S16844 - CC Analysis

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Install libraries

#install.packages("tidyverse")  
#install.packages("ggplot2")  
#install.packages("ggplot2")  
#install.packages("GGally")  
#install.packages("CCA")  
#install.packages("CCP")  
#install.packages("candisc")  
#install.packages("skimr")  
library(tidyverse)

## Warning: package 'tidyverse' was built under R version 4.0.5

## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.5 v purrr 0.3.4  
## v tibble 3.1.2 v dplyr 1.0.7  
## v tidyr 1.1.3 v stringr 1.4.0  
## v readr 1.4.0 v forcats 0.5.1

## Warning: package 'ggplot2' was built under R version 4.0.5

## Warning: package 'tibble' was built under R version 4.0.5

## Warning: package 'tidyr' was built under R version 4.0.5

## Warning: package 'readr' was built under R version 4.0.5

## Warning: package 'dplyr' was built under R version 4.0.5

## Warning: package 'forcats' was built under R version 4.0.5

## -- Conflicts ------------------------------------------ tidyverse\_conflicts() --  
## x dplyr::filter() masks stats::filter()  
## x dplyr::lag() masks stats::lag()

library(ggplot2)  
library(GGally)

## Warning: package 'GGally' was built under R version 4.0.5

## Registered S3 method overwritten by 'GGally':  
## method from   
## +.gg ggplot2

library(CCA)

## Warning: package 'CCA' was built under R version 4.0.5

## Loading required package: fda

## Warning: package 'fda' was built under R version 4.0.5

## Loading required package: splines

## Loading required package: Matrix

##   
## Attaching package: 'Matrix'

## The following objects are masked from 'package:tidyr':  
##   
## expand, pack, unpack

## Loading required package: fds

## Warning: package 'fds' was built under R version 4.0.5

## Loading required package: rainbow

## Warning: package 'rainbow' was built under R version 4.0.5

## Loading required package: MASS

##   
## Attaching package: 'MASS'

## The following object is masked from 'package:dplyr':  
##   
## select

## Loading required package: pcaPP

## Warning: package 'pcaPP' was built under R version 4.0.5

## Loading required package: RCurl

## Warning: package 'RCurl' was built under R version 4.0.5

##   
## Attaching package: 'RCurl'

## The following object is masked from 'package:tidyr':  
##   
## complete

##   
## Attaching package: 'fda'

## The following object is masked from 'package:graphics':  
##   
## matplot

## Loading required package: fields

## Warning: package 'fields' was built under R version 4.0.5

## Loading required package: spam

## Warning: package 'spam' was built under R version 4.0.5

## Loading required package: dotCall64

## Warning: package 'dotCall64' was built under R version 4.0.5

## Loading required package: grid

## Spam version 2.7-0 (2021-06-25) is loaded.  
## Type 'help( Spam)' or 'demo( spam)' for a short introduction   
## and overview of this package.  
## Help for individual functions is also obtained by adding the  
## suffix '.spam' to the function name, e.g. 'help( chol.spam)'.

##   
## Attaching package: 'spam'

## The following object is masked from 'package:Matrix':  
##   
## det

## The following objects are masked from 'package:base':  
##   
## backsolve, forwardsolve

## Loading required package: viridis

## Warning: package 'viridis' was built under R version 4.0.5

## Loading required package: viridisLite

## Warning: package 'viridisLite' was built under R version 4.0.5

## See https://github.com/NCAR/Fields for  
## an extensive vignette, other supplements and source code

library(CCP)  
library(candisc)

## Warning: package 'candisc' was built under R version 4.0.5

## Loading required package: car

## Warning: package 'car' was built under R version 4.0.5

## Loading required package: carData

##   
## Attaching package: 'car'

## The following object is masked from 'package:dplyr':  
##   
## recode

## The following object is masked from 'package:purrr':  
##   
## some

## Loading required package: heplots

## Warning: package 'heplots' was built under R version 4.0.5

##   
## Attaching package: 'candisc'

## The following object is masked from 'package:stats':  
##   
## cancor

library(skimr)

## Warning: package 'skimr' was built under R version 4.0.5

Import dataset

fat <- read.csv("Fat\_Supply\_Quantity\_Data.csv",header = TRUE)  
head(fat)

