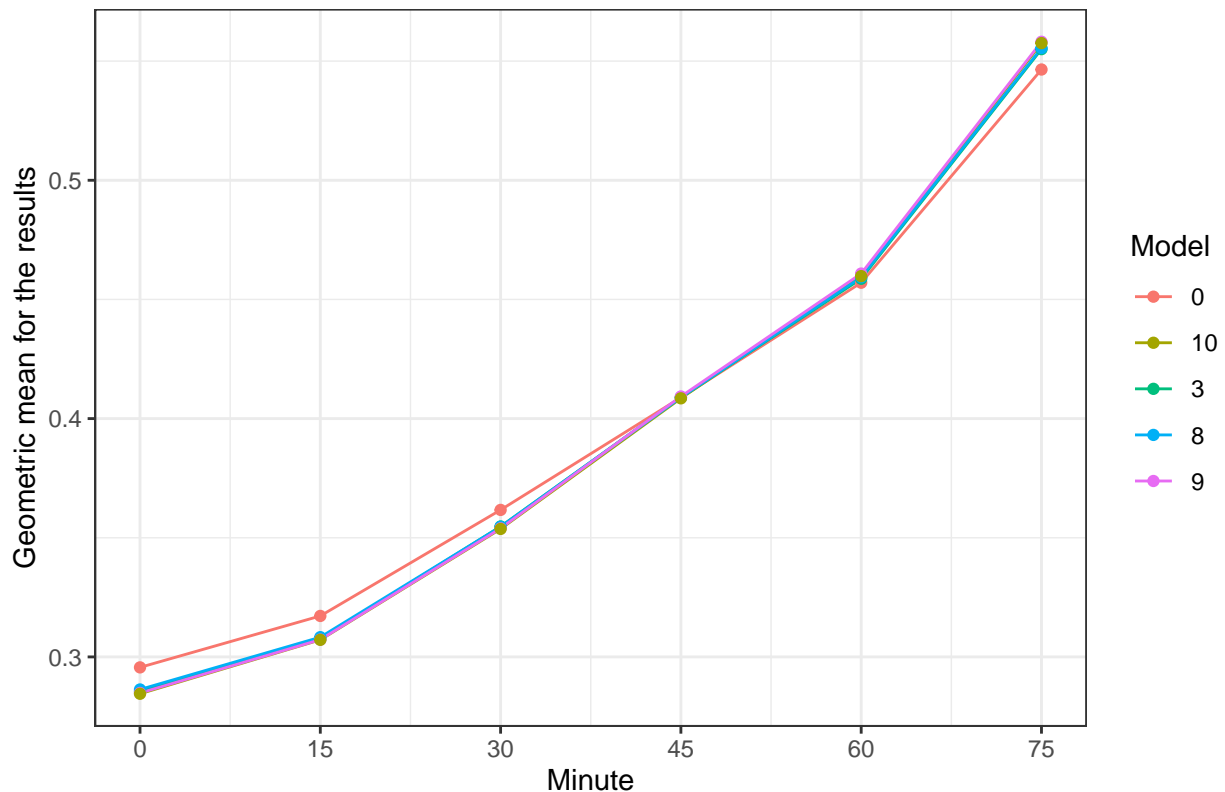
```
results_01 %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.2956123	0.3171910	0.3616782	0.4088358	0.4570105	0.5464660
3	0.2855482	0.3075360	0.3547167	0.4089197	0.4586845	0.5550264
8	0.2863381	0.3082845	0.3546301	0.4088898	0.4592993	0.5554717
9	0.2848570	0.3072533	0.3539536	0.4092738	0.4608471	0.5581029
10	0.2845445	0.3071655	0.3537072	0.4085122	0.4597715	0.5575412

```r
scores_01 = tibble(GeoMean = apply(HDA_01[,c(129:158)], 2, EnvStats::geoMean),
                   Minute = as.integer(rep(c(0, 15, 30, 45, 60, 75), 5)),
                   Model = factor(c(rep("0", 6),
                                    rep("3", 6),
                                    rep("8", 6),
                                    rep("9", 6),
                                    rep("10", 6))))
scores_01 %>%
  ggplot(aes(x = Minute, y = GeoMean, col = Model)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = c(0, 15, 30, 45, 60, 75)) +
  theme_bw() +
  ggtitle("All predicted matches with score 0-1 at minute 45") +
  ylab("Geometric mean for the scores")
```


All predicted matches with score 0−1 at minute 45

```
scores_01 %>%
  pivot_wider(id_cols = "Model", values_from = "GeoMean", names_from = "Minute",
              names_prefix = "Minute ") %>%
  kable()
```

Model	Minute 0	Minute 15	Minute 30	Minute 45	Minute 60	Minute 75
0	0.0634328	0.0713822	0.0883127	0.1206942	0.1722355	0.2569705
3	0.0615342	0.0693115	0.0867757	0.1200215	0.1719729	0.2647589
8	0.0620974	0.0703260	0.0875560	0.1201760	0.1729469	0.2644719
9	0.0614537	0.0695929	0.0865438	0.1192102	0.1721292	0.2648139
10	0.0614233	0.0694904	0.0863785	0.1189218	0.1711862	0.2641185