Sesión 9: Análisis de Factores

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Índice

1. Introducción

Se tienen datos con los tipos de cambio reales (respecto a USD) de varias economias (periodo 1970-2010). El objetivo es implementar el procedimiento inferencial de análisis de factores para estos datos utilizando uno y dos factores para comparar si el primer factor en ambos casos es similar o no.

2. Datos

```r
# Se cargan los paquetes
library("fields")
library("mnormt")
library("MCMCpack")
library("actuar")
library("ggplot2")
library("kernlab")
library("tidyverse")
library("readr")
library("psych")
library("mvtnorm")
library("MASS")
```

```r
library("xlsx")
library("knitr")
```

```r
# Función para extraer modas
getmode <- function(v) {
   uniqv <- unique(v)
   uniqv[which.max(tabulate(match(v, uniqv)))]
}
```

Leemos los datos correspondientes a los tipos de cambio de distintas economías. Se tienen 492 observaciones mensuales para 80 economías.

```r
# Cargamos los datos)
data<-read.xlsx("../01_Notas_Ovando/est46114_s06_data.xls",sheetName = 'RealXR_Data')

# Obtenemos las dimensiones de los datos
dim(data)
```

```
## [1] 492  81
```

```r
# Extraemos las fechas
fechas<-data$Date

data<-select(data,-Date)
```

Vemos que países están en la muestra:

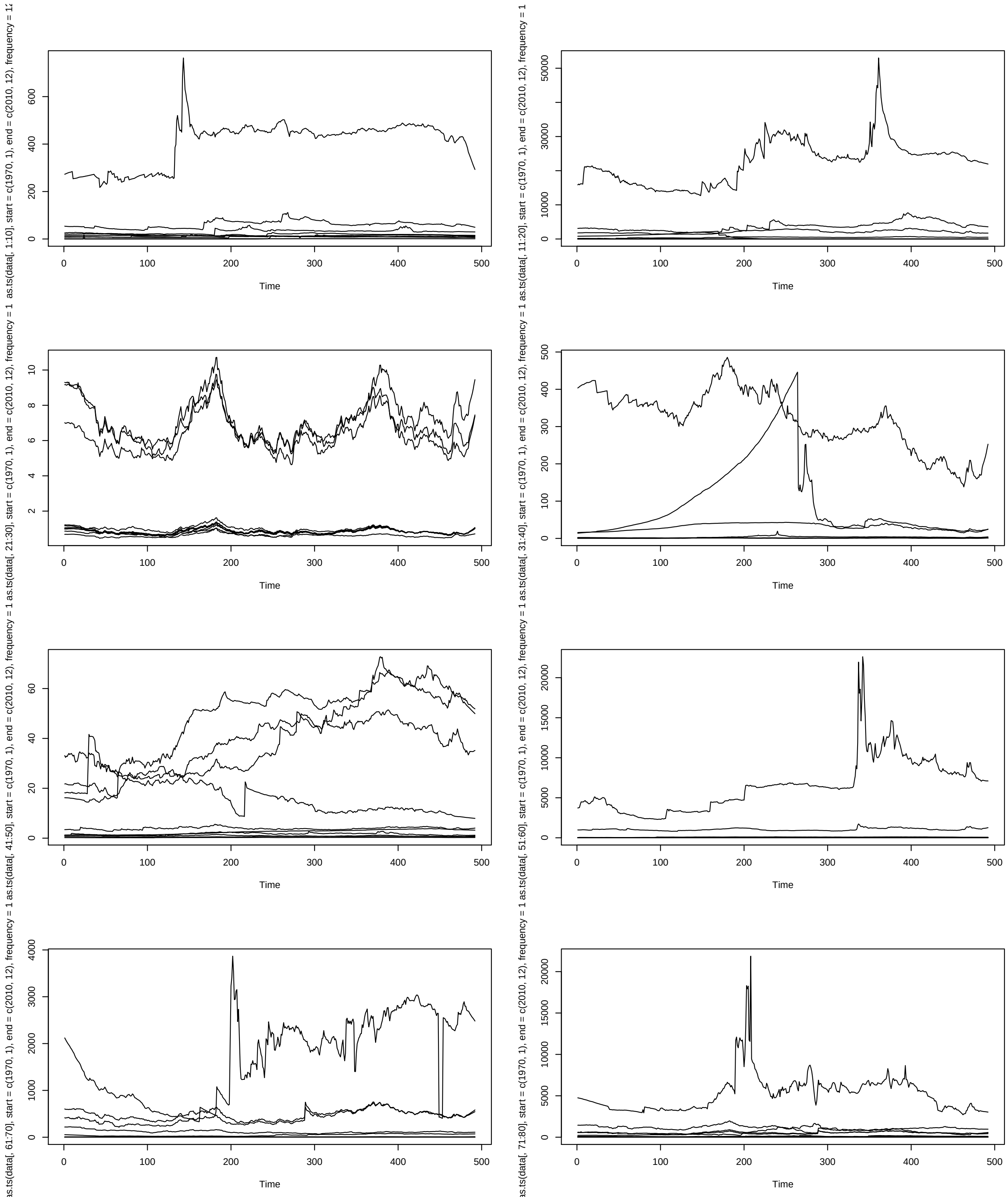
```r
# Vemos la lista de países
colnames(data)
```

```
##  [1] "Canada"        "Mexico"        "Guatemala"     "El.Salvador"
##  [5] "Honduras"      "Nicaragua"     "Costa.Rica"    "Panama"
##  [9] "Jamaica"       "Dominican.Rep" "Trin.Tobago"   "Colombia"
## [13] "Venezuela."    "Ecuador"       "Peru"          "Chile"
## [17] "Brazil."       "Paraguay"      "Uruguay"       "Argentina"
## [21] "EU12"          "Sweden"        "Norway"        "Finland"
## [25] "Denmark"       "U.K."          "Ireland"       "Luxembourg"
## [29] "Netherlands"   "France"        "Germany"       "Austria"
## [33] "Czech.Rep"     "Hungary"       "Switzerland"   "Poland"
## [37] "Russia"        "Spain"         "Portugal"      "Italy"
## [41] "Greece"        "Turkey"        "Syria"         "Israel"
## [45] "Jordan"        "Kuwait"        "Saudi.Arabia"  "India"
## [49] "Pakistan"      "Bangladesh"    "Sri.Lanka."    "Thailand"
## [53] "Malaysia"      "Singapore"     "Indonesia"     "Philippines"
## [57] "China.PR"      "Korea"         "Hong.Kong"     "Taiwan"
## [61] "Japan"         "Australia"     "New.Zealand"   "Morocco"
## [65] "Algeria"       "Tunisia"       "Egypt"         "Cameroon"
## [69] "Senegal"       "Sierra.Leone"  "Cote.d.Ivoire" "Ghana"
## [73] "Nigeria"       "Benin"         "Congo"         "Kenya"
## [77] "Tanzania"      "Mozambique"    "South.Africa"  "Zambia"
```

Graficamos las series de tiempo de los países para tener una idea de qué esté pasando.

```r
# SE parte el plot en 8 pedazos
par(mfrow=c(4,2))

# Se grafican series de tiempo de los tipos de cambio
plot.ts(as.ts(data[,1:10],start=c(1970,1),end=c(2010,12),frequency=12),plot.type='single')
```

```r
plot.ts(as.ts(data[,11:20],start=c(1970,1),end=c(2010,12),frequency=12),plot.type='single')
plot.ts(as.ts(data[,21:30],start=c(1970,1),end=c(2010,12),frequency=12),plot.type='single')
plot.ts(as.ts(data[,31:40],start=c(1970,1),end=c(2010,12),frequency=12),plot.type='single')
plot.ts(as.ts(data[,41:50],start=c(1970,1),end=c(2010,12),frequency=12),plot.type='single')
plot.ts(as.ts(data[,51:60],start=c(1970,1),end=c(2010,12),frequency=12),plot.type='single')
plot.ts(as.ts(data[,61:70],start=c(1970,1),end=c(2010,12),frequency=12),plot.type='single')
plot.ts(as.ts(data[,71:80],start=c(1970,1),end=c(2010,12),frequency=12),plot.type='single')
```



Como era de suponerse, parece haber economías que tienen la misma dinámica en sus tipos de cambios. Además hay economías que sobresalen del resto. Parecería buena idea reducir la dimensión de este conjunto de datos. Probablemente alguno de los factores latentes pueda estar relacionado con el nivel del tipo de cambio y otro con la tendencia.

3. Inferencia en Análisis de Factores

Pensemos que para cada observación mensual se tiene que

$$\boldsymbol{X}_j|f_j \sim N_p(\boldsymbol{X_j}|\lambda f_j, \boldsymbol{\Sigma}),$$

con $j = 1, \ldots, n = 492$ donde Λ es la matriz de cargas (desconocida), f_j son los factores latentes asociados a la observación j y Σ la matriz diagonal de varianzas (desconocida).

Además, los factores latentes satisfacen que

$$f_j \sim N(f_j|0, I_{k\times k})$$

Marginalmente, las observaciones x_j siguen una distribución normal de la forma

$$x_j|\lambda, \Sigma \sim N(x_i|0, \Omega) \qquad \forall\ j = 1, 2, \cdots, n$$

4. Ejercicio 1: Simulaciones mediante MCMC para 1 factor.

En esta sección se obtiene un análisis de factores para los datos del tipo de cambio utilizando un sólo factor.

4.1. Simulaciones para la posterior de los parámetros

se obtienen 10,000 iteraciones para encontrar la matriz de cargas (en este caso vector de cargas) y el valor de Σ (en este caso matriz diagonal de 80 valores). Notar que no existen restricciones en la matriz de cargas en este caso pues al tener un sólo factor no habrá problemas de identificabilidad.

```
# No de itreaciones
M.sim <- 10000

# periodo de calentamiento
M.burn <- 50

# Calcula la postrior para los datos de swiss
posterior.tc1 <- MCMCfactanal(data,
                              factors=1,
                              lambda.constraints=list(),
                              verbose=0, store.scores=TRUE,
                              a0=1, b0=0.15,
                              data=data,
                              burnin=M.burn, mcmc=M.sim, thin=20,seed=2348)
```

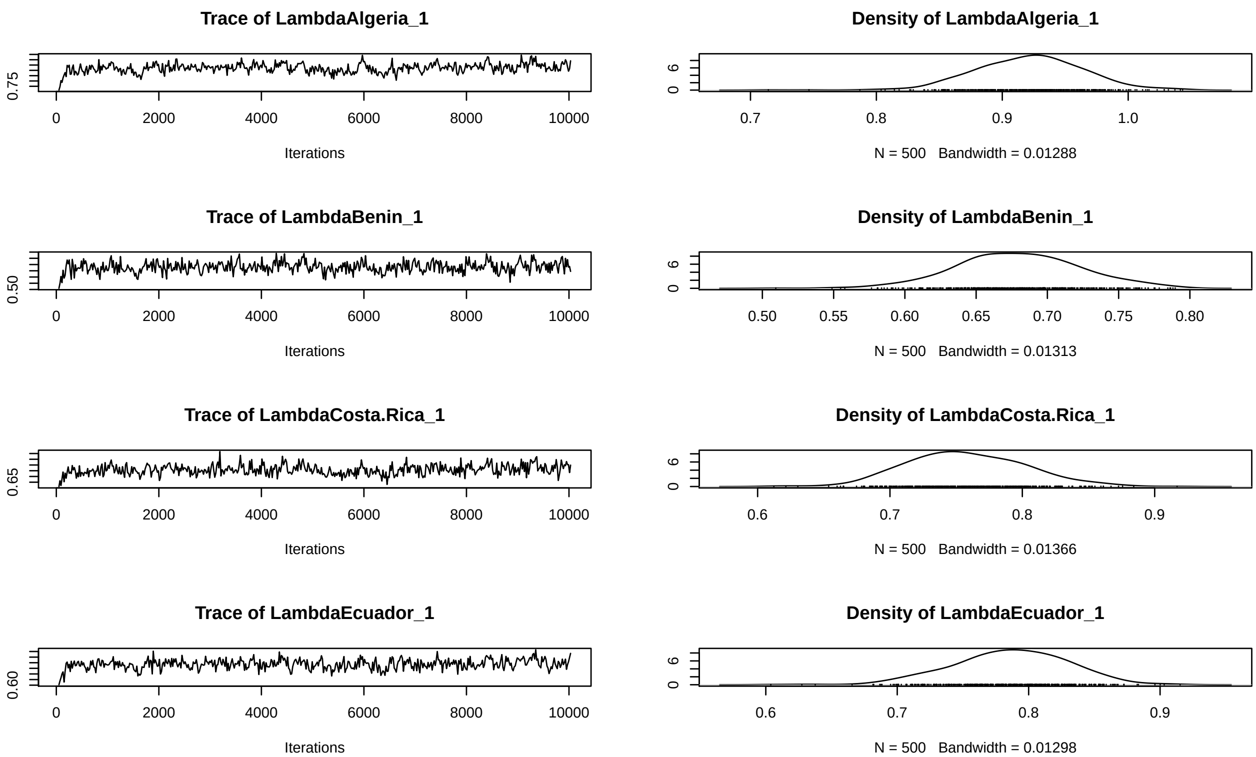
4.2. Resultados de las simulaciones

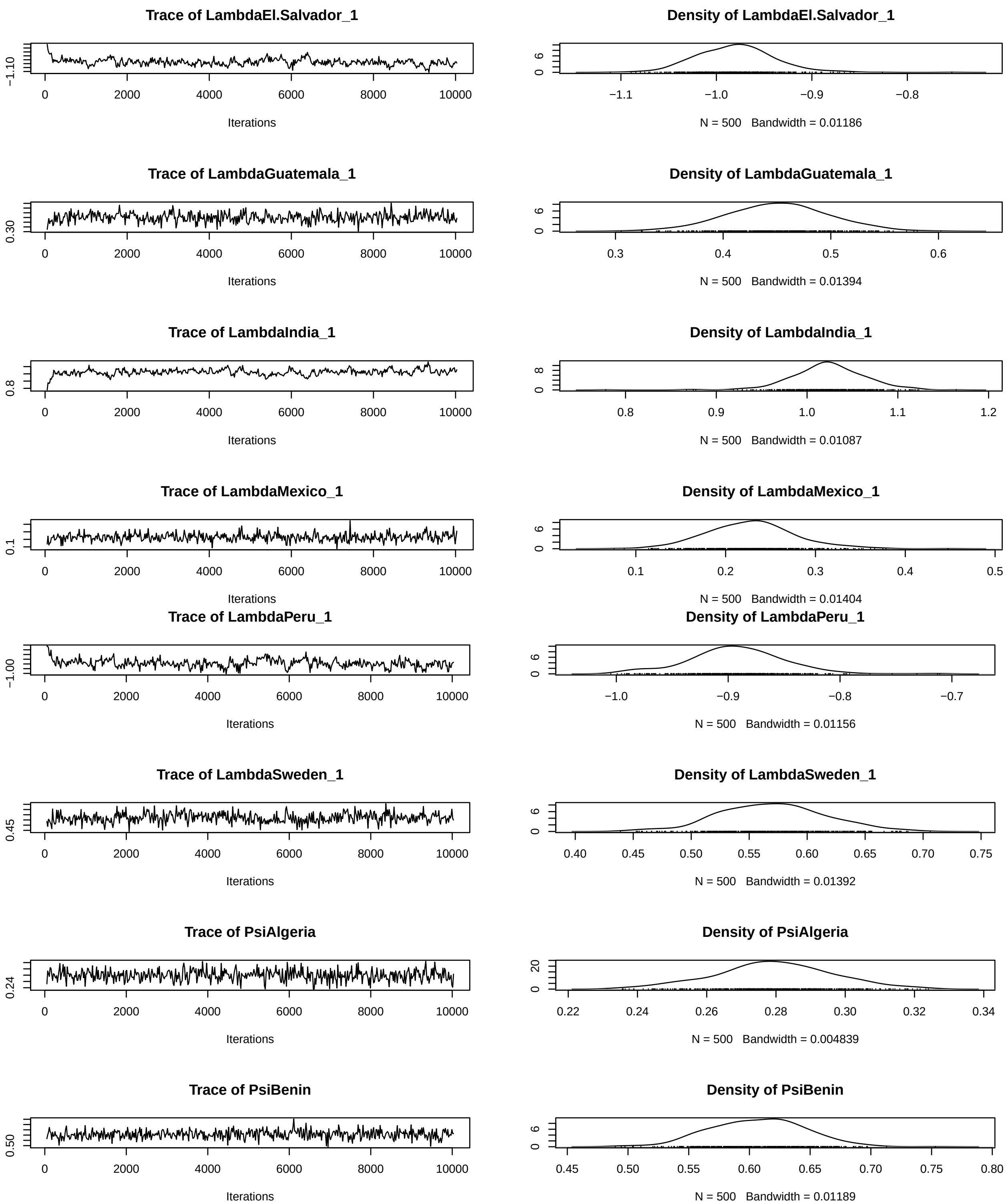
4.2.1. Histograma de los valores simulados para los parámetros