## AnimalProducts AnimalFats Cereals Eggs FishSeafood Fruits Meat Milk  
## 1 21.6397 6.2224 8.0353 0.6859 0.0327 0.4246 6.1244 8.2803  
## 2 32.0002 3.4172 2.6734 1.6448 0.1445 0.6418 8.7428 17.7576  
## 3 14.4175 0.8972 4.2035 1.2171 0.2008 0.5772 3.8961 8.0934  
## 4 15.3041 1.3130 6.5545 0.1539 1.4155 0.3488 11.0268 1.2309  
## 5 27.7033 4.6686 3.2153 0.3872 1.5263 1.2177 14.3202 6.6607  
## 6 30.3572 3.3076 1.3316 1.5706 0.1664 0.2091 19.2693 5.8512  
## Oilcrops Pulses Spices Treenuts VegetalProducts VegetableOils Vegetables  
## 1 1.0452 0.1960 0.2776 0.7513 28.3684 17.0831 0.3593  
## 2 3.1622 0.1148 0.0000 0.9181 17.9998 9.2443 0.6503  
## 3 1.1983 0.2698 0.1568 0.8595 35.5857 27.3606 0.5145  
## 4 3.9902 0.3282 0.0103 0.0308 34.7010 22.4638 0.1231  
## 5 1.3579 0.0673 0.3591 0.2020 22.2995 14.4436 0.2469  
## 6 0.0640 0.0213 0.0213 0.1366 19.6449 17.3147 0.1878

summary of “fat” dataset

skim(fat)

Data summary

|  |  |
| --- | --- |
| Name | fat |
| Number of rows | 170 |
| Number of columns | 15 |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| Column type frequency: |  |
| numeric | 15 |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| Group variables | None |

**Variable type: numeric**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| skim\_variable | n\_missing | complete\_rate | mean | sd | p0 | p25 | p50 | p75 | p100 | hist |
| AnimalProducts | 0 | 1 | 20.70 | 8.00 | 5.02 | 14.89 | 20.94 | 26.87 | 36.90 | ▅▆▇▇▃ |
| AnimalFats | 0 | 1 | 4.14 | 3.29 | 0.03 | 1.67 | 3.31 | 6.23 | 14.94 | ▇▅▃▁▁ |
| Cereals | 0 | 1 | 4.38 | 3.18 | 0.99 | 1.97 | 3.31 | 5.59 | 18.38 | ▇▂▁▁▁ |
| Eggs | 0 | 1 | 0.95 | 0.64 | 0.06 | 0.41 | 0.90 | 1.28 | 3.28 | ▇▇▃▁▁ |
| FishSeafood | 0 | 1 | 0.85 | 0.92 | 0.02 | 0.33 | 0.57 | 1.11 | 8.41 | ▇▁▁▁▁ |
| Fruits | 0 | 1 | 0.54 | 0.84 | 0.04 | 0.24 | 0.36 | 0.58 | 9.67 | ▇▁▁▁▁ |
| Meat | 0 | 1 | 9.49 | 4.67 | 0.91 | 6.26 | 9.26 | 11.75 | 26.43 | ▃▇▃▁▁ |
| Milk | 0 | 1 | 5.11 | 3.33 | 0.18 | 2.22 | 4.95 | 7.32 | 17.76 | ▇▇▅▁▁ |
| Oilcrops | 0 | 1 | 3.33 | 4.66 | 0.06 | 0.85 | 1.69 | 3.51 | 28.56 | ▇▁▁▁▁ |
| Pulses | 0 | 1 | 0.26 | 0.37 | 0.00 | 0.04 | 0.14 | 0.34 | 2.69 | ▇▁▁▁▁ |
| Spices | 0 | 1 | 0.28 | 0.45 | 0.00 | 0.04 | 0.10 | 0.34 | 2.69 | ▇▁▁▁▁ |
| Treenuts | 0 | 1 | 0.70 | 0.81 | 0.00 | 0.14 | 0.45 | 0.91 | 4.98 | ▇▂▁▁▁ |
| VegetalProducts | 0 | 1 | 29.30 | 8.00 | 13.10 | 23.13 | 29.06 | 35.12 | 44.98 | ▃▇▇▆▅ |
| VegetableOils | 0 | 1 | 18.57 | 6.77 | 4.95 | 13.81 | 18.19 | 23.60 | 36.42 | ▅▇▇▅▁ |
| Vegetables | 0 | 1 | 0.31 | 0.21 | 0.03 | 0.17 | 0.25 | 0.36 | 1.15 | ▇▅▂▁▁ |

set NA values to zero

fat[is.na(fat)] <- 0

standardized the dataset

st\_fat <- apply(fat,2,scale)

