$$C = \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix},$$

and we want to estimate ρ along with the variances of u_i and v_i. Here, it is trivial to ensure that C is positive-definite, by requiring $-1 < \rho < 1$, but in higher dimensions, this issue requires more careful consideration.

To ensure that C is positive-definite, you can parameterize the problem in terms of the Cholesky factor L, i.e., $C = LL'$, where L is a lower diagonal matrix with positive diagonal elements. There are $q(q-1)/2$ free parameters (the non-zero elements of L) to be estimated, where q is the dimension of C. Since C is a correlation matrix, we must ensure that its diagonal elements are unity. An example with $q = 4$ is

```
PARAMETER_SECTION
  matrix L(1,4,1,4)                // Cholesky factor
  init_vector a(1,6)              // Free parameters in C
  init_bounded_vector B(1,4,0,10)   // Standard deviations

PROCEDURE_SECTION
        k = 1
  int k=0;
  L(1,1) = 1.0;
  for(i=2;i<=4;i++)
  {
    L(i,i) = 1.0;
    for(j=1;j<=i-1;j++)
      L(i,j) = a(k++);
    L(i)(1,i) /= norm(L(i)(1,i));  // Ensures that C(i,i) = 1
  }
```