

Appendix

Matlab Code

The code given below estimates the direct and carryover for $\text{ECO}(t, t(t-1), p(\leq t))$ and $\text{ECO}(t, t(t-1), p')$. Take $p = p'$ for $\text{ECO}(t, t(t-1), p')$ design. The code for scattered missing observations and unit dropout in ECO design is available through E-mail on request to the author. Experimenter has to set the design parameters as shown between star boarders.

```
%.******  
t = 4  
n =12  
p = 4  
full1D = [4 1 2 3 4 1 2 3 4 1 2 3;  
          2 3 4 1 1 4 3 2 3 2 1 4;  
          3 2 1 4 2 3 4 1 1 4 3 2;  
          1 4 3 2 3 2 1 4 2 3 4 1]  
Y = [15 15 15 15 15 15 15 15 15 15 15 15;  
     15 15 15 15 15 15 15 15 15 15 15 15;  
     20 15 15 15 20 15 15 15 20 15 15 15;  
     15 15 20 15 15 20 15 15 15 15 15 20]
```

```

lamda = [-1 1 0 0] '%treatment contrast 2-1%'
delta = [1 0.9 0.8 0.7;
         0.9 1 0.9 0.8;
         0.8 0.9 1 0.9;
         0.7 0.8 0.9 1]

\%*****

for k = 1:p-1
    srno = 0;
    YR(1:n*p,1,k) = 0;
    if k == (p-1)
        for i = 1:n
            for j = 1:p
                srno = srno+1;
                YR(srno,1,k) = Y(j,i);
            end
        end
    else
        for i = 1:n
            for j = k+1:p
                srno = srno+1;
                YR(srno,1,k) = Y(j,i);
            end
        end
    end
end

```

```

end
Design = fullD(1:p,:)
incr = 0;
for inci = 1:n
    for incj = 1:p
        incr = incr+1;
        for inck = 1:p-1
            if inck == (p-1)
                Rot(incr,Design(incj,inci),inck) = 1;
            else
                if (incj-inck)>0
                    Rot(incr,Design(incj-inck,inci),inck) = 1;
                end
            end
        end
    end
end
end
for i = 1:p-2
    incr = 0;
    for j = 1:n*p
        if Rot(j,:,i)*ones(t,1) == 1
            incr = incr+1;
            Rstar(incr,:,i) = Rot(j,:,i);
        end
    end
end

```

```

    end

end

P = kron(ones(n,1),eye(p));
U = kron(eye(n),ones(p,1));
srno = 0;
for i = 1:p-1
    Dm(:,:,i) = Rot(:,:,i)'*Rot(:,:,i);
end
for i = 1:p-1
    Ntp(:,:,i) = Rot(:,:,i)'*P;
end
for i = 1:p-1
    Ntu(:,:,i) = Rot(:,:,i)'*U;
end
for i = 1:p-1
    for j = 1:p-1
        H(:,:,i,j) = Rot(:,:,i)'*Rot(:,:,j);
    end
end
for i = 1:p-1
    for j = 1:p-1
        C(:,:,i,j) = H(:,:,i,j)-
(1/n)*Ntp(:,:,i)*Ntp(:,:,j)'+
(1/p)*Ntu(:,:,i)*Ntu(:,:,j)'+

```

```

(1/(n.p))*Ntu(:,:,i)*ones(n)*Ntu(:,:,j)';
    end
end
for i = 1:p-1
    RestC = 0;
    for j = 1:p-1
        if i~ = j
            RestC = RestC+C(:,:,i,j)*pinv(C(:,:,j,j))*C(:,:,j,i);
        end
    end
    CR(:,:,i) = C(:,:,i,i)-RestC;
end
for i = 1:p-1
    if i == (p-1)
        MR(1:(n*p),1:(n*p),i)=kron(eye(n),(eye(p)-(ones(p)*(1/p))));
    else
        MR(1:(n*(p-i)),1:(n*(p-i)),i)
        =kron(eye(n),(eye(p-i)-(ones(p-i)*(1/(p-i)))));
    end
end
for i = 1:p-1
    if i == (p-1)
        QR(:,:,p-1)=Rot(:,:,p-1)'*MR(:,:,p-1)*YR(:,:,p-1);
    else

```

```

        QR(:, :, i) = Rstar(1:(n.(p-i)), :, i)' * MR(1:(n.(p-i)), 1:(n.(p-i)), i)
        * YR(1:(n.(p-i)), :, i);
    end
end
for i = 1:p-1
    if i == (p-1)
        Effect(:, :, p-1) = pinv(CR(:, :, p-1)) * QR(:, :, p-1);
    else
        Effect(:, :, i) = pinv(CR(:, :, i)) * QR(:, :, i);
    end
end
end
dvarcov = pinv(CR(:, :, p-1)) * Rot(:, :, p-1)' * MR(:, :, p-1) *
    kron(eye(n), delta(1:p, 1:p)) * MR(:, :, p-1)' *
    Rot(:, :, p-1) * pinv(CR(:, :, p-1));
VarDirect = lamda' * dvarcov * lamda;
for i = 1:p-2
    cvarcov = pinv(CR(:, :, i)) * Rstar(1:(n.(pi)), :, i)'
        * MR(1:(n.(p-i)), 1:(n.(pi)), i) * kron(eye(n), delta(1:p-i, 1:pi))
        * MR(1:(n.(p-i)), 1:(n.(p-i)), i)' * Rstar(1:(n.(pi)), :, i)
        * pinv(CR(:, :, i));
    VarCarry(:, :, i) = lamda' * cvarcov * lamda;
end
EffectDirect = Effect(:, :, p-1)
VarDirect

```

```
for i = 1:p-2
    EffectCarry(:, :, i) = Effect(:, :, i);
end
if p>2
    EffectCarry
    VarCarry
end
```