Splits the varibales into two sets. First set is “Animal Resources”(ani\_res) and second set is “Vegetative Resources”(veg\_res).

ani\_res <- st\_fat[,c('AnimalProducts','AnimalFats','Eggs','FishSeafood','Meat','Milk')]  
veg\_res <- st\_fat[,c('Cereals','Fruits','Oilcrops','Pulses','Spices','Treenuts','VegetalProducts','VegetableOils','Vegetables')]

Correlation between two sets

matcor(ani\_res,veg\_res)

## $Xcor  
## AnimalProducts AnimalFats Eggs FishSeafood Meat  
## AnimalProducts 1.00000000 0.6868303 0.4461958 -0.02027641 0.73678939  
## AnimalFats 0.68683030 1.0000000 0.2674917 -0.11754614 0.21371214  
## Eggs 0.44619576 0.2674917 1.0000000 0.19229567 0.22810965  
## FishSeafood -0.02027641 -0.1175461 0.1922957 1.00000000 0.01528619  
## Meat 0.73678939 0.2137121 0.2281097 0.01528619 1.00000000  
## Milk 0.60943676 0.3506991 0.2463719 -0.26602376 0.10211423  
## Milk  
## AnimalProducts 0.6094368  
## AnimalFats 0.3506991  
## Eggs 0.2463719  
## FishSeafood -0.2660238  
## Meat 0.1021142  
## Milk 1.0000000  
##   
## $Ycor  
## Cereals Fruits Oilcrops Pulses Spices  
## Cereals 1.000000000 0.01804879 0.11252934 0.40682269 0.13499804  
## Fruits 0.018048788 1.00000000 0.05167828 0.48241734 0.01554955  
## Oilcrops 0.112529336 0.05167828 1.00000000 0.14500474 0.11536861  
## Pulses 0.406822691 0.48241734 0.14500474 1.00000000 0.31650982  
## Spices 0.134998043 0.01554955 0.11536861 0.31650982 1.00000000  
## Treenuts -0.198261393 -0.09361863 -0.20672326 -0.12079719 0.11860613  
## VegetalProducts 0.456419856 0.10925225 0.42194166 0.42092041 0.17620613  
## VegetableOils -0.002545031 -0.07004792 -0.22393213 0.09636046 -0.04657770  
## Vegetables 0.039926154 0.02730002 -0.13495304 -0.01172584 0.17172166  
## Treenuts VegetalProducts VegetableOils Vegetables  
## Cereals -0.19826139 0.45641986 -0.002545031 0.03992615  
## Fruits -0.09361863 0.10925225 -0.070047924 0.02730002  
## Oilcrops -0.20672326 0.42194166 -0.223932131 -0.13495304  
## Pulses -0.12079719 0.42092041 0.096360456 -0.01172584  
## Spices 0.11860613 0.17620613 -0.046577696 0.17172166  
## Treenuts 1.00000000 -0.13241187 -0.047939298 0.24780791  
## VegetalProducts -0.13241187 1.00000000 0.674502751 -0.04952177  
## VegetableOils -0.04793930 0.67450275 1.000000000 -0.06930432  
## Vegetables 0.24780791 -0.04952177 -0.069304318 1.00000000  
##   
## $XYcor  
## AnimalProducts AnimalFats Eggs FishSeafood  
## AnimalProducts 1.00000000 0.68683030 0.44619576 -0.020276414  
## AnimalFats 0.68683030 1.00000000 0.26749169 -0.117546142  
## Eggs 0.44619576 0.26749169 1.00000000 0.192295671  
## FishSeafood -0.02027641 -0.11754614 0.19229567 1.000000000  
## Meat 0.73678939 0.21371214 0.22810965 0.015286193  
## Milk 0.60943676 0.35069914 0.24637188 -0.266023765  
## Cereals -0.45643149 -0.40273114 -0.29336002 -0.049916024  
## Fruits -0.10940757 -0.16692317 -0.06510226 0.025947315  
## Oilcrops -0.42194160 -0.33481262 -0.34613586 0.347880081  
## Pulses -0.42105198 -0.31283147 -0.31428263 -0.099382664  
## Spices -0.17628231 -0.19566357 -0.02504065 0.218045427  
## Treenuts 0.13243358 0.15206147 0.27170160 0.158674384  
## VegetalProducts -0.99999985 -0.68681291 -0.44626564 0.020239442  
## VegetableOils -0.67446607 -0.36692851 -0.16897391 -0.238868867  
## Vegetables 0.04953928 -0.09189163 0.17706187 -0.007835305  
## Meat Milk Cereals Fruits Oilcrops  
## AnimalProducts 0.736789390 0.60943676 -0.456431488 -0.10940757 -0.42194160  
## AnimalFats 0.213712136 0.35069914 -0.402731137 -0.16692317 -0.33481262  
## Eggs 0.228109655 0.24637188 -0.293360020 -0.06510226 -0.34613586  
## FishSeafood 0.015286193 -0.26602376 -0.049916024 0.02594731 0.34788008  
## Meat 1.000000000 0.10211423 -0.273723449 -0.03132812 -0.22400526  
## Milk 0.102114228 1.00000000 -0.254501602 -0.05127739 -0.39893051  
## Cereals -0.273723449 -0.25450160 1.000000000 0.01804879 0.11252934  
## Fruits -0.031328124 -0.05127739 0.018048788 1.00000000 0.05167828  
## Oilcrops -0.224005264 -0.39893051 0.112529336 0.05167828 1.00000000  
## Pulses -0.314142097 -0.17587621 0.406822691 0.48241734 0.14500474  
## Spices -0.147128089 -0.07775991 0.134998043 0.01554955 0.11536861  
## Treenuts -0.065104760 0.16678510 -0.198261393 -0.09361863 -0.20672326  
## VegetalProducts -0.736796408 -0.60942102 0.456419856 0.10925225 0.42194166  
## VegetableOils -0.568021495 -0.35644189 -0.002545031 -0.07004792 -0.22393213  
## Vegetables 0.005477866 0.16695759 0.039926154 0.02730002 -0.13495304  
## Pulses Spices Treenuts VegetalProducts  
## AnimalProducts -0.42105198 -0.17628231 0.13243358 -0.99999985  
## AnimalFats -0.31283147 -0.19566357 0.15206147 -0.68681291  
## Eggs -0.31428263 -0.02504065 0.27170160 -0.44626564  
## FishSeafood -0.09938266 0.21804543 0.15867438 0.02023944  
## Meat -0.31414210 -0.14712809 -0.06510476 -0.73679641  
## Milk -0.17587621 -0.07775991 0.16678510 -0.60942102  
## Cereals 0.40682269 0.13499804 -0.19826139 0.45641986  
## Fruits 0.48241734 0.01554955 -0.09361863 0.10925225  
## Oilcrops 0.14500474 0.11536861 -0.20672326 0.42194166  
## Pulses 1.00000000 0.31650982 -0.12079719 0.42092041  
## Spices 0.31650982 1.00000000 0.11860613 0.17620613  
## Treenuts -0.12079719 0.11860613 1.00000000 -0.13241187  
## VegetalProducts 0.42092041 0.17620613 -0.13241187 1.00000000  
## VegetableOils 0.09636046 -0.04657770 -0.04793930 0.67450275  
## Vegetables -0.01172584 0.17172166 0.24780791 -0.04952177  
## VegetableOils Vegetables  
## AnimalProducts -0.674466072 0.049539276  
## AnimalFats -0.366928510 -0.091891633  
## Eggs -0.168973910 0.177061868  
## FishSeafood -0.238868867 -0.007835305  
## Meat -0.568021495 0.005477866  
## Milk -0.356441894 0.166957587  
## Cereals -0.002545031 0.039926154  
## Fruits -0.070047924 0.027300020  
## Oilcrops -0.223932131 -0.134953038  
## Pulses 0.096360456 -0.011725843  
## Spices -0.046577696 0.171721665  
## Treenuts -0.047939298 0.247807910  
## VegetalProducts 0.674502751 -0.049521770  
## VegetableOils 1.000000000 -0.069304318  
## Vegetables -0.069304318 1.000000000