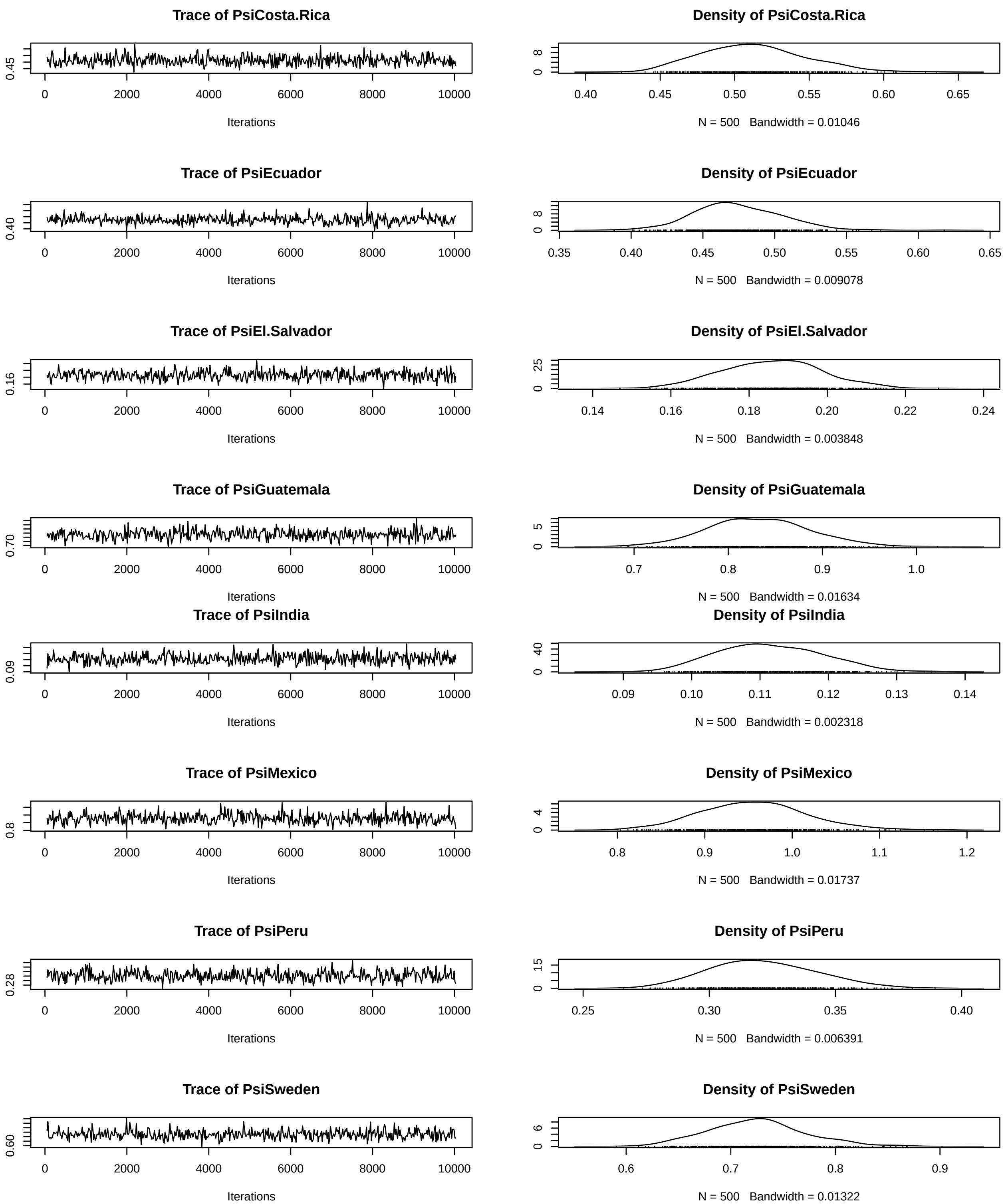
Veamos una muestra de los valores simulados para λ y Σ.

```
# Muestra de 10 países
set.seed(12)
aux<-sort(sample(colnames(data)[2:80],10))
```

```
# Indices para el vector de lambda y para el
# vector de sigma de los paises muestrados
ind1<-match(paste("Lambda",aux,"_1",sep=""),colnames(posterior.tc1))
ind2<-match(paste("Psi",aux,sep=""),colnames(posterior.tc1))

# Grafica de distribuciones
plot(posterior.tc1[,c(ind1,ind2)])
```




Trace of LambdaEl.Salvador_1
Iterations
Density of LambdaEl.Salvador_1
N = 500 Bandwidth = 0.01186
Trace of LambdaGuatemala_1
Iterations
Density of LambdaGuatemala_1
N = 500 Bandwidth = 0.01394
Trace of LambdaIndia_1
Iterations
Density of LambdaIndia_1
N = 500 Bandwidth = 0.01087
Trace of LambdaMexico_1
Iterations
Density of LambdaMexico_1
N = 500 Bandwidth = 0.01404
Trace of LambdaPeru_1
Iterations
Density of LambdaPeru_1
N = 500 Bandwidth = 0.01156
Trace of LambdaSweden_1
Iterations
Density of LambdaSweden_1
N = 500 Bandwidth = 0.01392
Trace of PsiAlgeria
Iterations
Density of PsiAlgeria
N = 500 Bandwidth = 0.004839
Trace of PsiBenin
Iterations
Density of PsiBenin
N = 500 Bandwidth = 0.01189



Se puede notar que todas las cadenas son estables, por lo tanto se puede pensar que llegaron a su estado estacionario. En cuanto a la distribuciones de las simulaciones, ésta no es homogénea a lo largo de los diferentes paises muestreados, algunas distribuciones paraecen ser simétricas y otras sesgadas ligeramente a la izquierda o a la derecha.

4.2.2. Resumen de los valores simulados para los parámetros

Veamos el resumen de las simulaciones de los parámetros.

```
resumen1<-summary(posterior.tc1)
```

Para Λ tenemos lo siguiente:

```
resumen.lambda<-cbind(resumen1$statistics[grep("Lambda",rownames(resumen1$statistics)),],
                      resumen1$quantiles[grep("Lambda",rownames(resumen1$quantiles)),])

kable(resumen.lambda,
      format.args=list(size="tiny",scalebox=0.8),
     type='latex',digits=3,
      caption='Resumen de las simulaciones para la matriz de cargas')
```

Tabla 1: Resumen de las simulaciones para la matriz de cargas

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
LambdaMexico_1	0.228	0.050	0.002	0.002	0.137	0.196	0.229	0.258	0.334
LambdaGuatemala_1	0.451	0.047	0.002	0.002	0.358	0.420	0.451	0.481	0.542
LambdaEl.Salvador_1	-0.980	0.041	0.002	0.005	-1.053	-1.008	-0.980	-0.957	-0.893
LambdaHonduras_1	0.664	0.046	0.002	0.003	0.570	0.634	0.664	0.695	0.754
LambdaNicaragua_1	0.986	0.042	0.002	0.005	0.901	0.961	0.988	1.011	1.064
LambdaCosta.Rica_1	0.758	0.045	0.002	0.003	0.681	0.727	0.755	0.788	0.851
LambdaPanama_1	1.063	0.042	0.002	0.006	0.983	1.040	1.063	1.086	1.147
LambdaJamaica_1	0.607	0.044	0.002	0.003	0.517	0.578	0.609	0.634	0.693
LambdaDominican.Rep_1	0.708	0.048	0.002	0.004	0.617	0.678	0.706	0.737	0.809
LambdaTrin.Tobago_1	-0.175	0.049	0.002	0.002	-0.275	-0.207	-0.172	-0.143	-0.076
LambdaColombia_1	0.739	0.044	0.002	0.003	0.651	0.713	0.739	0.769	0.821
LambdaVenezuela._1	0.417	0.050	0.002	0.003	0.323	0.382	0.419	0.452	0.509
LambdaEcuador_1	0.786	0.044	0.002	0.004	0.699	0.759	0.787	0.816	0.865
LambdaPeru_1	-0.893	0.043	0.002	0.004	-0.982	-0.919	-0.894	-0.868	-0.809
LambdaChile_1	0.865	0.044	0.002	0.004	0.775	0.838	0.866	0.892	0.948
LambdaBrazil._1	0.852	0.043	0.002	0.004	0.764	0.825	0.854	0.880	0.939
LambdaParaguay_1	0.897	0.043	0.002	0.004	0.810	0.871	0.900	0.926	0.980
LambdaUruguay_1	0.050	0.048	0.002	0.002	-0.033	0.018	0.048	0.082	0.149
LambdaArgentina_1	0.646	0.045	0.002	0.004	0.559	0.616	0.645	0.676	0.737
LambdaEU12_1	0.687	0.046	0.002	0.004	0.594	0.654	0.688	0.719	0.773
LambdaSweden_1	0.570	0.046	0.002	0.003	0.476	0.538	0.569	0.599	0.656
LambdaNorway_1	-0.066	0.053	0.002	0.002	-0.176	-0.098	-0.065	-0.033	0.048
LambdaFinland_1	0.158	0.047	0.002	0.002	0.066	0.124	0.158	0.191	0.247
LambdaDenmark_1	-0.297	0.050	0.002	0.003	-0.391	-0.331	-0.296	-0.263	-0.200
LambdaU.K._1	-0.567	0.048	0.002	0.003	-0.659	-0.600	-0.567	-0.535	-0.471
LambdaIreland_1	-0.382	0.051	0.002	0.003	-0.476	-0.421	-0.380	-0.348	-0.284
LambdaLuxembourg_1	0.058	0.049	0.002	0.002	-0.040	0.025	0.058	0.089	0.153
LambdaNetherlands_1	-0.062	0.049	0.002	0.002	-0.157	-0.096	-0.062	-0.025	0.027
LambdaFrance_1	0.071	0.049	0.002	0.002	-0.024	0.039	0.071	0.105	0.166
LambdaGermany_1	0.040	0.050	0.002	0.002	-0.061	0.007	0.038	0.072	0.139
LambdaAustria_1	-0.379	0.046	0.002	0.002	-0.464	-0.408	-0.379	-0.347	-0.296
LambdaCzech.Rep_1	0.166	0.048	0.002	0.003	0.079	0.131	0.167	0.198	0.257
LambdaHungary_1	-0.755	0.044	0.002	0.003	-0.840	-0.783	-0.751	-0.725	-0.675
LambdaSwitzerland_1	-0.495	0.048	0.002	0.003	-0.588	-0.530	-0.495	-0.463	-0.404
LambdaPoland_1	0.633	0.045	0.002	0.003	0.537	0.604	0.633	0.664	0.716
LambdaRussia_1	-0.030	0.049	0.002	0.002	-0.128	-0.060	-0.032	0.006	0.066

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
LambdaSpain_1	-0.413	0.048	0.002	0.003	-0.502	-0.446	-0.412	-0.380	-0.327
LambdaPortugal_1	-0.478	0.049	0.002	0.004	-0.575	-0.512	-0.476	-0.447	-0.381
LambdaItaly_1	-0.174	0.051	0.002	0.002	-0.276	-0.208	-0.176	-0.137	-0.073
LambdaGreece_1	-0.314	0.049	0.002	0.002	-0.423	-0.343	-0.311	-0.282	-0.224
LambdaTurkey_1	0.297	0.049	0.002	0.002	0.211	0.266	0.294	0.332	0.392
LambdaSyria_1	-0.981	0.043	0.002	0.005	-1.067	-1.011	-0.979	-0.953	-0.900
LambdaIsrael_1	0.255	0.050	0.002	0.003	0.147	0.224	0.256	0.288	0.350
LambdaJordan_1	0.909	0.043	0.002	0.004	0.824	0.883	0.909	0.937	0.990
LambdaKuwait_1	0.947	0.043	0.002	0.005	0.852	0.923	0.949	0.975	1.036
LambdaSaudi.Arabia_1	1.071	0.041	0.002	0.005	0.990	1.047	1.072	1.095	1.148
LambdaIndia_1	1.023	0.041	0.002	0.005	0.940	1.001	1.023	1.048	1.106
LambdaPakistan_1	1.040	0.041	0.002	0.005	0.959	1.017	1.041	1.065	1.116
LambdaBangladesh_1	0.960	0.044	0.002	0.005	0.874	0.935	0.960	0.988	1.044
LambdaSri.Lanka._1	0.697	0.045	0.002	0.003	0.610	0.666	0.700	0.724	0.788
LambdaThailand_1	0.880	0.044	0.002	0.004	0.795	0.851	0.878	0.911	0.967
LambdaMalaysia_1	1.000	0.041	0.002	0.005	0.915	0.977	1.002	1.026	1.077
LambdaSingapore_1	0.298	0.048	0.002	0.002	0.209	0.265	0.297	0.331	0.397
LambdaIndonesia_1	0.890	0.044	0.002	0.004	0.799	0.864	0.891	0.919	0.970
LambdaPhilippines_1	0.690	0.046	0.002	0.004	0.591	0.660	0.689	0.721	0.775
LambdaChina.PR_1	1.019	0.041	0.002	0.005	0.936	0.996	1.021	1.047	1.102
LambdaKorea_1	0.389	0.049	0.002	0.003	0.289	0.356	0.387	0.420	0.483
LambdaHong.Kong_1	0.439	0.047	0.002	0.003	0.350	0.406	0.437	0.470	0.538
LambdaTaiwan_1	-0.100	0.050	0.002	0.002	-0.194	-0.135	-0.099	-0.066	-0.003
LambdaJapan_1	-0.672	0.049	0.002	0.004	-0.767	-0.702	-0.673	-0.641	-0.569
LambdaAustralia_1	0.520	0.047	0.002	0.004	0.427	0.489	0.524	0.552	0.607
LambdaNew.Zealand_1	-0.014	0.047	0.002	0.002	-0.101	-0.049	-0.013	0.018	0.079
LambdaMorocco_1	0.787	0.044	0.002	0.004	0.704	0.760	0.787	0.816	0.872
LambdaAlgeria_1	0.921	0.043	0.002	0.004	0.843	0.892	0.923	0.949	1.004
LambdaTunisia_1	0.826	0.043	0.002	0.004	0.742	0.798	0.825	0.854	0.905
LambdaEgypt_1	0.668	0.046	0.002	0.003	0.578	0.637	0.669	0.699	0.755
LambdaCameroon_1	0.394	0.049	0.002	0.002	0.301	0.363	0.394	0.425	0.488
LambdaSenegal_1	0.816	0.047	0.002	0.004	0.725	0.785	0.817	0.848	0.908
LambdaSierra.Leone_1	0.872	0.043	0.002	0.004	0.786	0.846	0.874	0.900	0.962
LambdaCote.d.Ivoire_1	0.393	0.050	0.002	0.003	0.302	0.359	0.394	0.424	0.492
LambdaGhana_1	0.908	0.042	0.002	0.005	0.827	0.884	0.909	0.934	0.994
LambdaNigeria_1	0.753	0.044	0.002	0.003	0.665	0.725	0.753	0.784	0.840
LambdaBenin_1	0.679	0.044	0.002	0.003	0.591	0.651	0.680	0.709	0.765
LambdaCongo_1	-0.689	0.044	0.002	0.003	-0.784	-0.718	-0.687	-0.662	-0.602
LambdaKenya_1	0.126	0.050	0.002	0.002	0.032	0.092	0.128	0.162	0.217
LambdaTanzania_1	0.891	0.043	0.002	0.004	0.802	0.865	0.891	0.919	0.973
LambdaMozambique_1	1.023	0.042	0.002	0.005	0.938	0.998	1.025	1.047	1.106
LambdaSouth.Africa_1	0.806	0.044	0.002	0.004	0.718	0.777	0.810	0.835	0.884
LambdaZambia_1	0.337	0.048	0.002	0.002	0.246	0.307	0.336	0.369	0.431

Algunos países tienen carga positiva y otros tienen carga negativa. Intuitivamente podría pensarse que este signo está relacionado con el hecho de si la moneda se aprecia o deprecia en el tiempo respecto al dolar.

Veamos cuantos países tienen peso positivo y cuantos tienen peso negativo utilizando la mediana como estimador puntual.

