Asset-allocation

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02/10/2020

Asset Allocation Problem

Problema

Revisão Bibliográfica

Base de Dados

Importando os dados da Economatica A FGV disponibiliza aos alunos o acesso à base de dados economatica. Para esse trabalho temos o interesse em obter as cotações do fundo analisado (JGP Strategy...) e dos índices que servirão como proxy para os fatores de risco.

Entretanto, para trabalhar esse conjunto de dados como cross-sectional devemos utilizar os retornos ao invés dos níveis de preço.

```r
# Selecionar janelas de interesse
index(dat) <- as.Date(index(dat))

## Janela 1: janela de 70 dias até 2016-07-01
end_date <- index(dat[index(dat)>='2016-07-01',][1,])
start_date <- index(dat)[match(end_date,index(dat))-69]
jan1 <- window(dat, start = start_date, end = end_date)
str(jan1)
```

```
## 'zoo' series from 2016-03-28 to 2016-07-01
##   Data: num [1:70, 1:22] 7.34 7.34 7.33 7.3 7.31 ...
##  - attr(*, "dimnames")=List of 2
##   ..$ : NULL
##   ..$ : chr [1:22] "Cota" "Fechamento.ibov" "Fechamento.snp" "Fechamento.imab5" ...
##   Index:  Date[1:70], format: "2016-03-28" "2016-03-29" "2016-03-30" "2016-03-31" "2016-04-01" ...
```

```r
## Janela 2: janela de 70 dias até 2018-07-01
end_date <- index(dat[index(dat)>='2018-07-01',][1,])
start_date <- index(dat)[match(end_date,index(dat))-69]
jan2 <- window(dat, start = start_date, end = end_date)
str(jan2)
```

```
## 'zoo' series from 2018-03-27 to 2018-07-02
##   Data: num [1:70, 1:22] 9.52 9.51 9.55 9.55 9.51 ...
##  - attr(*, "dimnames")=List of 2
##   ..$ : NULL
##   ..$ : chr [1:22] "Cota" "Fechamento.ibov" "Fechamento.snp" "Fechamento.imab5" ...
##   Index:  Date[1:70], format: "2018-03-27" "2018-03-28" "2018-03-29" "2018-03-30" "2018-04-02" ...
```

```r
## Janela 3: janela de 70 dias até 2020-07-01
end_date <- index(dat[index(dat)>='2020-07-01',][1,])
start_date <- index(dat)[match(end_date,index(dat))-69]
jan3 <- window(dat, start = start_date, end = end_date)
str(jan3)
```

```
## 'zoo' series from 2020-03-26 to 2020-07-01
##   Data: num [1:70, 1:22] 10.2 10 10.2 10 9.8 ...
##  - attr(*, "dimnames")=List of 2
##   ..$ : NULL
##   ..$ : chr [1:22] "Cota" "Fechamento.ibov" "Fechamento.snp" "Fechamento.imab5" ...
##   Index:  Date[1:70], format: "2020-03-26" "2020-03-27" "2020-03-30" "2020-03-31" "2020-04-01" ...
```

```r
#Para c/ janela de tempo de cada fator calculamos as estatiscas descritivas.

## Janela 1:

media1 <- with(jan1, cbind(mean(Ret.verde), mean(Ret.ibov), mean(Ret.snp), mean(Ret.imab5), mean(Ret.ima

ep1 <- with(jan1, cbind(sd(Ret.verde), sd(Ret.ibov), sd(Ret.snp), sd(Ret.imab5), sd(Ret.imab5p), sd(Ret

skew1 <- with(jan1, cbind(skewness(Ret.verde), skewness(Ret.ibov), skewness(Ret.snp), skewness(Ret.imab5

kurt1 <- with(jan1, cbind(kurtosis(Ret.verde), kurtosis(Ret.ibov), kurtosis(Ret.snp), kurtosis(Ret.imab5

corr1 <- with(jan1, cbind(cor(Ret.verde,Ret.verde), cor(Ret.verde,Ret.ibov), cor(Ret.verde,Ret.snp), co

## Janela 2:
media2 <- with(jan2, cbind(mean(Ret.verde), mean(Ret.ibov), mean(Ret.snp), mean(Ret.imab5), mean(Ret.ima

ep2 <- with(jan2, cbind(sd(Ret.verde), sd(Ret.ibov), sd(Ret.snp), sd(Ret.imab5), sd(Ret.imab5p), sd(Ret

skew2 <- with(jan2, cbind(skewness(Ret.verde), skewness(Ret.ibov), skewness(Ret.snp), skewness(Ret.imab5

kurt2 <- with(jan2, cbind(kurtosis(Ret.verde), kurtosis(Ret.ibov), kurtosis(Ret.snp), kurtosis(Ret.imab5

corr2 <- with(jan2, cbind(cor(Ret.verde,Ret.verde), cor(Ret.verde,Ret.ibov), cor(Ret.verde,Ret.snp), co

## Janela 3:

media3 <- with(jan3, cbind(mean(Ret.verde), mean(Ret.ibov), mean(Ret.snp), mean(Ret.imab5), mean(Ret.ima

ep3 <- with(jan3, cbind(sd(Ret.verde), sd(Ret.ibov), sd(Ret.snp), sd(Ret.imab5), sd(Ret.imab5p), sd(Ret

skew3 <- with(jan3, cbind(skewness(Ret.verde), skewness(Ret.ibov), skewness(Ret.snp), skewness(Ret.imab5

kurt3 <- with(jan3, cbind(kurtosis(Ret.verde), kurtosis(Ret.ibov), kurtosis(Ret.snp), kurtosis(Ret.imab5

corr3 <- with(jan3, cbind(cor(Ret.verde,Ret.verde), cor(Ret.verde,Ret.ibov), cor(Ret.verde,Ret.snp), co
```