Canonical correlation model

cc\_model <- cc(ani\_res,veg\_res)

Canonical correlations

cc\_model$cor

## [1] 0.9999999 0.5533591 0.4215768 0.3705586 0.2367454 0.1914381

Test the significance of canonical correlations

rho <- cc\_model$cor  
n <- dim(ani\_res)[1]  
p <- dim(ani\_res)[2]  
q <- dim(veg\_res)[2]  
  
#Wilk's test  
p.asym(rho,n,p,q,tstat = "Wilks")

## Wilks' Lambda, using F-approximation (Rao's F):  
## stat approx df1 df2 p.value  
## 1 to 6: 1.112543e-07 325.429415 54 794.9421 0.000000e+00  
## 2 to 6: 4.475420e-01 3.457492 40 682.7827 2.371991e-11  
## 3 to 6: 6.450649e-01 2.620456 28 567.4938 1.553457e-05  
## 4 to 6: 7.844900e-01 2.227060 18 447.3768 2.787973e-03  
## 5 to 6: 9.093572e-01 1.547238 10 318.0000 1.216218e-01  
## 6 to 6: 9.633514e-01 1.521711 4 160.0000 1.983265e-01

Lawley-Hotelling test

p.asym(rho,n,p,q,tstat = "Hotelling")

## Hotelling-Lawley Trace, using F-approximation:  
## stat approx df1 df2 p.value  
## 1 to 6: 4.022692e+06 1.142246e+07 54 920 0.000000e+00  
## 2 to 6: 9.140807e-01 3.549680e+00 40 932 3.363754e-12  
## 3 to 6: 4.727301e-01 2.656293e+00 28 944 8.080889e-06  
## 4 to 6: 2.565890e-01 2.271288e+00 18 956 1.860239e-03  
## 5 to 6: 9.741909e-02 1.571695e+00 10 968 1.099439e-01  
## 6 to 6: 3.804278e-02 1.553413e+00 4 980 1.846772e-01

Pillai’s test

p.asym(rho,n,p,q,tstat = "Pillai")

## Pillai-Bartlett Trace, using F-approximation:  
## stat approx df1 df2 p.value  
## 1 to 6: 1.71394364 7.109125 54 960 0.000000e+00  
## 2 to 6: 0.71394389 3.282000 40 972 9.294088e-11  
## 3 to 6: 0.40773761 2.562302 28 984 1.769430e-05  
## 4 to 6: 0.23001063 2.205767 18 996 2.642202e-03  
## 5 to 6: 0.09269693 1.581746 10 1008 1.068099e-01  
## 6 to 6: 0.03664856 1.567136 4 1020 1.808639e-01

Roy’s largest root test

p.asym(rho,n,p,q,tstat = "Roy")

## Roy's Largest Root, using F-approximation:  
## stat approx df1 df2 p.value  
## 1 to 1: 0.9999998 71514512 9 160 0  
##   
## F statistic for Roy's Greatest Root is an upper bound.

Test the independence between two sets of variables

Wilks(cancor(ani\_res,veg\_res))

##   
## Test of H0: The canonical correlations in the   
## current row and all that follow are zero  
##   
## CanR LR test stat approx F numDF denDF Pr(> F)   
## 1 1.00000 0.00000 325.43 54 794.94 < 2.2e-16 \*\*\*  
## 2 0.55336 0.44754 3.46 40 682.78 2.372e-11 \*\*\*  
## 3 0.42158 0.64506 2.62 28 567.49 1.553e-05 \*\*\*  
## 4 0.37056 0.78449 2.23 18 447.38 0.002788 \*\*   
## 5 0.23675 0.90936 1.55 10 318.00 0.121622   
## 6 0.19144 0.96335 1.52 4 160.00 0.198327   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Significant canonical correlations

cc\_model$cor[1:4]