Los países con peso positivo son:

```r
lambdas<-resumen1$quantiles[grep("Lambda",rownames(resumen1$quantiles)),3]

positivos<-substring(names(lambdas)[which(lambdas>0)],7)
positivos<-substring(positivos, 1, nchar(positivos)-2)

length(positivos)
```

```
## [1] 58
```

```r
positivos
```

```
##  [1] "Mexico"        "Guatemala"     "Honduras"      "Nicaragua"
##  [5] "Costa.Rica"    "Panama"        "Jamaica"       "Dominican.Rep"
##  [9] "Colombia"      "Venezuela."    "Ecuador"       "Chile"
## [13] "Brazil."       "Paraguay"      "Uruguay"       "Argentina"
## [17] "EU12"          "Sweden"        "Finland"       "Luxembourg"
## [21] "France"        "Germany"       "Czech.Rep"     "Poland"
## [25] "Turkey"        "Israel"        "Jordan"        "Kuwait"
## [29] "Saudi.Arabia"  "India"         "Pakistan"      "Bangladesh"
## [33] "Sri.Lanka."    "Thailand"      "Malaysia"      "Singapore"
## [37] "Indonesia"     "Philippines"   "China.PR"      "Korea"
## [41] "Hong.Kong"     "Australia"     "Morocco"       "Algeria"
## [45] "Tunisia"       "Egypt"         "Cameroon"      "Senegal"
## [49] "Sierra.Leone"  "Cote.d.Ivoire" "Ghana"         "Nigeria"
## [53] "Benin"         "Kenya"         "Tanzania"      "Mozambique"
## [57] "South.Africa"  "Zambia"
```

Tenemos 58 paises con carga positiva para los factores. No se puede generalizar que un sólo tipo de país tenga cargas positivas, es decir, tenemos tanto países desarrollados (EU, Suecia, Francia, etc) como países en vías de desarrollo (México, Panamá, India, etc), países de LA, Zona Euro, Asia, etc.

Los países con peso negativo son:

```r
negativos<-substring(names(lambdas)[which(lambdas<0)],7)
negativos<-substring(negativos, 1, nchar(negativos)-2)

length(negativos)
```

```
## [1] 21
```

```r
negativos
```

```
##  [1] "El.Salvador" "Trin.Tobago" "Peru"        "Norway"      "Denmark"
##  [6] "U.K."        "Ireland"     "Netherlands" "Austria"     "Hungary"
## [11] "Switzerland" "Russia"      "Spain"       "Portugal"    "Italy"
## [16] "Greece"      "Syria"       "Taiwan"      "Japan"       "New.Zealand"
## [21] "Congo"
```

Se tienen 21 paises con carga negativa. tampoco es posible generalizar que un sólo tipo de país tenga cargas negativas, pero si se puede destacar que son más los países con carga positiva que negativa.

Para Σ tenemos que

```r
resumen.sigma<-cbind(resumen1$statistics[grep("Psi",rownames(resumen1$statistics)),],
                     resumen1$quantiles[grep("Psi",rownames(resumen1$quantiles)),])

kable(resumen.sigma,
      format.args=list(size="tiny",scalebox=0.8),
```

```
    type='latex',digits=3,
     caption='Resumen de las simulaciones para la matriz de varianzas $\\Sigma$')
```

Tabla 2: Resumen de las simulaciones para la matriz de varianzas Σ

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
PsiMexico	0.956	0.061	0.003	0.003	0.839	0.916	0.954	0.992	1.081
PsiGuatemala	0.832	0.054	0.002	0.002	0.728	0.796	0.831	0.867	0.941
PsiEl.Salvador	0.186	0.013	0.001	0.001	0.162	0.177	0.187	0.194	0.211
PsiHonduras	0.628	0.042	0.002	0.002	0.547	0.600	0.628	0.654	0.707
PsiNicaragua	0.175	0.012	0.001	0.001	0.153	0.167	0.175	0.183	0.199
PsiCosta.Rica	0.513	0.034	0.002	0.002	0.455	0.488	0.511	0.534	0.584
PsiPanama	0.041	0.004	0.000	0.000	0.034	0.039	0.041	0.043	0.048
PsiJamaica	0.689	0.045	0.002	0.002	0.611	0.658	0.686	0.719	0.781
PsiDominican.Rep	0.572	0.038	0.002	0.001	0.505	0.545	0.571	0.598	0.648
PsiTrin.Tobago	0.977	0.064	0.003	0.003	0.856	0.933	0.972	1.018	1.103
PsiColombia	0.541	0.033	0.001	0.001	0.479	0.518	0.538	0.563	0.609
PsiVenezuela.	0.854	0.055	0.002	0.002	0.758	0.818	0.853	0.891	0.974
PsiEcuador	0.474	0.031	0.001	0.001	0.417	0.454	0.472	0.494	0.534
PsiPeru	0.321	0.021	0.001	0.001	0.284	0.307	0.320	0.335	0.365
PsiChile	0.364	0.025	0.001	0.001	0.316	0.347	0.365	0.379	0.417
PsiBrazil.	0.380	0.026	0.001	0.001	0.331	0.361	0.380	0.397	0.432
PsiParaguay	0.315	0.021	0.001	0.001	0.275	0.301	0.315	0.329	0.354
PsiUruguay	1.004	0.065	0.003	0.003	0.890	0.957	1.003	1.046	1.145
PsiArgentina	0.650	0.042	0.002	0.002	0.579	0.622	0.647	0.676	0.750
PsiEU12	0.602	0.040	0.002	0.002	0.529	0.574	0.601	0.626	0.676
PsiSweden	0.725	0.047	0.002	0.002	0.642	0.694	0.725	0.752	0.820
PsiNorway	0.998	0.063	0.003	0.003	0.882	0.951	0.997	1.038	1.126
PsiFinland	0.985	0.059	0.003	0.003	0.876	0.943	0.984	1.024	1.100
PsiDenmark	0.926	0.056	0.003	0.003	0.826	0.888	0.923	0.962	1.038
PsiU.K.	0.730	0.050	0.002	0.002	0.643	0.694	0.730	0.761	0.840
PsiIreland	0.885	0.057	0.003	0.002	0.780	0.846	0.881	0.919	1.011
PsiLuxembourg	0.998	0.061	0.003	0.003	0.891	0.954	0.997	1.040	1.126
PsiNetherlands	0.996	0.064	0.003	0.003	0.885	0.953	0.991	1.036	1.132
PsiFrance	0.999	0.066	0.003	0.003	0.874	0.957	0.996	1.044	1.129
PsiGermany	1.000	0.064	0.003	0.003	0.882	0.956	0.996	1.041	1.130
PsiAustria	0.879	0.055	0.002	0.002	0.782	0.836	0.878	0.917	0.985
PsiCzech.Rep	0.980	0.062	0.003	0.003	0.866	0.937	0.977	1.020	1.101
PsiHungary	0.521	0.036	0.002	0.002	0.458	0.496	0.518	0.546	0.600
PsiSwitzerland	0.795	0.053	0.002	0.002	0.695	0.758	0.794	0.830	0.903
PsiPoland	0.661	0.039	0.002	0.002	0.591	0.634	0.660	0.686	0.749
PsiRussia	1.001	0.067	0.003	0.003	0.875	0.957	0.998	1.040	1.137
PsiSpain	0.859	0.055	0.002	0.002	0.752	0.822	0.856	0.893	0.969
PsiPortugal	0.808	0.052	0.002	0.002	0.712	0.772	0.809	0.841	0.909
PsiItaly	0.976	0.062	0.003	0.002	0.861	0.932	0.973	1.016	1.109
PsiGreece	0.920	0.061	0.003	0.003	0.805	0.878	0.917	0.962	1.048
PsiTurkey	0.928	0.058	0.003	0.003	0.821	0.887	0.923	0.967	1.040
PsiSyria	0.179	0.012	0.001	0.000	0.157	0.171	0.178	0.187	0.205
PsiIsrael	0.951	0.061	0.003	0.003	0.831	0.910	0.951	0.990	1.074
PsiJordan	0.296	0.021	0.001	0.001	0.261	0.282	0.294	0.310	0.341
PsiKuwait	0.241	0.015	0.001	0.001	0.213	0.230	0.240	0.251	0.273
PsiSaudi.Arabia	0.026	0.003	0.000	0.000	0.022	0.025	0.026	0.028	0.032
PsiIndia	0.112	0.008	0.000	0.000	0.098	0.106	0.111	0.117	0.126

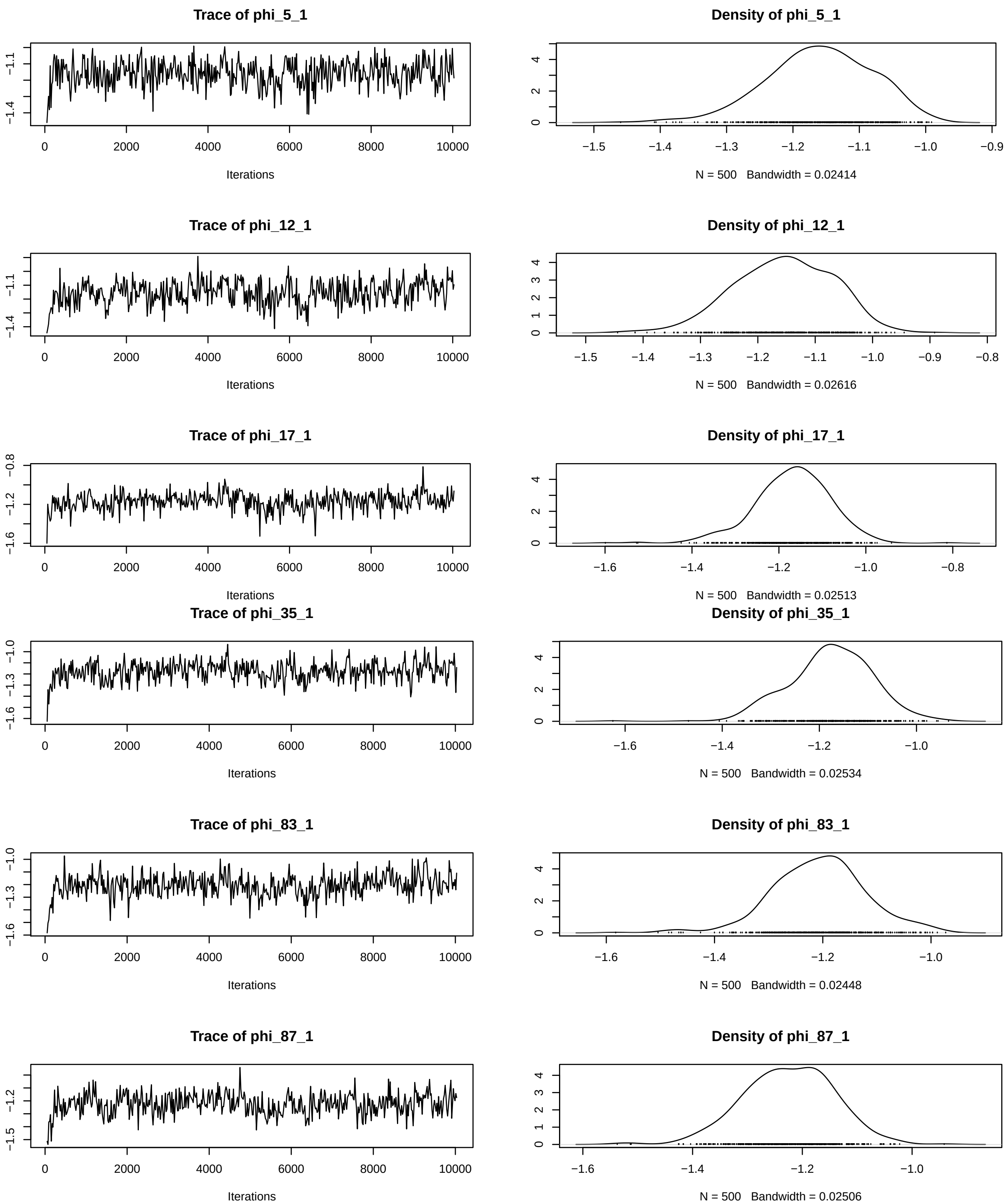
	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
PsiPakistan	0.080	0.006	0.000	0.000	0.070	0.076	0.080	0.084	0.092
PsiBangladesh	0.215	0.014	0.001	0.001	0.190	0.205	0.215	0.225	0.247
PsiSri.Lanka.	0.589	0.038	0.002	0.002	0.521	0.563	0.588	0.616	0.665
PsiThailand	0.345	0.022	0.001	0.001	0.304	0.329	0.345	0.360	0.391
PsiMalaysia	0.153	0.010	0.000	0.000	0.134	0.146	0.153	0.160	0.173
PsiSingapore	0.924	0.061	0.003	0.003	0.815	0.879	0.920	0.963	1.053
PsiIndonesia	0.329	0.022	0.001	0.001	0.290	0.314	0.329	0.344	0.370
PsiPhilippines	0.597	0.037	0.002	0.002	0.526	0.570	0.596	0.622	0.669
PsiChina.PR	0.119	0.009	0.000	0.000	0.103	0.113	0.119	0.124	0.137
PsiKorea	0.875	0.057	0.003	0.002	0.765	0.840	0.875	0.910	0.990
PsiHong.Kong	0.838	0.055	0.002	0.002	0.732	0.802	0.835	0.873	0.950
PsiTaiwan	0.997	0.062	0.003	0.003	0.890	0.952	0.997	1.037	1.132
PsiJapan	0.618	0.039	0.002	0.002	0.544	0.589	0.617	0.643	0.700
PsiAustralia	0.774	0.050	0.002	0.002	0.680	0.741	0.774	0.804	0.881
PsiNew.Zealand	1.001	0.062	0.003	0.002	0.884	0.958	1.000	1.041	1.124
PsiMorocco	0.474	0.032	0.001	0.001	0.419	0.450	0.471	0.494	0.545
PsiAlgeria	0.279	0.017	0.001	0.001	0.245	0.269	0.279	0.290	0.313
PsiTunisia	0.421	0.028	0.001	0.001	0.368	0.400	0.421	0.440	0.480
PsiEgypt	0.623	0.039	0.002	0.002	0.555	0.597	0.620	0.649	0.706
PsiCameroon	0.871	0.057	0.003	0.003	0.764	0.835	0.869	0.908	0.987
PsiSenegal	0.436	0.027	0.001	0.001	0.385	0.417	0.436	0.454	0.487
PsiSierra.Leone	0.355	0.023	0.001	0.001	0.311	0.340	0.353	0.370	0.400
PsiCote.d.Ivoire	0.869	0.055	0.002	0.002	0.771	0.833	0.867	0.905	0.973
PsiGhana	0.301	0.020	0.001	0.001	0.265	0.287	0.300	0.314	0.343
PsiNigeria	0.518	0.034	0.002	0.002	0.457	0.494	0.517	0.542	0.588
PsiBenin	0.607	0.039	0.002	0.002	0.535	0.580	0.607	0.633	0.679
PsiCongo	0.598	0.038	0.002	0.002	0.530	0.572	0.596	0.621	0.680
PsiKenya	0.987	0.062	0.003	0.003	0.881	0.945	0.983	1.028	1.109
PsiTanzania	0.326	0.021	0.001	0.001	0.287	0.312	0.327	0.341	0.365
PsiMozambique	0.111	0.008	0.000	0.000	0.097	0.105	0.111	0.116	0.127
PsiSouth.Africa	0.450	0.029	0.001	0.001	0.402	0.430	0.447	0.466	0.516
PsiZambia	0.908	0.060	0.003	0.003	0.796	0.864	0.907	0.945	1.031

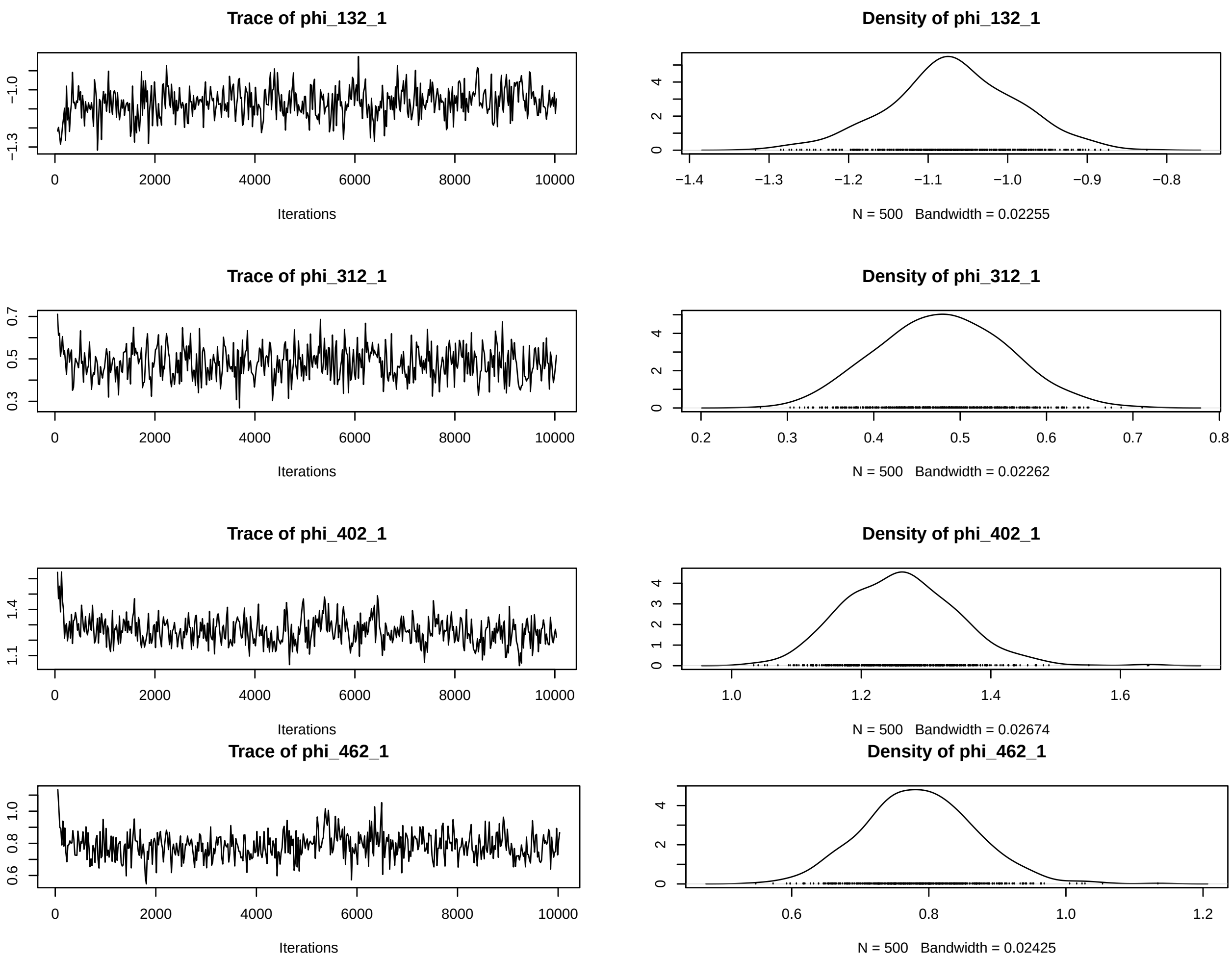
Todas las medias para las simulaciones de los valores de la matriz Σ son positivas (como se esperaba) y varían desde 0.01 hasta 1 aproximadamente.

