

```

> # =====
> # QM PROJECT – Markov Chains
> # Transition matrices, steady-state and plots
> # =====
>
> # States:
> # N = No stay
> # S = Stay
>
>
> # =====
> # (1) RAW DATA – OBSERVED COUNTS
> # =====
>
> counts_dirette <- matrix(c(
+   52, 48,
+   59, 41
+ ), nrow = 2, byrow = TRUE,
+ dimnames = list(c("N", "S"), c("N", "S")))
>
> counts_napoleon <- matrix(c(
+   47, 53,
+   43, 57
+ ), nrow = 2, byrow = TRUE,
+ dimnames = list(c("N", "S"), c("N", "S")))
>
> counts_sardegna <- matrix(c(
+   44, 56,
+   51, 49
+ ), nrow = 2, byrow = TRUE,
+ dimnames = list(c("N", "S"), c("N", "S")))
>
>
> # =====
> # (2) TRANSITION MATRICES
> # =====
>
> transition_matrix <- function(counts) {
+   counts / rowSums(counts)
+ }
>
> P_dirette <- transition_matrix(counts_dirette)
> P_napoleon <- transition_matrix(counts_napoleon)
> P_sardegna <- transition_matrix(counts_sardegna)
>
>
> # =====
> # (3) STEADY-STATE DISTRIBUTION
> # =====
>
> steady_state <- function(P) {
+   A <- matrix(c(1 - P[1,1], -P[2,1],
+                 1, 1),
+               nrow = 2, byrow = TRUE)
+   b <- c(0, 1)
+   solve(A, b)
+ }
>
> pi_dirette <- steady_state(P_dirette)
> pi_napoleon <- steady_state(P_napoleon)
> pi_sardegna <- steady_state(P_sardegna)
>
>
> # =====

```

```

> # (4) COMPARISON TABLE
> # =====
>
> steady_states <- rbind(
+   Dirette = pi_dirette,
+   Napoleon = pi_napoleon,
+   Sardegna_Travel = pi_sardegna
+ )
>
> colnames(steady_states) <- c("No stay (N)", "Stay (S)")
> steady_states
      No stay (N) Stay (S)
Dirette      0.5514019 0.4485981
Napoleon     0.4479167 0.5520833
Sardegna_Travel 0.4766355 0.5233645
>
>
> # =====
> # (5) PLOT - STEADY-STATE COMPARISON
> # =====
>
> barplot(
+   t(steady_states),
+   beside = TRUE,
+   legend.text = c("No stay (N)", "Stay (S)"),
+   args.legend = list(x = "topright"),
+   main = "Steady-state distribution comparison",
+   ylab = "Probability",
+   ylim = c(0, 1)
+ )
>
>
> # =====
> # (6) TEXT OUTPUT
> # =====
>
> cat("\nSteady-state probabilities (long run):\n\n")
Steady-state probabilities (long run):

>
> cat("Dirette -> No stay:", round(pi_dirette[1], 3),
+   " Stay:", round(pi_dirette[2], 3), "\n")
Dirette -> No stay: 0.551 Stay: 0.449
>
> cat("Napoleon -> No stay:", round(pi_napoleon[1], 3),
+   " Stay:", round(pi_napoleon[2], 3), "\n")
Napoleon -> No stay: 0.448 Stay: 0.552
>
> cat("Sardegna Travel -> No stay:", round(pi_sardegna[1], 3),
+   " Stay:", round(pi_sardegna[2], 3), "\n")
Sardegna Travel -> No stay: 0.477 Stay: 0.523

```