## [1] 0.9999999 0.5533591 0.4215768 0.3705586

Squared canoncal correlations

cc\_model$cor[1:4]^2

## [1] 0.9999998 0.3062063 0.1777270 0.1373137

Canonical coefficients of “ani\_res”/“X” set

cc\_model$xcoef

## [,1] [,2] [,3] [,4] [,5]  
## AnimalProducts 0.9976232826 -2.4319721 45.659204 32.900305 -21.998206  
## AnimalFats 0.0009558419 1.0097234 -18.906548 -14.072821 8.796062  
## Eggs 0.0003018777 0.6603871 -4.118515 -1.942727 1.173209  
## FishSeafood 0.0002717702 -0.7476856 -5.481495 -3.651426 2.629940  
## Meat 0.0013725996 1.2404833 -26.289839 -19.480356 12.654152  
## Milk 0.0009512173 0.8444683 -18.996125 -13.272894 10.113044  
## [,6]  
## AnimalProducts 46.395161  
## AnimalFats -18.200507  
## Eggs -3.775237  
## FishSeafood -5.178059  
## Meat -27.823843  
## Milk -19.386196

Canonical coefficeints of “veg\_res”/“Y” set

cc\_model$ycoef

## [,1] [,2] [,3] [,4] [,5]  
## Cereals 4.570047e-05 1.05494516 0.390373285 0.1506988 -3.41524936  
## Fruits -9.841973e-05 0.14345828 -0.008032296 0.3311021 -1.33116594  
## Oilcrops 7.767810e-05 0.97257212 -0.370950339 -0.7350961 -4.53988448  
## Pulses -9.430399e-05 0.45090825 0.132607195 -0.5366556 0.69313194  
## Spices -4.609398e-05 -0.16917091 -0.340577118 0.1816536 -0.55261436  
## Treenuts 4.275477e-05 0.09905329 -0.598279358 0.2204507 -0.78211597  
## VegetalProducts -1.000072e+00 -2.90147472 0.434466565 0.9746708 7.68910949  
## VegetableOils 1.251305e-04 2.75651525 -0.778604325 -0.7691170 -6.47587348  
## Vegetables 4.227223e-05 0.24592643 0.104341368 0.5575298 -0.01334811  
## [,6]  
## Cereals 0.59983462  
## Fruits -0.35715100  
## Oilcrops 0.16267779  
## Pulses 0.31490783  
## Spices -0.43740568  
## Treenuts 0.82422368  
## VegetalProducts -0.30511423  
## VegetableOils 0.05501768  
## Vegetables -0.36984505

Canonical loadings

loadings <- comput(ani\_res,veg\_res,cc\_model)

Correlation between “ani\_res” variables and the canonical variables for “ani\_res”

loadings$corr.X.xscores

## [,1] [,2] [,3] [,4]  
## AnimalProducts 0.99999999 -1.617076e-05 8.333953e-05 -4.354264e-05  
## AnimalFats 0.68682947 1.651676e-01 -2.841463e-01 -3.843286e-01  
## Eggs 0.44629255 1.925868e-01 -5.340615e-01 5.570080e-01  
## FishSeafood -0.02024282 -8.957598e-01 -3.253313e-01 1.952269e-01  
## Meat 0.73678527 -1.101341e-01 3.477803e-01 -1.016160e-01  
## Milk 0.60941697 2.047182e-01 -4.128288e-02 3.459455e-01  
## [,5] [,6]  
## AnimalProducts 5.743002e-05 2.647053e-05  
## AnimalFats -5.730575e-02 5.188964e-01  
## Eggs -4.055938e-01 -6.121575e-02  
## FishSeafood -2.292318e-01 2.651973e-02  
## Meat -3.335592e-01 -4.499770e-01  
## Milk 6.728883e-01 1.119829e-01