4.3. Factor Latente

Por último, hagamos un análisis de los factores obtenidos. Veamos la distribución de los valores simulados para los factores para algunas observaciones.

```r
# Muestra de 10 observaciones
set.seed(12)
aux<-sort(sample(1:nrow(data),10))

# Indices para el vector de phi's a examinar
ind<-match(paste("phi_",aux,"_1",sep=""),colnames(posterior.tc1))

# Grafica de distribuciones
plot(posterior.tc1[,ind])
```


Trace of phi_5_1
Iterations
Density of phi_5_1
N = 500 Bandwidth = 0.02414
Trace of phi_12_1
Iterations
Density of phi_12_1
N = 500 Bandwidth = 0.02616
Trace of phi_17_1
Iterations
Density of phi_17_1
N = 500 Bandwidth = 0.02513
Trace of phi_35_1
Iterations
Density of phi_35_1
N = 500 Bandwidth = 0.02534
Trace of phi_83_1
Iterations
Density of phi_83_1
N = 500 Bandwidth = 0.02448
Trace of phi_87_1
Iterations
Density of phi_87_1
N = 500 Bandwidth = 0.02506



Todas las cadenas de las simulaciones de los factores parecen estar convirgiendo. Las distribuciones de los facotres en cada observaciones no son centradas y tienen al menos una cola pesada. Se obtienen valoes tanto positivos como negativos para el factor latente.

De hecho, este factor podría pensarse como un índice de los tipos de cambio respecto al dólar a lo largo del tiempo. Veamos los primeros valores simulados.

```r
resumen.factores<-cbind(resumen1$statistics[grep("phi",rownames(resumen1$statistics)),],
                        resumen1$quantiles[grep("phi",rownames(resumen1$quantiles)),])

kable(head(resumen.factores,10),
      format.args=list(size="tiny",scalebox=0.8),
     type='latex',digits=3,
      caption='Resumen de las simulaciones para el factor latente')
```

Tabla 3: Resumen de las simulaciones para el factor latente

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
phi_1_1	-1.189	0.078	0.003	0.006	-1.347	-1.238	-1.187	-1.139	-1.045
phi_2_1	-1.180	0.079	0.004	0.005	-1.328	-1.230	-1.177	-1.125	-1.033
phi_3_1	-1.169	0.083	0.004	0.006	-1.335	-1.218	-1.166	-1.116	-1.018
phi_4_1	-1.162	0.083	0.004	0.006	-1.346	-1.209	-1.158	-1.114	-1.004
phi_5_1	-1.160	0.079	0.004	0.005	-1.322	-1.208	-1.158	-1.103	-1.023
phi_6_1	-1.169	0.083	0.004	0.006	-1.336	-1.225	-1.165	-1.119	-1.001

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
phi_7_1	-1.167	0.085	0.004	0.006	-1.351	-1.219	-1.165	-1.111	-1.001
phi_8_1	-1.161	0.087	0.004	0.006	-1.327	-1.216	-1.158	-1.100	-0.992
phi_9_1	-1.152	0.084	0.004	0.007	-1.318	-1.202	-1.150	-1.100	-0.992
phi_10_1	-1.153	0.084	0.004	0.006	-1.308	-1.207	-1.151	-1.099	-0.991

```
aux<-data_frame(id=1:nrow(resumen.factores),
                median=resumen.factores[,7])

ggplot(aux,aes(x=id,y=median))+theme_bw()+
  geom_line(color='royalblue1')+geom_hline(yintercept=0,lty=2,col='red')
```


```
  ggtitle('Factor Latente para el Ejercicio 1')+
  theme(plot.title = element_text(hjust=0.5))
```

```
## NULL
```

El factor latente es negativo para los primeros 224 meses de la muestra y positivo después de este punto. La gráfica anterior muestra la serie de tiempo de la mediana del factor latente. Esto refleja que el dólar se apreció respecto al resto de las monedas desde el inicio de la muestra y hasta inicios del 2009 para posteriormente presentar una depreciación hacia el final de la muestra.

5. Ejercicio 2: Simulaciones mediante MCMC para 2 factores.

En esta sección se obtiene un análisis de factores para los datos del tipo de cambio utilizando dos factores.

5.1. Simulaciones para la posterior de los parámetros

Se obtienen 10,000 iteraciones para encontrar la matriz de cargas (en este caso vector de cargas) y el valor de Σ (en este caso matriz diagonal de 80 valores). Notar que sólo se debe imponer una restricción en la matriz de cargas pues ésta tiene 2 columnas.

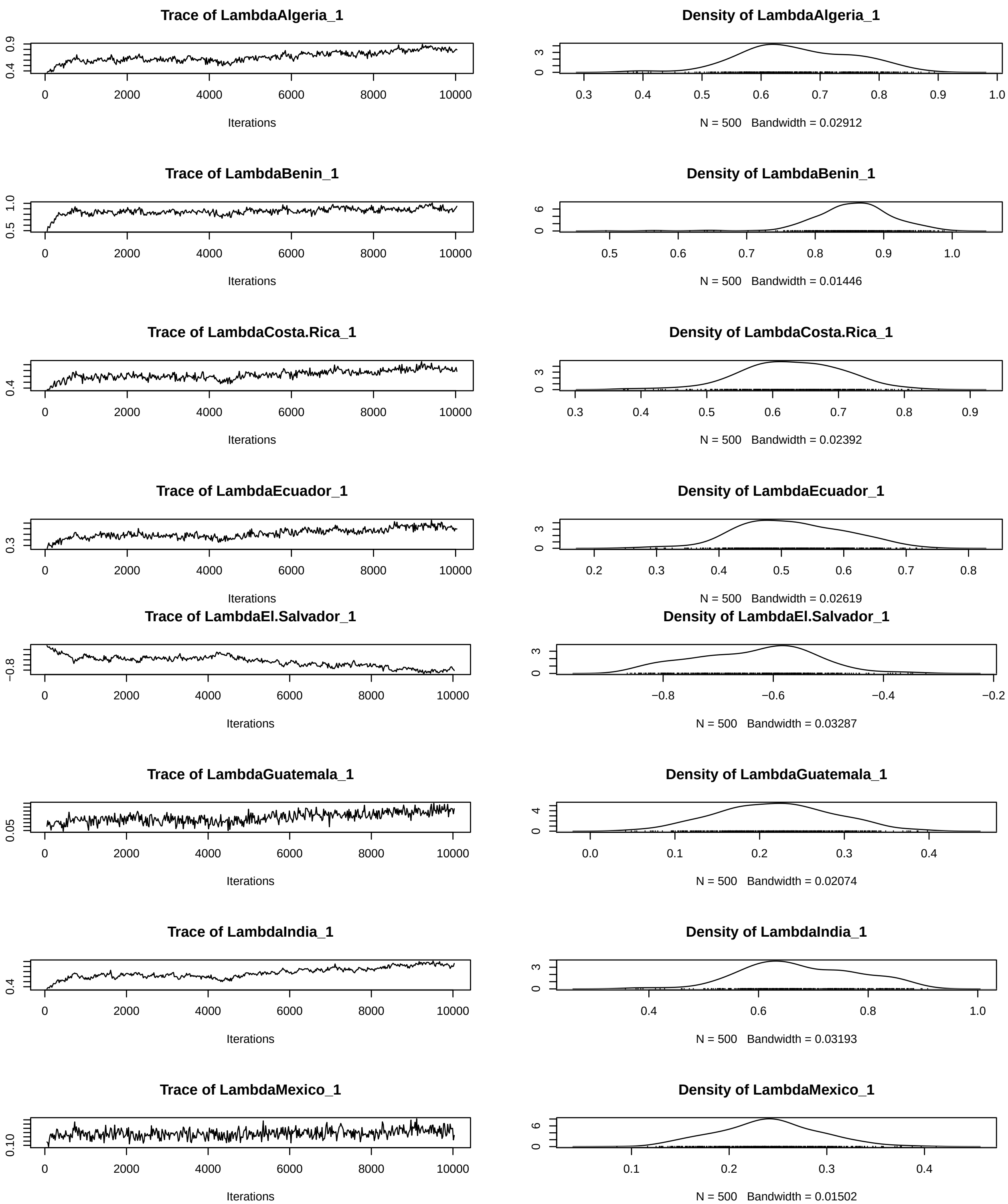
```
# No de itreaciones
M.sim <- 10000

# periodo de calentamiento
M.burn <- 50

# Calcula la postrior para los datos de swiss
posterior.tc2 <- MCMCfactanal(data,
                              factors=2,
                              lambda.constraints=list(Canada=c(2,0)),
                              verbose=0, store.scores=TRUE,
                              a0=1, b0=0.15,
                              data=data,
                              burnin=M.burn, mcmc=M.sim, thin=20,seed=2348)
```

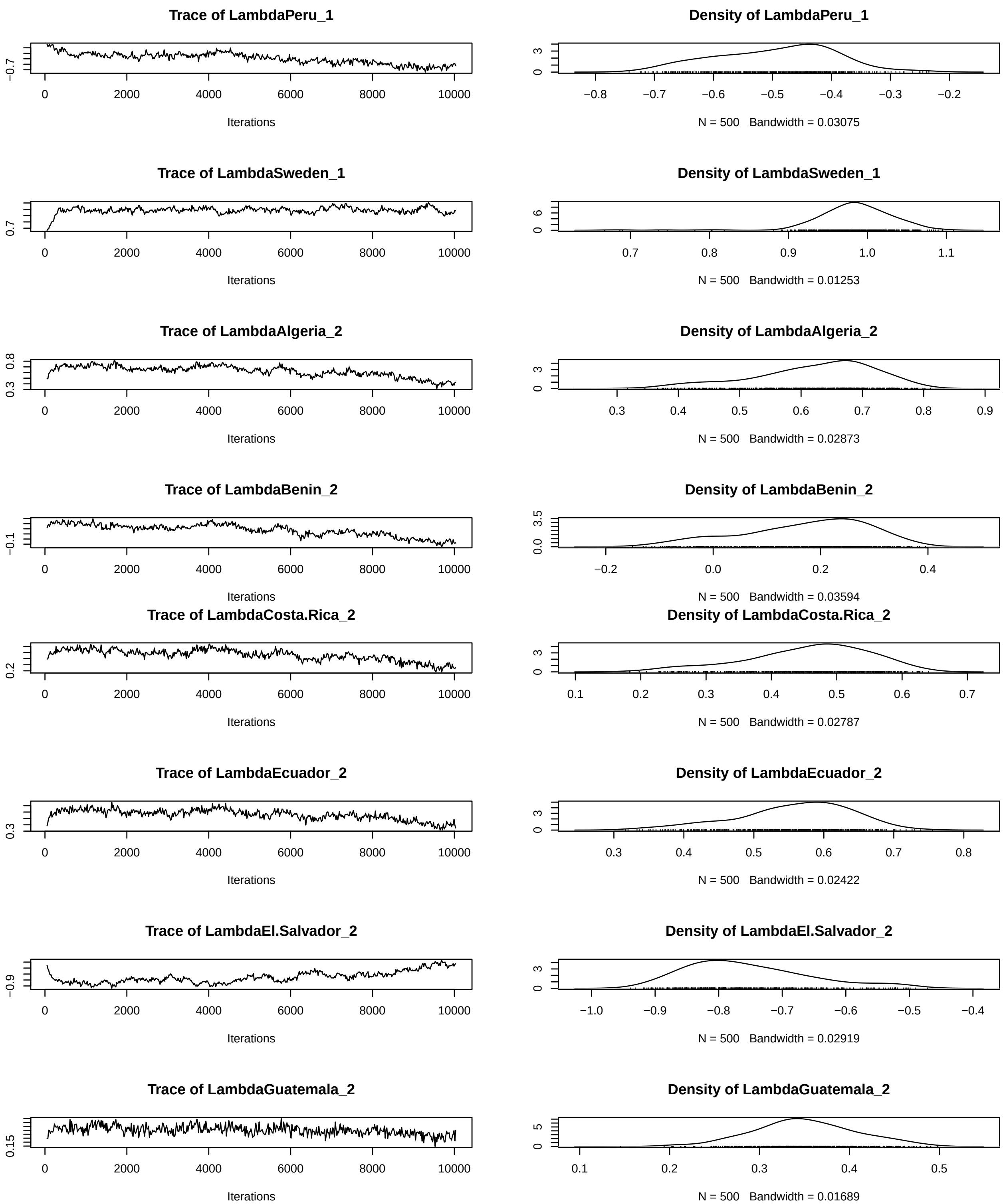
5.2. Resultados de las simulaciones

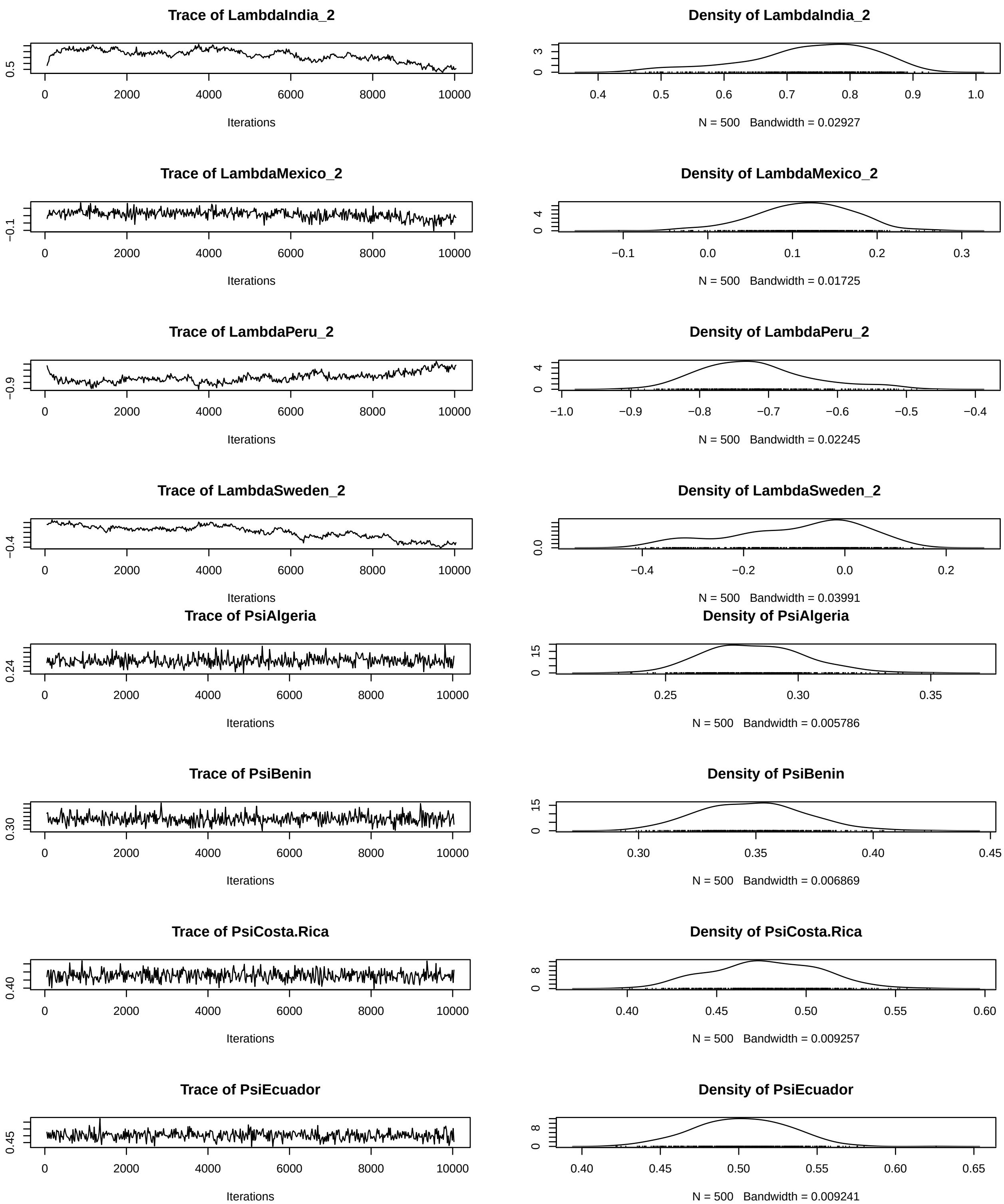
5.2.1. Histograma de los valores simulados para los parámetros

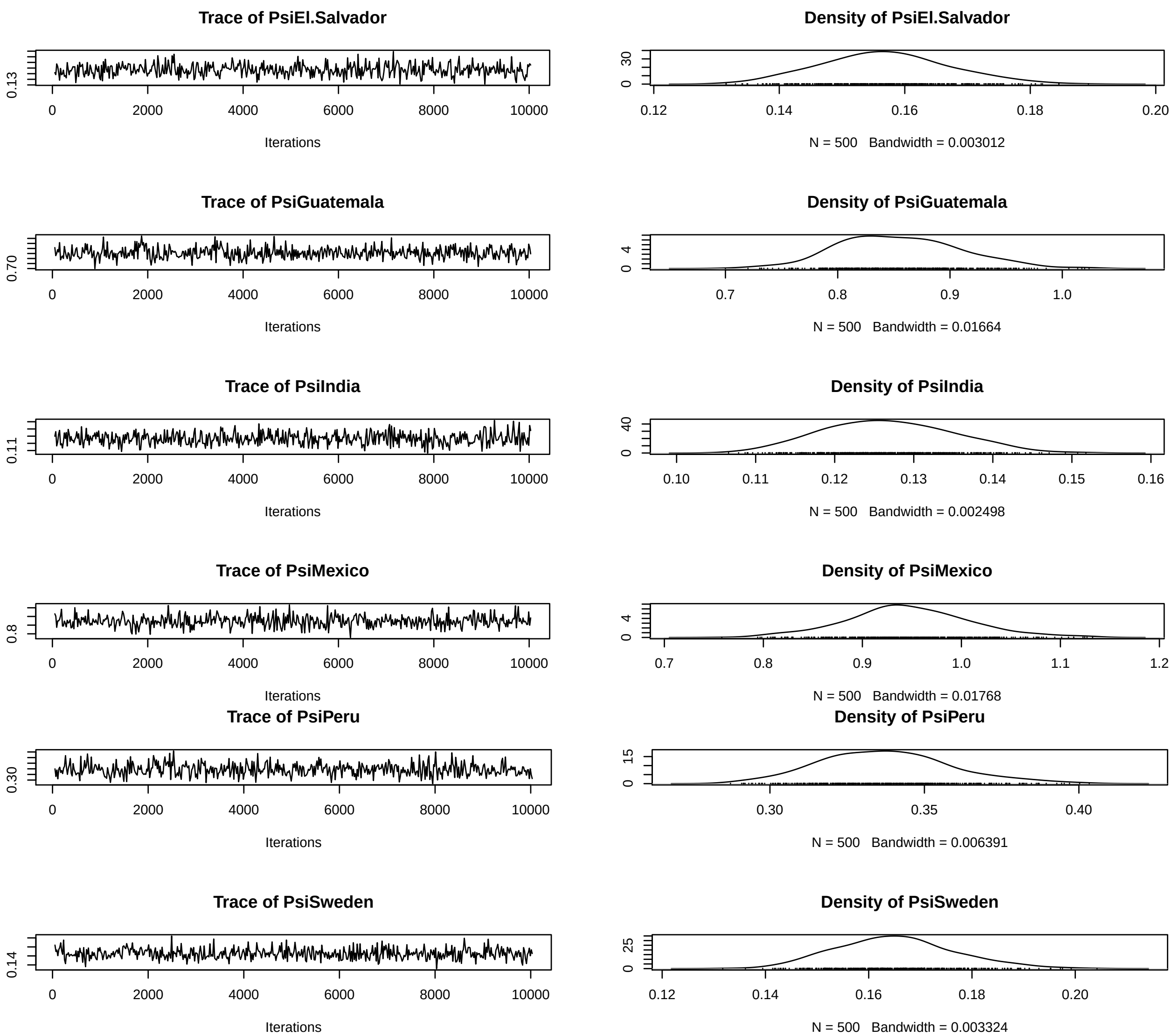
Veamos una muestra de los valores simulados para λ y Σ.

```
# Muestra de 10 países
set.seed(12)

aux<-sort(sample(colnames(data)[2:80],10))

# Indices para el vector de lambda y para el
# vector de sigma de los paises muestrados
ind1<-match(paste("Lambda",aux,"_1",sep=""),colnames(posterior.tc2))
ind2<-match(paste("Lambda",aux,"_2",sep=""),colnames(posterior.tc2))
ind3<-match(paste("Psi",aux,sep=""),colnames(posterior.tc2))

# Grafica de distribuciones
plot(posterior.tc2[,c(ind1,ind2,ind3)])
```


Trace of LambdaAlgeria_1
Iterations
Density of LambdaAlgeria_1
N = 500 Bandwidth = 0.02912
Trace of LambdaBenin_1
Iterations
Density of LambdaBenin_1
N = 500 Bandwidth = 0.01446
Trace of LambdaCosta.Rica_1
Iterations
Density of LambdaCosta.Rica_1
N = 500 Bandwidth = 0.02392
Trace of LambdaEcuador_1
Iterations
Density of LambdaEcuador_1
N = 500 Bandwidth = 0.02619
Trace of LambdaEl.Salvador_1
Iterations
Density of LambdaEl.Salvador_1
N = 500 Bandwidth = 0.03287
Trace of LambdaGuatemala_1
Iterations
Density of LambdaGuatemala_1
N = 500 Bandwidth = 0.02074
Trace of LambdaIndia_1
Iterations
Density of LambdaIndia_1
N = 500 Bandwidth = 0.03193
Trace of LambdaMexico_1
Iterations
Density of LambdaMexico_1
N = 500 Bandwidth = 0.01502


Trace of LambdaPeru_1
Iterations
Density of LambdaPeru_1
N = 500 Bandwidth = 0.03075
Trace of LambdaSweden_1
Iterations
Density of LambdaSweden_1
N = 500 Bandwidth = 0.01253
Trace of LambdaAlgeria_2
Iterations
Density of LambdaAlgeria_2
N = 500 Bandwidth = 0.02873
Trace of LambdaBenin_2
Iterations
Density of LambdaBenin_2
N = 500 Bandwidth = 0.03594
Trace of LambdaCosta.Rica_2
Iterations
Density of LambdaCosta.Rica_2
N = 500 Bandwidth = 0.02787
Trace of LambdaEcuador_2
Iterations
Density of LambdaEcuador_2
N = 500 Bandwidth = 0.02422
Trace of LambdaEl.Salvador_2
Iterations
Density of LambdaEl.Salvador_2
N = 500 Bandwidth = 0.02919
Trace of LambdaGuatemala_2
Iterations
Density of LambdaGuatemala_2
N = 500 Bandwidth = 0.01689


Trace of LambdaIndia_2
Density of LambdaIndia_2
Iterations
N = 500 Bandwidth = 0.02927
Trace of LambdaMexico_2
Density of LambdaMexico_2
Iterations
N = 500 Bandwidth = 0.01725
Trace of LambdaPeru_2
Density of LambdaPeru_2
Iterations
N = 500 Bandwidth = 0.02245
Trace of LambdaSweden_2
Density of LambdaSweden_2
Iterations
N = 500 Bandwidth = 0.03991
Trace of PsiAlgeria
Density of PsiAlgeria
Iterations
N = 500 Bandwidth = 0.005786
Trace of PsiBenin
Density of PsiBenin
Iterations
N = 500 Bandwidth = 0.006869
Trace of PsiCosta.Rica
Density of PsiCosta.Rica
Iterations
N = 500 Bandwidth = 0.009257
Trace of PsiEcuador
Density of PsiEcuador
Iterations
N = 500 Bandwidth = 0.009241



Se puede notar que no todas todas las cadenas son estables, algunas llegaron a su estado estacionario pero otras muestran tendencia. En cuanto a la distribuciones de las simulaciones, esta no es tan homogénea como en el caso anterior. De hecho las cadenas que muestran tendencia son las que presentan "chipotes" en las distribuciones. Podría ser útil aumentar el no. de simulaciones.

5.2.2. Resumen de los valores simulados para los parámetros

Veamos el resumen de las simulaciones de los parámetros.

```
resumen2<-summary(posterior.tc2)
```

Para Λ tenemos lo siguiente:

```
resumen.lambda.1<-cbind(resumen2$statistics[grep(regex("Lambda.+\\_1"),rownames(resumen2$statistics)),]
                        resumen2$quantiles[grep(regex("Lambda.+\\_1"),rownames(resumen2$quantiles)),])

kable(resumen.lambda.1,
      format.args=list(size="tiny",scalebox=0.8),
     type='latex',digits=3,
```

```
    caption='Resumen de las simulaciones para las cargas del primer factor')
```

Tabla 4: Resumen de las simulaciones para las cargas del primer factor

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
LambdaMexico_1	0.240	0.053	0.002	0.004	0.141	0.207	0.240	0.273	0.344
LambdaGuatemala_1	0.219	0.068	0.003	0.023	0.097	0.172	0.219	0.265	0.342
LambdaEl.Salvador_1	-0.636	0.107	0.005	0.042	-0.840	-0.718	-0.618	-0.560	-0.437
LambdaHonduras_1	0.224	0.087	0.004	0.036	0.073	0.161	0.214	0.285	0.400
LambdaNicaragua_1	0.551	0.110	0.005	0.050	0.352	0.473	0.530	0.634	0.763
LambdaCosta.Rica_1	0.629	0.078	0.003	0.023	0.469	0.578	0.627	0.683	0.774
LambdaPanama_1	0.613	0.117	0.005	0.053	0.411	0.527	0.593	0.701	0.829
LambdaJamaica_1	0.445	0.071	0.003	0.024	0.312	0.395	0.444	0.490	0.586
LambdaDominican.Rep_1	0.434	0.082	0.004	0.029	0.287	0.376	0.427	0.491	0.591
LambdaTrin.Tobago_1	-0.166	0.053	0.002	0.006	-0.265	-0.201	-0.161	-0.132	-0.065
LambdaColombia_1	0.510	0.082	0.004	0.030	0.357	0.453	0.504	0.566	0.671
LambdaVenezuela._1	0.131	0.069	0.003	0.027	0.009	0.080	0.131	0.176	0.270
LambdaEcuador_1	0.516	0.086	0.004	0.029	0.350	0.455	0.511	0.577	0.680
LambdaPeru_1	-0.495	0.101	0.004	0.044	-0.682	-0.572	-0.482	-0.422	-0.309
LambdaChile_1	0.612	0.091	0.004	0.039	0.445	0.546	0.608	0.676	0.786
LambdaBrazil._1	0.800	0.077	0.003	0.021	0.656	0.753	0.798	0.856	0.942
LambdaParaguay_1	0.621	0.094	0.004	0.034	0.437	0.560	0.610	0.689	0.796
LambdaUruguay_1	0.254	0.051	0.002	0.005	0.161	0.218	0.256	0.292	0.352
LambdaArgentina_1	0.474	0.077	0.003	0.025	0.341	0.418	0.468	0.529	0.633
LambdaEU12_1	1.022	0.056	0.002	0.010	0.918	0.998	1.025	1.052	1.114
LambdaSweden_1	0.984	0.052	0.002	0.008	0.901	0.959	0.985	1.014	1.064
LambdaNorway_1	0.724	0.086	0.004	0.033	0.541	0.663	0.745	0.787	0.854
LambdaFinland_1	0.781	0.065	0.003	0.015	0.631	0.747	0.790	0.826	0.885
LambdaDenmark_1	0.589	0.104	0.005	0.049	0.372	0.511	0.621	0.665	0.742
LambdaU.K._1	0.155	0.109	0.005	0.056	-0.069	0.074	0.180	0.240	0.319
LambdaIreland_1	0.450	0.104	0.005	0.050	0.233	0.374	0.475	0.531	0.601
LambdaLuxembourg_1	0.846	0.079	0.004	0.027	0.667	0.795	0.867	0.901	0.965
LambdaNetherlands_1	0.761	0.088	0.004	0.034	0.567	0.696	0.782	0.824	0.895
LambdaFrance_1	0.850	0.076	0.003	0.024	0.675	0.801	0.869	0.902	0.964
LambdaGermany_1	0.834	0.079	0.004	0.026	0.655	0.781	0.856	0.889	0.955
LambdaAustria_1	0.495	0.108	0.005	0.053	0.271	0.412	0.527	0.577	0.651
LambdaCzech.Rep_1	0.253	0.046	0.002	0.002	0.169	0.223	0.250	0.285	0.349
LambdaHungary_1	-0.095	0.115	0.005	0.061	-0.315	-0.184	-0.068	-0.001	0.082
LambdaSwitzerland_1	0.306	0.110	0.005	0.053	0.081	0.229	0.333	0.392	0.473
LambdaPoland_1	0.414	0.074	0.003	0.026	0.274	0.362	0.406	0.465	0.552
LambdaRussia_1	-0.028	0.051	0.002	0.002	-0.123	-0.064	-0.030	0.006	0.073
LambdaSpain_1	0.442	0.109	0.005	0.055	0.213	0.360	0.473	0.524	0.604
LambdaPortugal_1	0.375	0.110	0.005	0.058	0.139	0.291	0.407	0.459	0.534
LambdaItaly_1	0.588	0.088	0.004	0.036	0.396	0.524	0.605	0.653	0.723
LambdaGreece_1	0.482	0.099	0.004	0.046	0.278	0.413	0.507	0.556	0.628
LambdaTurkey_1	0.632	0.051	0.002	0.006	0.517	0.603	0.637	0.667	0.716
LambdaSyria_1	-0.539	0.113	0.005	0.053	-0.740	-0.629	-0.516	-0.456	-0.340
LambdaIsrael_1	0.559	0.050	0.002	0.004	0.468	0.528	0.554	0.592	0.659
LambdaJordan_1	0.669	0.093	0.004	0.039	0.491	0.606	0.658	0.732	0.841
LambdaKuwait_1	0.783	0.090	0.004	0.030	0.621	0.725	0.779	0.849	0.953
LambdaSaudi.Arabia_1	0.661	0.114	0.005	0.050	0.465	0.579	0.638	0.746	0.878
LambdaIndia_1	0.678	0.104	0.005	0.042	0.490	0.605	0.664	0.756	0.871