Correlations between “veg\_res” variables and the canonical variables for “veg\_res”

loadings$corr.Y.yscores

## [,1] [,2] [,3] [,4]  
## Cereals -0.45645161 -1.354637e-02 6.795183e-01 3.055238e-01  
## Fruits -0.10941149 -8.498520e-02 1.993843e-01 1.947085e-01  
## Oilcrops -0.42195573 -7.506256e-01 1.197709e-01 -2.952161e-01  
## Pulses -0.42107070 6.625405e-02 3.048556e-01 -6.173674e-02  
## Spices -0.17627460 -3.552740e-01 -2.290476e-01 2.819358e-01  
## Treenuts 0.13245861 -8.613161e-02 -6.489986e-01 4.438821e-01  
## VegetalProducts -0.99999998 3.514645e-05 -6.960627e-05 6.160517e-06  
## VegetableOils -0.67444851 5.984756e-01 -3.528274e-01 -8.004472e-02  
## Vegetables 0.04955136 1.035675e-01 -6.083604e-03 7.689409e-01  
## [,5] [,6]  
## Cereals -6.229153e-02 3.631788e-01  
## Fruits 6.489570e-02 -3.172500e-01  
## Oilcrops -9.824484e-02 -5.461504e-02  
## Pulses 5.354597e-01 5.342975e-02  
## Spices 2.227011e-01 -2.656214e-01  
## Treenuts 9.785763e-02 5.613001e-01  
## VegetalProducts -7.008511e-05 4.871979e-05  
## VegetableOils -4.003546e-02 -1.268832e-01  
## Vegetables 1.978142e-01 -2.408587e-01

Correlation between the “ani\_res” variables and the canonical variate for “veg\_res”

loadings$corr.X.yscores

## [,1] [,2] [,3] [,4]  
## AnimalProducts 0.99999987 -8.948234e-06 3.513401e-05 -0.0000161351  
## AnimalFats 0.68682939 9.139697e-02 -1.197895e-01 -0.1424162619  
## Eggs 0.44629250 1.065697e-01 -2.251479e-01 0.2064041314  
## FishSeafood -0.02024282 -4.956768e-01 -1.371521e-01 0.0723430262  
## Meat 0.73678518 -6.094371e-02 1.466161e-01 -0.0376546744  
## Milk 0.60941690 1.132827e-01 -1.740390e-02 0.1281930964  
## [,5] [,6]  
## AnimalProducts 1.359629e-05 5.067468e-06  
## AnimalFats -1.356687e-02 9.933656e-02  
## Eggs -9.602245e-02 -1.171903e-02  
## FishSeafood -5.426956e-02 5.076889e-03  
## Meat -7.896859e-02 -8.614276e-02  
## Milk 1.593032e-01 2.143780e-02

Correlation between the “veg\_res” variables and the canonical variate for “ani\_res”

loadings$corr.Y.xscores

## [,1] [,2] [,3] [,4]  
## Cereals -0.45645155 -7.496004e-03 2.864691e-01 1.132145e-01  
## Fruits -0.10941147 -4.702733e-02 8.405578e-02 7.215092e-02  
## Oilcrops -0.42195568 -4.153655e-01 5.049264e-02 -1.093949e-01  
## Pulses -0.42107065 3.666228e-02 1.285200e-01 -2.287708e-02  
## Spices -0.17627458 -1.965941e-01 -9.656115e-02 1.044737e-01  
## Treenuts 0.13245860 -4.766171e-02 -2.736027e-01 1.644843e-01  
## VegetalProducts -0.99999986 1.944861e-05 -2.934439e-05 2.282833e-06  
## VegetableOils -0.67444843 3.311719e-01 -1.487439e-01 -2.966126e-02  
## Vegetables 0.04955135 5.731004e-02 -2.564706e-03 2.849377e-01  
## [,5] [,6]  
## Cereals -1.474723e-02 6.952628e-02  
## Fruits 1.536376e-02 -6.073376e-02  
## Oilcrops -2.325901e-02 -1.045540e-02  
## Pulses 1.267676e-01 1.022849e-02  
## Spices 5.272345e-02 -5.085007e-02  
## Treenuts 2.316734e-02 1.074542e-01  
## VegetalProducts -1.659233e-05 9.326826e-06  
## VegetableOils -9.478210e-03 -2.429029e-02  
## Vegetables 4.683160e-02 -4.610953e-02