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
LambdaPakistan_1	0.708	0.105	0.005	0.043	0.521	0.635	0.695	0.788	0.904
LambdaBangladesh_1	0.655	0.102	0.005	0.043	0.463	0.585	0.641	0.732	0.842
LambdaSri.Lanka._1	0.497	0.077	0.003	0.025	0.342	0.444	0.494	0.554	0.641
LambdaThailand_1	0.826	0.078	0.004	0.022	0.676	0.778	0.823	0.880	0.971
LambdaMalaysia_1	0.747	0.098	0.004	0.036	0.579	0.682	0.736	0.817	0.922
LambdaSingapore_1	0.656	0.052	0.002	0.007	0.536	0.623	0.660	0.688	0.749
LambdaIndonesia_1	0.712	0.087	0.004	0.027	0.557	0.653	0.704	0.774	0.875
LambdaPhilippines_1	0.756	0.065	0.003	0.013	0.630	0.720	0.757	0.799	0.874
LambdaChina.PR_1	0.657	0.106	0.005	0.043	0.461	0.581	0.642	0.739	0.853
LambdaKorea_1	0.652	0.050	0.002	0.005	0.560	0.621	0.653	0.685	0.740
LambdaHong.Kong_1	0.515	0.057	0.003	0.009	0.401	0.482	0.515	0.552	0.620
LambdaTaiwan_1	0.300	0.061	0.003	0.017	0.175	0.258	0.307	0.344	0.406
LambdaJapan_1	-0.038	0.107	0.005	0.061	-0.244	-0.113	-0.017	0.043	0.131
LambdaAustralia_1	0.858	0.051	0.002	0.007	0.762	0.829	0.859	0.890	0.945
LambdaNew.Zealand_1	0.620	0.072	0.003	0.021	0.455	0.570	0.632	0.673	0.736
LambdaMorocco_1	0.981	0.064	0.003	0.014	0.855	0.952	0.984	1.017	1.096
LambdaAlgeria_1	0.662	0.095	0.004	0.048	0.490	0.599	0.653	0.739	0.838
LambdaTunisia_1	0.996	0.067	0.003	0.015	0.881	0.963	0.997	1.035	1.117
LambdaEgypt_1	0.328	0.088	0.004	0.035	0.181	0.263	0.318	0.389	0.501
LambdaCameroon_1	0.842	0.053	0.002	0.009	0.728	0.814	0.845	0.877	0.928
LambdaSenegal_1	0.900	0.070	0.003	0.017	0.771	0.863	0.901	0.947	1.031
LambdaSierra.Leone_1	0.524	0.096	0.004	0.043	0.347	0.457	0.509	0.593	0.710
LambdaCote.d.Ivoire_1	0.865	0.054	0.002	0.009	0.756	0.837	0.870	0.901	0.956
LambdaGhana_1	0.656	0.093	0.004	0.033	0.482	0.594	0.651	0.722	0.831
LambdaNigeria_1	0.486	0.084	0.004	0.034	0.327	0.424	0.478	0.548	0.647
LambdaBenin_1	0.855	0.061	0.003	0.011	0.744	0.826	0.858	0.890	0.961
LambdaCongo_1	0.011	0.113	0.005	0.063	-0.218	-0.072	0.044	0.098	0.179
LambdaKenya_1	0.398	0.051	0.002	0.006	0.294	0.364	0.398	0.429	0.493
LambdaTanzania_1	0.348	0.110	0.005	0.053	0.167	0.264	0.322	0.433	0.557
LambdaMozambique_1	0.593	0.112	0.005	0.047	0.396	0.510	0.570	0.676	0.800
LambdaSouth.Africa_1	0.820	0.073	0.003	0.019	0.672	0.775	0.820	0.865	0.958
LambdaZambia_1	0.401	0.053	0.002	0.005	0.292	0.369	0.403	0.435	0.511

```
resumen.lambda.2<-cbind(resumen2$statistics[grep(regex("Lambda.+\\_2"),rownames(resumen2$statistics)),],
                        resumen2$quantiles[grep(regex("Lambda.+\\_2"),rownames(resumen2$quantiles)),])

kable(resumen.lambda.2,
      format.args=list(size="tiny",scalebox=0.8,scalebox=0.8),
     type='latex',digits=3,
      caption='Resumen de las simulaciones para las cargas del segundo factor')
```

Tabla 5: Resumen de las simulaciones para las cargas del segundo factor

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
LambdaMexico_2	0.114	0.058	0.003	0.010	-0.018	0.078	0.117	0.153	0.214
LambdaGuatemala_2	0.350	0.058	0.003	0.010	0.240	0.314	0.348	0.388	0.461
LambdaEl.Salvador_2	-0.753	0.097	0.004	0.038	-0.901	-0.825	-0.769	-0.697	-0.522
LambdaHonduras_2	0.638	0.057	0.003	0.013	0.516	0.600	0.644	0.680	0.741
LambdaNicaragua_2	0.809	0.087	0.004	0.034	0.604	0.762	0.822	0.871	0.941
LambdaCosta.Rica_2	0.456	0.094	0.004	0.036	0.246	0.401	0.471	0.523	0.606

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
LambdaPanama__2	0.866	0.094	0.004	0.037	0.645	0.816	0.882	0.936	1.006
LambdaJamaica__2	0.388	0.075	0.003	0.025	0.228	0.345	0.391	0.443	0.522
LambdaDominican.Rep__2	0.528	0.074	0.003	0.025	0.371	0.479	0.531	0.586	0.655
LambdaTrin.Tobago__2	-0.144	0.056	0.003	0.008	-0.246	-0.182	-0.145	-0.109	-0.035
LambdaColombia__2	0.489	0.080	0.004	0.026	0.304	0.442	0.496	0.548	0.618
LambdaVenezuela.__2	0.408	0.053	0.002	0.006	0.305	0.374	0.407	0.445	0.511
LambdaEcuador__2	0.557	0.082	0.004	0.029	0.373	0.510	0.570	0.616	0.689
LambdaPeru__2	-0.719	0.081	0.004	0.030	-0.852	-0.776	-0.726	-0.678	-0.527
LambdaChile__2	0.610	0.094	0.004	0.034	0.406	0.558	0.628	0.677	0.755
LambdaBrazil.__2	0.419	0.112	0.005	0.053	0.169	0.353	0.439	0.508	0.574
LambdaParaguay__2	0.614	0.095	0.004	0.037	0.402	0.563	0.630	0.682	0.763
LambdaUruguay__2	-0.163	0.057	0.003	0.014	-0.278	-0.201	-0.163	-0.122	-0.052
LambdaArgentina__2	0.448	0.079	0.004	0.032	0.280	0.403	0.459	0.503	0.585
LambdaEU12__2	0.018	0.136	0.006	0.070	-0.259	-0.076	0.049	0.123	0.210
LambdaSweden__2	-0.096	0.130	0.006	0.068	-0.357	-0.180	-0.067	0.001	0.099
LambdaNorway__2	-0.727	0.100	0.004	0.035	-0.913	-0.795	-0.719	-0.664	-0.525
LambdaFinland__2	-0.484	0.106	0.005	0.040	-0.692	-0.560	-0.469	-0.408	-0.294
LambdaDenmark__2	-0.903	0.087	0.004	0.027	-1.064	-0.966	-0.902	-0.847	-0.710
LambdaU.K.__2	-0.889	0.055	0.002	0.010	-0.979	-0.921	-0.890	-0.864	-0.771
LambdaIreland__2	-0.886	0.074	0.003	0.021	-1.020	-0.934	-0.893	-0.843	-0.728
LambdaLuxembourg__2	-0.664	0.114	0.005	0.046	-0.878	-0.742	-0.643	-0.589	-0.444
LambdaNetherlands__2	-0.754	0.105	0.005	0.042	-0.947	-0.826	-0.741	-0.687	-0.542
LambdaFrance__2	-0.648	0.115	0.005	0.047	-0.864	-0.730	-0.626	-0.577	-0.431
LambdaGermany__2	-0.672	0.112	0.005	0.044	-0.881	-0.749	-0.652	-0.600	-0.457
LambdaAustria__2	-0.943	0.079	0.004	0.022	-1.090	-0.996	-0.946	-0.895	-0.766
LambdaCzech.Rep__2	0.001	0.060	0.003	0.012	-0.129	-0.040	0.004	0.044	0.111
LambdaHungary__2	-0.915	0.055	0.002	0.010	-1.004	-0.952	-0.920	-0.888	-0.792
LambdaSwitzerland__2	-0.934	0.063	0.003	0.015	-1.045	-0.970	-0.940	-0.902	-0.781
LambdaPoland__2	0.470	0.075	0.003	0.029	0.310	0.427	0.477	0.522	0.609
LambdaRussia__2	-0.020	0.048	0.002	0.002	-0.114	-0.052	-0.022	0.012	0.074
LambdaSpain__2	-0.942	0.075	0.003	0.021	-1.074	-0.991	-0.942	-0.898	-0.768
LambdaPortugal__2	-0.947	0.068	0.003	0.017	-1.066	-0.987	-0.954	-0.912	-0.790
LambdaItaly__2	-0.735	0.087	0.004	0.029	-0.890	-0.798	-0.731	-0.679	-0.557
LambdaGreece__2	-0.838	0.076	0.003	0.023	-0.979	-0.889	-0.842	-0.790	-0.666
LambdaTurkey__2	-0.177	0.091	0.004	0.037	-0.365	-0.237	-0.165	-0.108	-0.024
LambdaSyria__2	-0.834	0.086	0.004	0.032	-0.973	-0.896	-0.847	-0.788	-0.630
LambdaIsrael__2	-0.122	0.086	0.004	0.044	-0.300	-0.181	-0.113	-0.058	0.028
LambdaJordan__2	0.580	0.100	0.004	0.046	0.351	0.523	0.601	0.657	0.725
LambdaKuwait__2	0.559	0.112	0.005	0.053	0.304	0.500	0.578	0.647	0.715
LambdaSaudi.Arabia__2	0.834	0.099	0.004	0.039	0.604	0.782	0.852	0.909	0.978
LambdaIndia__2	0.736	0.100	0.004	0.044	0.496	0.683	0.751	0.812	0.882
LambdaPakistan__2	0.746	0.105	0.005	0.041	0.501	0.694	0.764	0.829	0.897
LambdaBangladesh__2	0.702	0.098	0.004	0.040	0.478	0.644	0.719	0.775	0.853
LambdaSri.Lanka.__2	0.494	0.080	0.004	0.028	0.312	0.443	0.508	0.548	0.632
LambdaThailand__2	0.422	0.114	0.005	0.052	0.168	0.353	0.444	0.512	0.585
LambdaMalaysia__2	0.659	0.106	0.005	0.049	0.419	0.598	0.679	0.742	0.810
LambdaSingapore__2	-0.190	0.095	0.004	0.039	-0.372	-0.256	-0.178	-0.122	-0.019
LambdaIndonesia__2	0.535	0.103	0.005	0.045	0.313	0.473	0.555	0.610	0.699
LambdaPhilippines__2	0.227	0.107	0.005	0.049	-0.006	0.164	0.247	0.303	0.388
LambdaChina.PR__2	0.754	0.099	0.004	0.041	0.530	0.702	0.769	0.829	0.904
LambdaKorea__2	-0.055	0.093	0.004	0.036	-0.259	-0.115	-0.042	0.013	0.094
LambdaHong.Kong__2	0.161	0.082	0.004	0.034	-0.018	0.112	0.174	0.220	0.293

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
LambdaTaiwan_2	-0.382	0.061	0.003	0.014	-0.504	-0.421	-0.379	-0.343	-0.257
LambdaJapan_2	-0.857	0.053	0.002	0.009	-0.955	-0.888	-0.859	-0.828	-0.758
LambdaAustralia_2	-0.084	0.117	0.005	0.058	-0.320	-0.166	-0.059	0.003	0.094
LambdaNew.Zealand_2	-0.571	0.089	0.004	0.033	-0.746	-0.626	-0.563	-0.512	-0.391
LambdaMorocco_2	0.176	0.132	0.006	0.068	-0.105	0.090	0.207	0.282	0.358
LambdaAlgeria_2	0.621	0.098	0.004	0.037	0.396	0.566	0.637	0.692	0.771
LambdaTunisia_2	0.222	0.134	0.006	0.064	-0.064	0.142	0.255	0.326	0.407
LambdaEgypt_2	0.581	0.067	0.003	0.021	0.438	0.538	0.587	0.628	0.703
LambdaCameroon_2	-0.228	0.114	0.005	0.048	-0.456	-0.302	-0.202	-0.141	-0.042
LambdaSenegal_2	0.284	0.122	0.005	0.056	0.011	0.208	0.311	0.381	0.450
LambdaSierra.Leone_2	0.665	0.086	0.004	0.031	0.477	0.614	0.675	0.728	0.807
LambdaCote.d.Ivoire_2	-0.259	0.118	0.005	0.052	-0.493	-0.339	-0.233	-0.172	-0.070
LambdaGhana_2	0.598	0.098	0.004	0.045	0.380	0.541	0.611	0.673	0.745
LambdaNigeria_2	0.538	0.081	0.004	0.029	0.353	0.486	0.545	0.597	0.676
LambdaBenin_2	0.170	0.117	0.005	0.055	-0.077	0.096	0.190	0.260	0.348
LambdaCongo_2	-0.922	0.054	0.002	0.010	-1.009	-0.959	-0.924	-0.893	-0.820
LambdaKenya_2	-0.225	0.068	0.003	0.022	-0.361	-0.272	-0.223	-0.173	-0.107
LambdaTanzania_2	0.843	0.068	0.003	0.020	0.681	0.809	0.851	0.889	0.958
LambdaMozambique_2	0.809	0.092	0.004	0.035	0.595	0.760	0.824	0.877	0.942
LambdaSouth.Africa_2	0.344	0.112	0.005	0.052	0.096	0.278	0.364	0.434	0.499
LambdaZambia_2	0.075	0.067	0.003	0.022	-0.077	0.032	0.080	0.123	0.192

Nuevamente se tienen valores positivos y negativos en la matriz de cargas para ambos factores.

Para Σ tenemos que

```
resumen.sigma<-cbind(resumen2$statistics[grep("Psi",rownames(resumen2$statistics)),],
                     resumen2$quantiles[grep("Psi",rownames(resumen2$quantiles)),])

kable(resumen.sigma,
      format.args=list(size="tiny",scalebox=0.8),
     type='latex',digits=3,
      caption='Resumen de las simulaciones para la matriz de varianzas $\\Sigma$')
```

Tabla 6: Resumen de las simulaciones para la matriz de varianzas Σ

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
PsiMexico	0.946	0.063	0.003	0.003	0.822	0.906	0.943	0.984	1.078
PsiGuatemala	0.855	0.054	0.002	0.003	0.757	0.817	0.853	0.891	0.966
PsiEl.Salvador	0.157	0.010	0.000	0.000	0.138	0.150	0.157	0.163	0.178
PsiHonduras	0.602	0.041	0.002	0.002	0.532	0.574	0.598	0.627	0.695
PsiNicaragua	0.169	0.011	0.000	0.000	0.148	0.162	0.169	0.177	0.192
PsiCosta.Rica	0.477	0.030	0.001	0.001	0.422	0.458	0.477	0.501	0.534
PsiPanama	0.020	0.002	0.000	0.000	0.017	0.018	0.019	0.020	0.023
PsiJamaica	0.699	0.043	0.002	0.002	0.613	0.667	0.700	0.728	0.777
PsiDominican.Rep	0.591	0.039	0.002	0.002	0.518	0.566	0.589	0.615	0.672
PsiTrin.Tobago	0.960	0.061	0.003	0.003	0.853	0.916	0.956	1.000	1.095
PsiColombia	0.571	0.035	0.002	0.002	0.503	0.546	0.570	0.593	0.640
PsiVenezuela.	0.843	0.050	0.002	0.002	0.742	0.808	0.846	0.875	0.937
PsiEcuador	0.502	0.030	0.001	0.001	0.442	0.481	0.502	0.523	0.555
PsiPeru	0.337	0.021	0.001	0.001	0.298	0.323	0.337	0.351	0.383
PsiChile	0.353	0.023	0.001	0.001	0.310	0.338	0.353	0.367	0.401

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
PsiBrazil.	0.293	0.019	0.001	0.001	0.259	0.279	0.292	0.305	0.337
PsiParaguay	0.336	0.023	0.001	0.001	0.294	0.320	0.336	0.350	0.380
PsiUruguay	0.922	0.056	0.003	0.003	0.817	0.884	0.921	0.957	1.034
PsiArgentina	0.632	0.039	0.002	0.002	0.560	0.606	0.631	0.656	0.720
PsiEU12	0.104	0.007	0.000	0.000	0.092	0.100	0.105	0.109	0.118
PsiSweden	0.165	0.011	0.001	0.000	0.144	0.157	0.165	0.172	0.189
PsiNorway	0.107	0.007	0.000	0.000	0.094	0.102	0.107	0.112	0.121
PsiFinland	0.284	0.018	0.001	0.001	0.250	0.272	0.283	0.295	0.321
PsiDenmark	0.009	0.001	0.000	0.000	0.008	0.009	0.009	0.010	0.011
PsiU.K.	0.298	0.019	0.001	0.001	0.266	0.285	0.296	0.310	0.334
PsiIreland	0.158	0.011	0.000	0.000	0.138	0.150	0.157	0.165	0.182
PsiLuxembourg	0.018	0.001	0.000	0.000	0.015	0.017	0.018	0.018	0.020
PsiNetherlands	0.025	0.002	0.000	0.000	0.022	0.024	0.025	0.026	0.029
PsiFrance	0.030	0.002	0.000	0.000	0.026	0.028	0.029	0.031	0.034
PsiGermany	0.025	0.002	0.000	0.000	0.022	0.024	0.025	0.026	0.029
PsiAustria	0.032	0.003	0.000	0.000	0.028	0.031	0.032	0.034	0.038
PsiCzech.Rep	0.949	0.060	0.003	0.003	0.836	0.910	0.947	0.988	1.075
PsiHungary	0.270	0.018	0.001	0.001	0.237	0.258	0.270	0.281	0.306
PsiSwitzerland	0.177	0.011	0.001	0.001	0.155	0.169	0.176	0.184	0.200
PsiPoland	0.663	0.043	0.002	0.002	0.582	0.635	0.663	0.690	0.756
PsiRussia	1.001	0.063	0.003	0.003	0.893	0.956	1.000	1.043	1.124
PsiSpain	0.078	0.005	0.000	0.000	0.069	0.075	0.078	0.081	0.089
PsiPortugal	0.109	0.007	0.000	0.000	0.096	0.105	0.109	0.114	0.124
PsiItaly	0.248	0.015	0.001	0.001	0.222	0.238	0.248	0.258	0.280
PsiGreece	0.203	0.013	0.001	0.001	0.178	0.194	0.203	0.212	0.228
PsiTurkey	0.633	0.042	0.002	0.002	0.556	0.605	0.631	0.663	0.720
PsiSyria	0.141	0.009	0.000	0.000	0.125	0.135	0.140	0.147	0.162
PsiIsrael	0.724	0.044	0.002	0.002	0.647	0.693	0.722	0.753	0.813
PsiJordan	0.321	0.021	0.001	0.001	0.284	0.306	0.319	0.335	0.360
PsiKuwait	0.197	0.014	0.001	0.001	0.173	0.187	0.197	0.207	0.225
PsiSaudi.Arabia	0.014	0.001	0.000	0.000	0.012	0.013	0.014	0.015	0.017
PsiIndia	0.127	0.008	0.000	0.000	0.112	0.121	0.126	0.132	0.143
PsiPakistan	0.080	0.005	0.000	0.000	0.070	0.076	0.080	0.083	0.090
PsiBangladesh	0.193	0.012	0.001	0.001	0.170	0.184	0.192	0.201	0.217
PsiSri.Lanka.	0.575	0.038	0.002	0.002	0.507	0.550	0.575	0.598	0.655
PsiThailand	0.255	0.017	0.001	0.001	0.225	0.243	0.254	0.267	0.290
PsiMalaysia	0.140	0.009	0.000	0.000	0.124	0.134	0.139	0.146	0.158
PsiSingapore	0.608	0.037	0.002	0.001	0.539	0.582	0.609	0.633	0.682
PsiIndonesia	0.312	0.020	0.001	0.001	0.275	0.298	0.311	0.323	0.350
PsiPhilippines	0.466	0.031	0.001	0.001	0.410	0.444	0.465	0.486	0.531
PsiChina.PR	0.131	0.009	0.000	0.000	0.116	0.125	0.131	0.138	0.148
PsiKorea	0.638	0.041	0.002	0.002	0.567	0.609	0.637	0.662	0.726
PsiHong.Kong	0.751	0.048	0.002	0.002	0.667	0.717	0.749	0.783	0.849
PsiTaiwan	0.796	0.050	0.002	0.002	0.697	0.763	0.795	0.829	0.895
PsiJapan	0.365	0.022	0.001	0.001	0.323	0.349	0.364	0.382	0.411
PsiAustralia	0.370	0.023	0.001	0.001	0.326	0.355	0.369	0.384	0.417
PsiNew.Zealand	0.396	0.026	0.001	0.001	0.351	0.378	0.394	0.412	0.451
PsiMorocco	0.142	0.010	0.000	0.000	0.124	0.135	0.142	0.148	0.165
PsiAlgeria	0.284	0.019	0.001	0.001	0.252	0.271	0.283	0.296	0.322
PsiTunisia	0.103	0.007	0.000	0.000	0.092	0.099	0.103	0.107	0.117
PsiEgypt	0.618	0.039	0.002	0.002	0.546	0.590	0.619	0.645	0.697
PsiCameroon	0.352	0.024	0.001	0.001	0.310	0.336	0.352	0.367	0.398

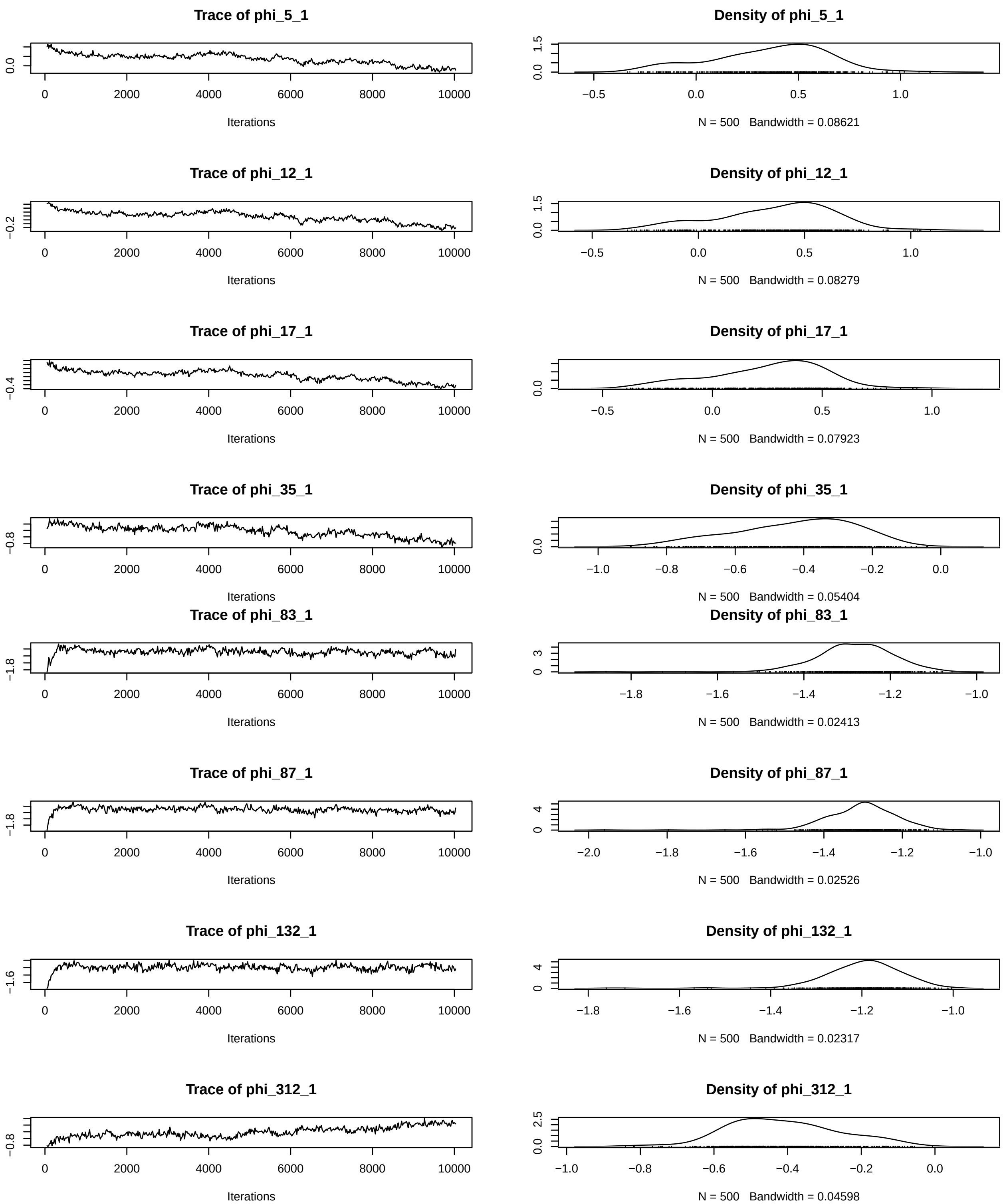
	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
PsiSenegal	0.235	0.015	0.001	0.001	0.208	0.225	0.234	0.244	0.267
PsiSierra.Leone	0.377	0.025	0.001	0.001	0.336	0.359	0.377	0.391	0.425
PsiCote.d.Ivoire	0.307	0.019	0.001	0.001	0.272	0.295	0.306	0.320	0.349
PsiGhana	0.320	0.021	0.001	0.001	0.285	0.305	0.317	0.334	0.363
PsiNigeria	0.547	0.036	0.002	0.001	0.487	0.521	0.546	0.570	0.620
PsiBenin	0.349	0.022	0.001	0.001	0.307	0.332	0.348	0.363	0.396
PsiCongo	0.266	0.018	0.001	0.001	0.233	0.254	0.266	0.277	0.303
PsiKenya	0.832	0.056	0.003	0.003	0.729	0.793	0.832	0.866	0.957
PsiTanzania	0.276	0.018	0.001	0.001	0.244	0.264	0.275	0.287	0.311
PsiMozambique	0.122	0.008	0.000	0.000	0.106	0.116	0.122	0.128	0.138
PsiSouth.Africa	0.314	0.019	0.001	0.001	0.279	0.301	0.313	0.326	0.353
PsiZambia	0.859	0.055	0.002	0.002	0.757	0.824	0.855	0.897	0.968

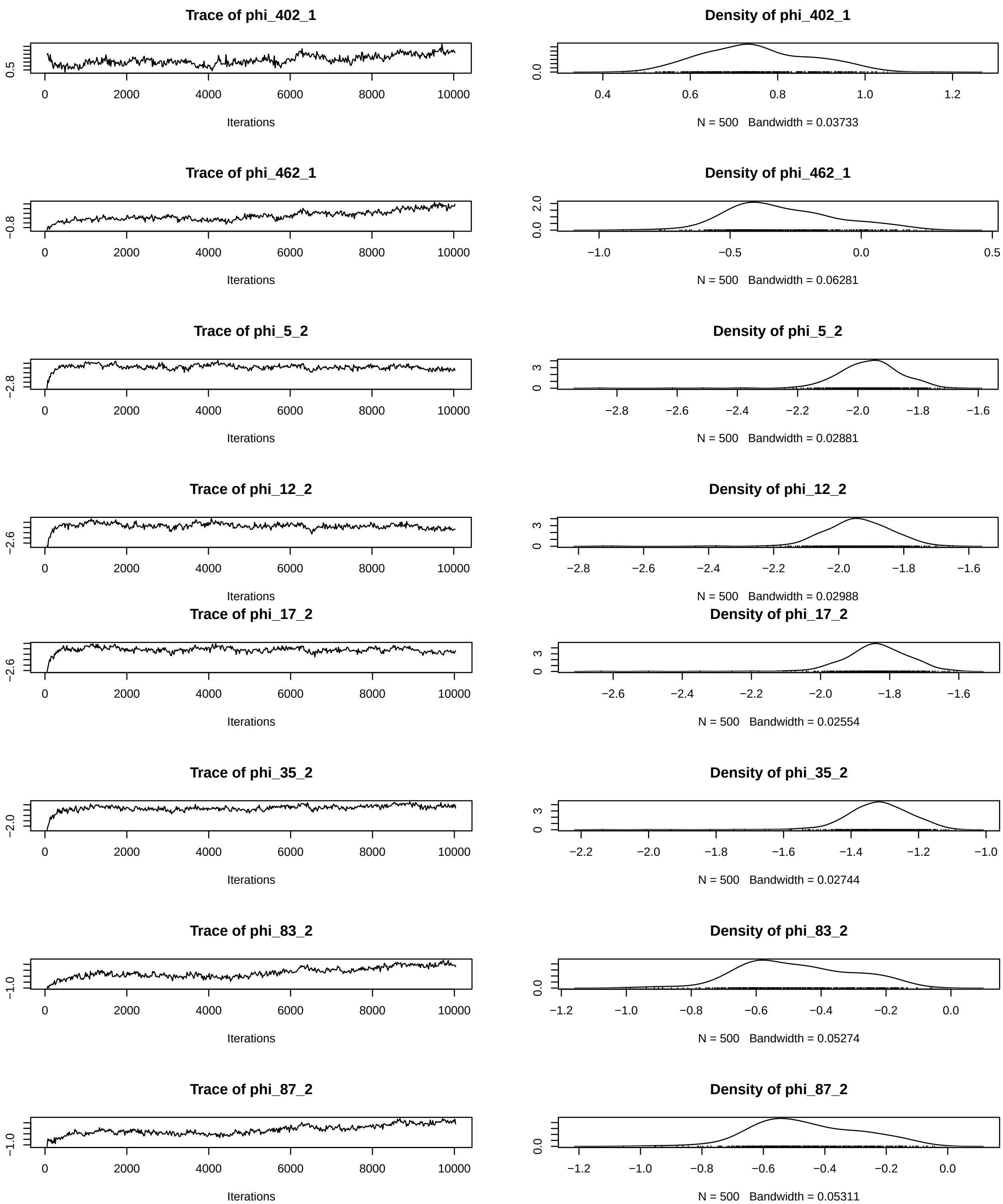
Los valore para Σ van desde 0.01 hasta 1 al igual que en ejercicio 1. Esto era de esperarse pues hay economías con mayor variabilidad en su tipo de cambio.

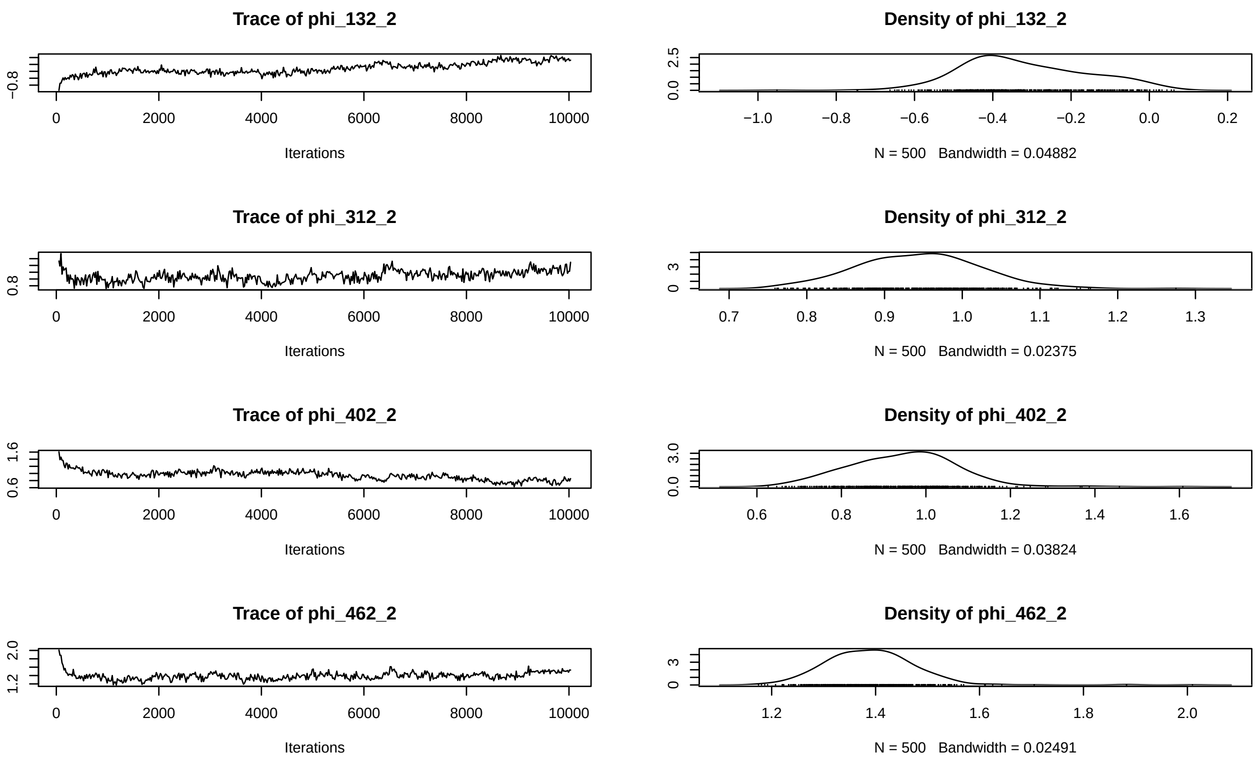
5.3. Factores Latentes

Por último, hagamos un análisis de los factores obtenidos. Veamos la distribución de los valores simulados para los factores para algunas observaciones.

```r
# Muestra de 10 observaciones
set.seed(12)
aux<-sort(sample(1:nrow(data),10))

# Indices para el vector de phi's a examinar
ind1<-match(paste("phi_",aux,"_1",sep=""),colnames(posterior.tc2))
ind2<-match(paste("phi_",aux,"_2",sep=""),colnames(posterior.tc2))

# Grafica de distribuciones
plot(posterior.tc2[,c(ind1,ind2)])
```


Trace of phi_5_1
Iterations
Density of phi_5_1
N = 500 Bandwidth = 0.08621
Trace of phi_12_1
Iterations
Density of phi_12_1
N = 500 Bandwidth = 0.08279
Trace of phi_17_1
Iterations
Density of phi_17_1
N = 500 Bandwidth = 0.07923
Trace of phi_35_1
Iterations
Density of phi_35_1
N = 500 Bandwidth = 0.05404
Trace of phi_83_1
Iterations
Density of phi_83_1
N = 500 Bandwidth = 0.02413
Trace of phi_87_1
Iterations
Density of phi_87_1
N = 500 Bandwidth = 0.02526
Trace of phi_132_1
Iterations
Density of phi_132_1
N = 500 Bandwidth = 0.02317
Trace of phi_312_1
Iterations
Density of phi_312_1
N = 500 Bandwidth = 0.04598


Trace of phi_402_1
Iterations
Density of phi_402_1
N = 500 Bandwidth = 0.03733
Trace of phi_462_1
Iterations
Density of phi_462_1
N = 500 Bandwidth = 0.06281
Trace of phi_5_2
Iterations
Density of phi_5_2
N = 500 Bandwidth = 0.02881
Trace of phi_12_2
Iterations
Density of phi_12_2
N = 500 Bandwidth = 0.02988
Trace of phi_17_2
Iterations
Density of phi_17_2
N = 500 Bandwidth = 0.02554
Trace of phi_35_2
Iterations
Density of phi_35_2
N = 500 Bandwidth = 0.02744
Trace of phi_83_2
Iterations
Density of phi_83_2
N = 500 Bandwidth = 0.05274
Trace of phi_87_2
Iterations
Density of phi_87_2
N = 500 Bandwidth = 0.05311



Algunas de las cadenas de simluaciones de los factores no parecen estar llegando al estado estacionario pues muestran tendencia. Las densidades de los facotres son muy distintas entre si, pero se caracterizan por tener al menos una cola pesada e incluso algunas presentan "chipotes". Veamos los primeros valores simulados para cada factor:

```
resumen.factores.1<-cbind(resumen2$statistics[grep(regex("phi.+\\_1"),rownames(resumen2$statistics)),],
                           resumen2$quantiles[grep(regex("phi.+\\_1"),rownames(resumen2$quantiles)),])

kable(head(resumen.factores.1,10),
      format.args=list(size="tiny",scalebox=0.8),
     type='latex',digits=3,
      caption='Resumen de las simulaciones para el primer factor latente')
```

Tabla 7: Resumen de las simulaciones para el primer factor latente

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
phi_1_1	0.327	0.279	0.012	0.118	-0.227	0.146	0.378	0.524	0.768
phi_2_1	0.338	0.283	0.013	0.139	-0.239	0.164	0.385	0.540	0.783
phi_3_1	0.341	0.274	0.012	0.123	-0.247	0.163	0.393	0.534	0.792
phi_4_1	0.347	0.280	0.013	0.112	-0.229	0.170	0.390	0.549	0.793
phi_5_1	0.358	0.282	0.013	0.120	-0.219	0.177	0.403	0.556	0.814
phi_6_1	0.369	0.280	0.013	0.117	-0.230	0.192	0.420	0.566	0.834
phi_7_1	0.347	0.277	0.012	0.113	-0.224	0.154	0.397	0.548	0.833
phi_8_1	0.343	0.274	0.012	0.120	-0.213	0.177	0.396	0.537	0.813
phi_9_1	0.349	0.280	0.013	0.122	-0.240	0.165	0.398	0.548	0.818
phi_10_1	0.353	0.270	0.012	0.100	-0.225	0.196	0.399	0.540	0.795

```
resumen.factores.2<-cbind(resumen2$statistics[grep(regex("phi.+\\_2"),rownames(resumen2$statistics)),],
                           resumen2$quantiles[grep(regex("phi.+\\_2"),rownames(resumen2$quantiles)),])
```

```r
kable(head(resumen.factores.2,10),
      format.args=list(size="tiny",scalebox=0.8),
      type='latex',digits=3,
      caption='Resumen de las simulaciones para el segundo factor latente')
```

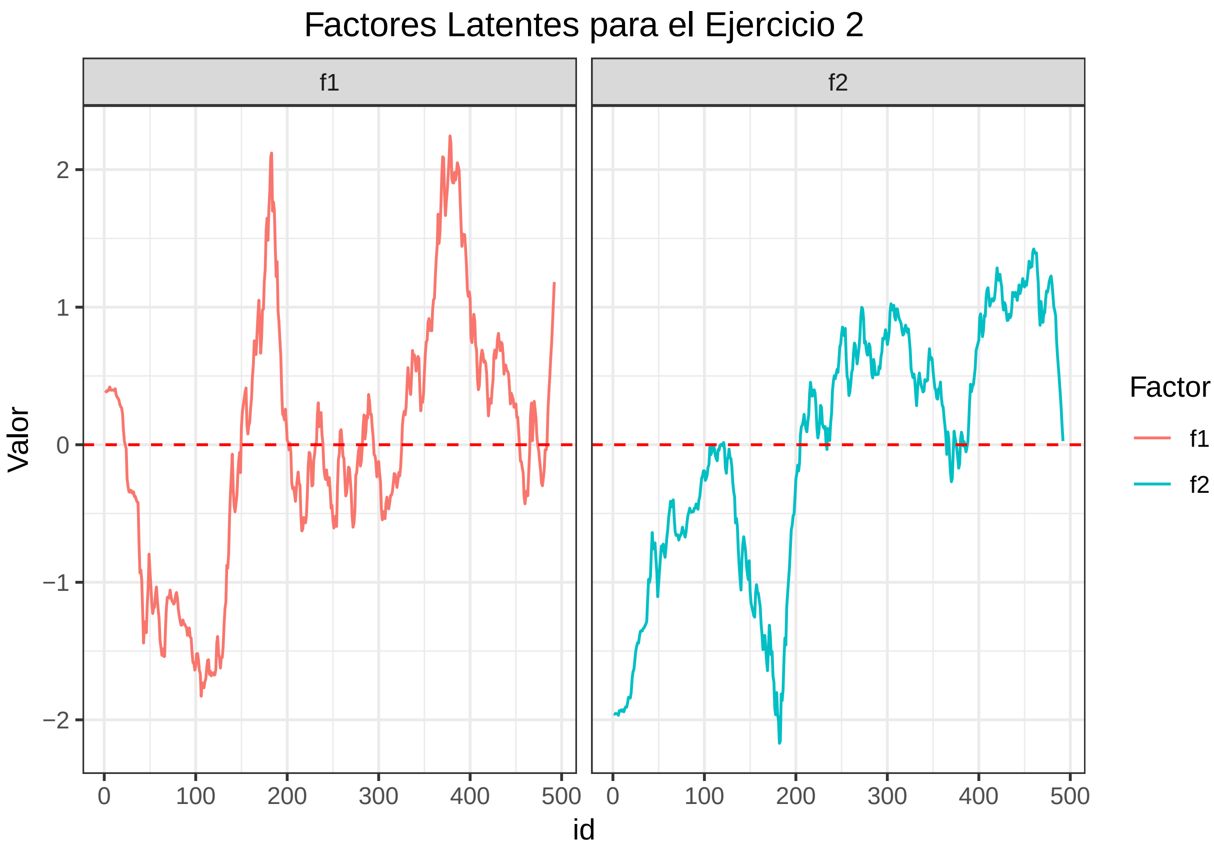
Tabla 8: Resumen de las simulaciones para el segundo factor latente

	Mean	SD	Naive SE	Time-series SE	2.5 %	25 %	50 %	75 %	97.5 %
phi_1_2	-1.962	0.114	0.005	0.018	-2.187	-2.014	-1.955	-1.898	-1.762
phi_2_2	-1.964	0.111	0.005	0.018	-2.154	-2.024	-1.959	-1.895	-1.772
phi_3_2	-1.958	0.115	0.005	0.020	-2.167	-2.017	-1.953	-1.891	-1.762
phi_4_2	-1.963	0.108	0.005	0.018	-2.157	-2.021	-1.955	-1.899	-1.780
phi_5_2	-1.963	0.113	0.005	0.018	-2.166	-2.023	-1.956	-1.897	-1.774
phi_6_2	-1.972	0.112	0.005	0.017	-2.160	-2.036	-1.967	-1.899	-1.776
phi_7_2	-1.941	0.113	0.005	0.018	-2.157	-1.992	-1.933	-1.876	-1.768
phi_8_2	-1.938	0.109	0.005	0.017	-2.143	-1.993	-1.938	-1.875	-1.755
phi_9_2	-1.937	0.111	0.005	0.018	-2.143	-1.991	-1.928	-1.871	-1.754
phi_10_2	-1.939	0.114	0.005	0.019	-2.151	-2.000	-1.938	-1.864	-1.745

El primer factor tiene valores positivos y negativos a lo largo del periodo muestral y el segundo factor es negativo al inicio y positivo posteriormente.

Graficamos la mediana para analizar los dos factores por completo.

```r
aux<-data_frame(id=1:nrow(resumen.factores),
                f1=resumen.factores.1[,7],
                f2=resumen.factores.2[,7])%>%
  gather(Factor, Valor, f1:f2)


ggplot(aux,aes(x=id,y=Valor,color=Factor))+theme_bw()+
  geom_line()+geom_hline(yintercept=0,lty=2,col='red')+
  facet_grid(~Factor)+
  ggtitle('Factores Latentes para el Ejercicio 2')+
  theme(plot.title = element_text(hjust=0.5))
```

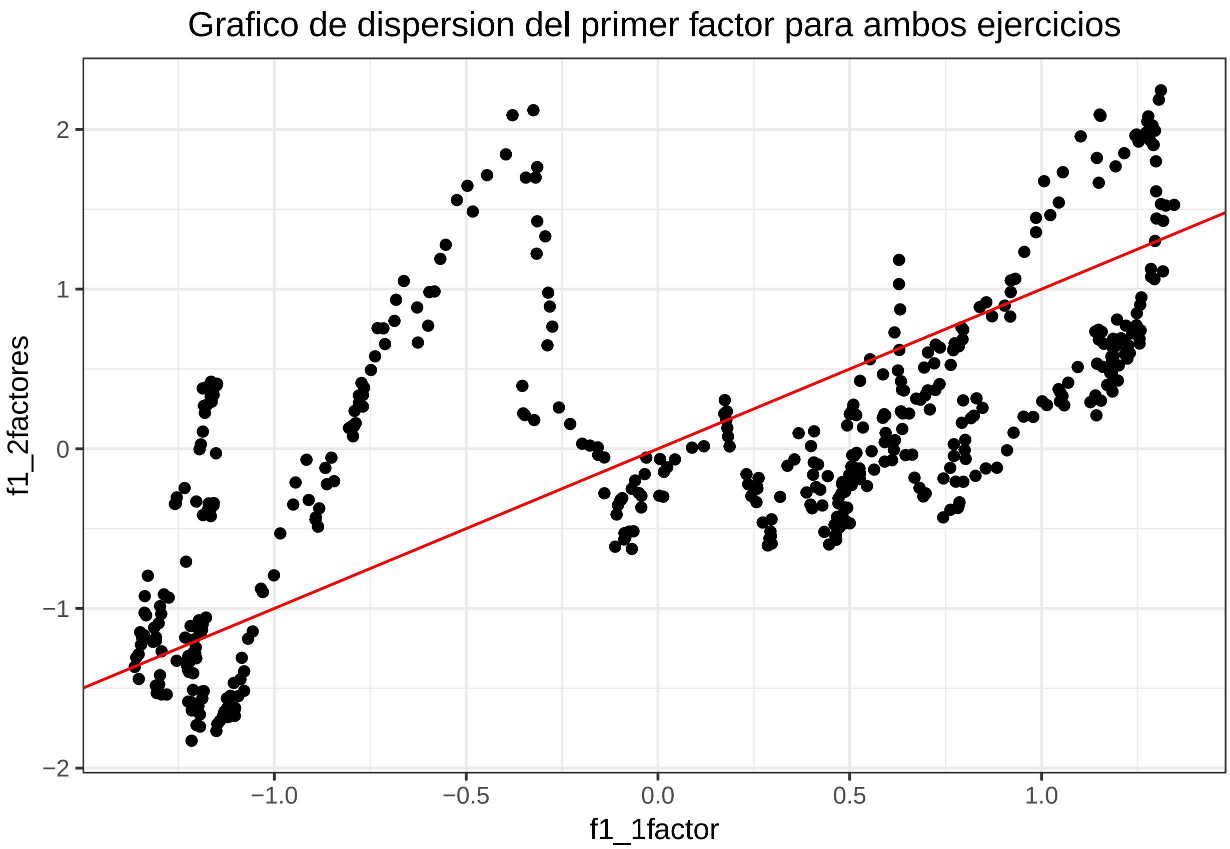


El primer factor podría estar asociado al nivel de los tipos de cambio y el segundo factor a la pendiente promedio de estos.

6. Comparación del primer factor

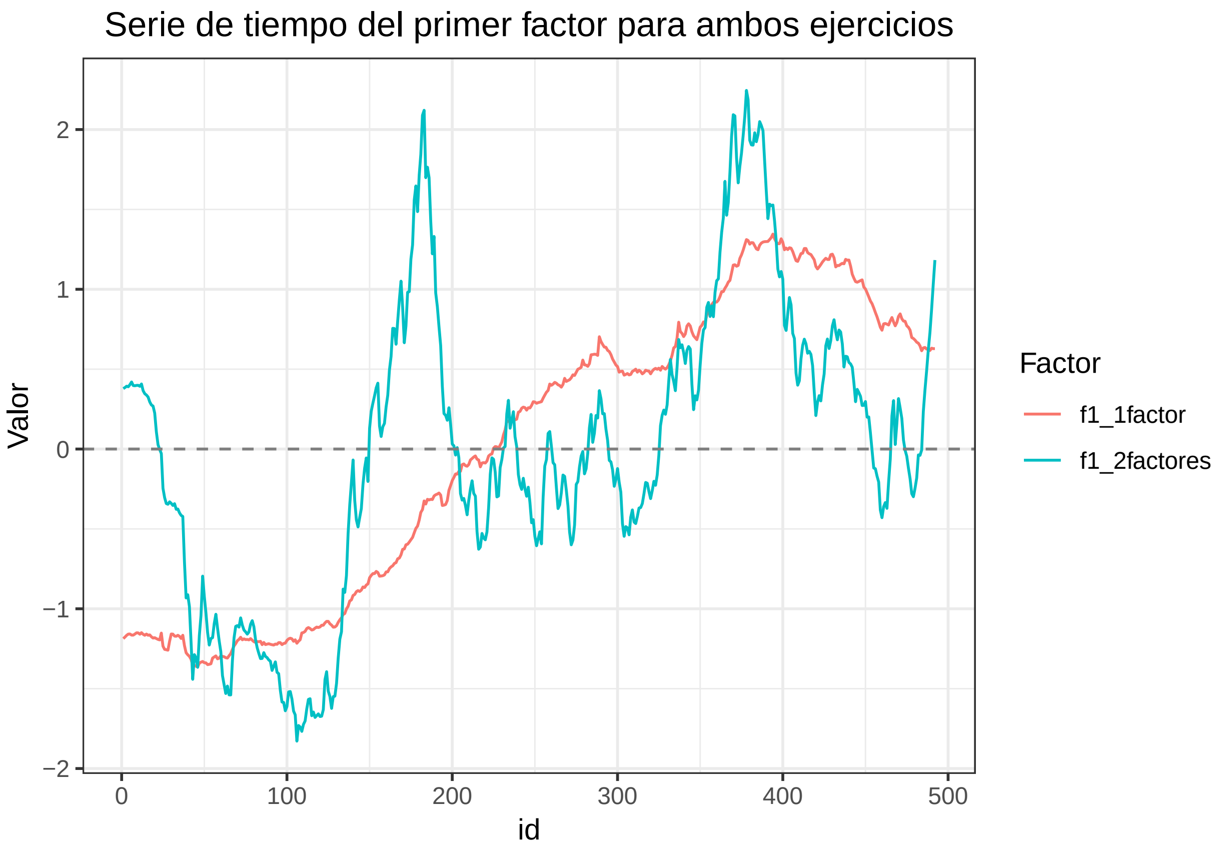
En este apartado comparamos el primer factor del Ejercicio 1 con el primer factor del Ejercicio 2 tomando como estimador puntual la mediana de los factores simulados.

```
plot.f1<-data_frame(f1_1factor=resumen.factores[,7],
                    f1_2factores=resumen.factores.1[,7])

ggplot(plot.f1,aes(x=f1_1factor,y=f1_2factores))+theme_bw()+
  geom_point()+
  geom_abline(slope=1,intercept=0,col='red')+
  ggtitle('Grafico de dispersion del primer factor para ambos ejercicios')+
  theme(plot.title = element_text(hjust=0.5))
```



Claramente, el primer factor del Análsiis de factores con 1 factor y el primer factor del Análisis de Factores con 2 factores no son iguales, de serlo esperaríamos ver los puntos al rededor de la recta de 45 grados. Para las primeras observacioens de la muestra pareciera que el primer factor, del analisis con 1 factor, es menor que el primer factor, del análisis con 2 facotres, y lo contrario ocurre para el final de la muestra.

```
plot.f1<-data_frame(id=1:nrow(resumen.factores),
                    f1_1factor=resumen.factores[,7],
                    f1_2factores=resumen.factores.1[,7])%>%
  gather(Factor, Valor, f1_1factor:f1_2factores)

ggplot(plot.f1,aes(x=id,y=Valor, color=Factor))+theme_bw()+
  geom_line()+
  geom_hline(yintercept=0,col='gray50',lty=2)+
  ggtitle('Serie de tiempo del primer factor para ambos ejercicios')+
  theme(plot.title = element_text(hjust=0.5))
```



En efecto uno de los factores captura mayor variablidad que el otro.