Estatisticas Janela 1:

Fator	Mean	Standard Deviation	Skewness	Kurtosis	Corr(Ret.verde)
Ret.verde	7.29148×10^{-4}	0.0025	0.17683	-0.11601	1

Fator	Mean	Standard Deviation	Skewness	Kurtosis	Corr(Ret.verde)
Ret.ibov	7.22502×10^{-4}	0.01675	0.08879	-0.32057	0.30804
Ret.snp	4.62621×10^{-4}	0.00834	-1.10564	4.33331	0.26019
Ret.imab5	4.73732×10^{-4}	0.00153	-0.33008	0.37232	0.51465
Ret.imab5p	0.00108	0.00638	-0.13693	0.28799	0.46484
Ret.dolar	-0.00237	0.01279	-0.22905	-0.3774	-0.20607
Ret.di17	-4.68077×10^{-4}	0.00633	-0.14933	-0.17146	-0.36593
Ret.di21	-0.00238	0.01497	-1.30217	5.17812	-0.06382

Estatisticas Janela 2:

Fator	Mean	Standard Deviation	Skewness	Kurtosis	Corr(Ret.verde)
Ret.verde	-1.5308×10^{-4}	0.00261	0.56725	0.74125	1
Ret.ibov	-0.00222	0.01394	-0.55792	0.33693	0.57737
Ret.snp	3.61641×10^{-4}	0.008	-0.56696	0.6379	0.5139
Ret.imab5	-6.00189×10^{-5}	0.0025	-0.80765	4.94592	0.44209
Ret.imab5p	-9.49613×10^{-4}	0.00501	0.11619	0.56857	0.64233
Ret.dolar	0.0022	0.01026	-1.92269	8.88002	-0.21302
Ret.di19	0.00214	0.01822	1.26345	3.67099	-0.3581
Ret.di23	0.00245	0.01381	0.55181	1.68525	-0.44113

Estatisticas Janela 3:

Fator	Mean	Standard Deviation	Skewness	Kurtosis	Corr(Ret.verde)
Ret.verde	0.00196	0.00946	0.69417	2.96592	1
Ret.ibov	0.00357	0.02285	-0.15094	0.23776	0.77174
Ret.snp	0.00329	0.02117	-8.34192×10^{-4}	1.53933	0.81666
Ret.imab5	7.55271×10^{-4}	0.00263	-3.06574	17.47893	0.20285
Ret.imab5p	0.0012	0.01172	-1.69967	10.64168	0.40333
Ret.dolar	8.18726×10^{-4}	0.0169	-0.23034	-0.84309	-0.41428
Ret.di21	-0.00747	0.03095	0.76854	4.96674	-0.08984
Ret.di25	-0.00443	0.03091	1.88079	11.25917	-0.26715

Matriz de correlacoes entre os fatores Janela 1:

Fator	Ret.ibov	Ret.snp	Ret.imab5	Ret.imab5p	Ret.dolar	Ret.di17	Ret.di21
Ret.ibov	1	0.50746	0.24343	0.44399	-0.33297	-0.37188	-0.07136
Ret.snp	0.50746	1	-0.16683	0.01784	-0.30857	0.01393	0.08797
Ret.imab5	0.24343	-0.16683	1	0.80795	0.04429	-0.75792	-0.09329
Ret.imab5p	0.44399	0.01784	0.80795	1	-0.15847	-0.68497	-0.19831
Ret.dolar	-0.33297	-0.30857	0.04429	-0.15847	1	-0.03542	0.11565
Ret.di17	-0.37188	0.01393	-0.75792	-0.68497	-0.03542	1	0.05042
Ret.di21	-0.07136	0.08797	-0.09329	-0.19831	0.11565	0.05042	1

Matriz de correlacoes entre os fatores Janela 2:

Fator	Ret.ibov	Ret.snp	Ret.imab5	Ret.imab5p	Ret.dolar	Ret.di19	Ret.di23
Ret.ibov	1	0.27338	0.38453	0.44793	-0.23299	-0.40104	-0.30494

Fator	Ret.ibov	Ret.snp	Ret.imab5	Ret.imab5p	Ret.dolar	Ret.di19	Ret.di23
Ret.snp	0.27338	1	0.09631	0.18585	-0.09519	-0.02541	-0.02289
Ret.imab5	0.38453	0.09631	1	0.79508	-0.56285	-0.91074	-0.66136
Ret.imab5p	0.44793	0.18585	0.79508	1	-0.59193	-0.7545	-0.72291
Ret.dolar	-0.23299	-0.09519	-0.56285	-0.59193	1	0.5842	0.42331
Ret.di19	-0.40104	-0.02541	-0.91074	-0.7545	0.5842	1	0.66667
Ret.di23	-0.30494	-0.02289	-0.66136	-0.72291	0.42331	0.66667	1

Matriz de correlacoes entre os fatores Janela 3:

Fator	Ret.ibov	Ret.snp	Ret.imab5	Ret.imab5p	Ret.dolar	Ret.di21	Ret.di25
Ret.ibov	1	0.5552	0.41902	0.63003	-0.56217	-0.30168	-0.45199
Ret.snp	0.5552	1	0.10655	0.21534	-0.32727	-0.01258	-0.12843
Ret.imab5	0.41902	0.10655	1	0.80462	-0.27185	-0.78478	-0.86603
Ret.imab5p	0.63003	0.21534	0.80462	1	-0.44815	-0.62987	-0.86414
Ret.dolar	-0.56217	-0.32727	-0.27185	-0.44815	1	0.14479	0.31295
Ret.di21	-0.30168	-0.01258	-0.78478	-0.62987	0.14479	1	0.69089
Ret.di25	-0.45199	-0.12843	-0.86603	-0.86414	0.31295	0.69089	1

```r
# Regressão linear OLS
## Regressão da janela 1 (2016)
regres1 <- lm(Ret.verde~Ret.ibov+Ret.snp+Ret.imab5+Ret.imab5p+
               Ret.dolar+Ret.di17+Ret.di21, data=jan1)
b1.hat<-coef(regres1) #coeficientes
regres1.hat<-fitted(regres1) #retorno previsto
u1.hat<-resid(regres1) #residuos
summary(regres1)
```

```
##
## Call:
## lm(formula = Ret.verde ~ Ret.ibov + Ret.snp + Ret.imab5 + Ret.imab5p +
##     Ret.dolar + Ret.di17 + Ret.di21, data = jan1)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.006060 -0.001411  0.000269  0.001361  0.004376
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.17e-05   2.72e-04    0.34  0.73719
## Ret.ibov    -3.24e-03   2.03e-02   -0.16  0.87382
## Ret.snp      1.06e-01   3.68e-02    2.87  0.00562 **
## Ret.imab5    1.19e+00   3.33e-01    3.58  0.00069 ***
## Ret.imab5p  -2.33e-02   7.52e-02   -0.31  0.75744
## Ret.dolar   -2.71e-02   2.13e-02   -1.27  0.20830
## Ret.di17     5.06e-02   6.26e-02    0.81  0.42134
## Ret.di21    -5.14e-03   1.69e-02   -0.30  0.76251
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.00202 on 62 degrees of freedom
```

```
## Multiple R-squared:  0.415,  Adjusted R-squared:  0.349
## F-statistic: 6.28 on 7 and 62 DF,  p-value: 1.39e-05
```

```r
## Regressão da janela 2 (2018)
regres2 <- lm(Ret.verde~Ret.ibov+Ret.snp+Ret.imab5+Ret.imab5p+
               Ret.dolar+Ret.di19+Ret.di23, data=jan2)
b2.hat<-coef(regres2) #coeficientes
regres2.hat<-fitted(regres2) #retorno previsto
u2.hat<-resid(regres2) #residuos
summary(regres2)
```

```
##
## Call:
## lm(formula = Ret.verde ~ Ret.ibov + Ret.snp + Ret.imab5 + Ret.imab5p +
##     Ret.dolar + Ret.di19 + Ret.di23, data = jan2)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.002635 -0.000916 -0.000093  0.000549  0.006030
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  9.51e-05   1.98e-04    0.48  0.63260
## Ret.ibov     5.58e-02   1.55e-02    3.60  0.00063 ***
## Ret.snp      1.07e-01   2.49e-02    4.29  6.4e-05 ***
## Ret.imab5    1.18e-01   1.96e-01    0.60  0.55022
## Ret.imab5p   3.25e-01   7.37e-02    4.41  4.1e-05 ***
## Ret.dolar    4.76e-02   2.34e-02    2.04  0.04580 *
## Ret.di19     4.26e-02   2.63e-02    1.62  0.11069
## Ret.di23    -1.76e-02   2.03e-02   -0.86  0.39105
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.00154 on 62 degrees of freedom
## Multiple R-squared:  0.688,  Adjusted R-squared:  0.652
## F-statistic: 19.5 on 7 and 62 DF,  p-value: 1.61e-13
```

```r
## Regressão da janela 3 (2020)
regres3 <- lm(Ret.verde~Ret.ibov+Ret.snp+Ret.imab5+Ret.imab5p+
               Ret.dolar+Ret.di21+Ret.di25, data=jan3)
b3.hat<-coef(regres3) #coeficientes
regres3.hat<-fitted(regres3) #retorno previsto
u3.hat<-resid(regres3) #residuos
summary(regres3)
```

```
##
## Call:
## lm(formula = Ret.verde ~ Ret.ibov + Ret.snp + Ret.imab5 + Ret.imab5p +
##     Ret.dolar + Ret.di21 + Ret.di25, data = jan3)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.008934 -0.002115 -0.000218  0.001651  0.014358
##
## Coefficients:
```

```
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.000711   0.000551    1.29     0.20
## Ret.ibov     0.199721   0.036716    5.44  9.6e-07 ***
## Ret.snp      0.248032   0.029575    8.39  8.5e-12 ***
## Ret.imab5   -0.471024   0.459079   -1.03     0.31
## Ret.imab5p   0.056476   0.106238    0.53     0.60
## Ret.dolar    0.029659   0.037031    0.80     0.43
## Ret.di21     0.016981   0.026720    0.64     0.53
## Ret.di25    -0.026302   0.040191   -0.65     0.52
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0042 on 62 degrees of freedom
## Multiple R-squared:  0.823,  Adjusted R-squared:  0.803
## F-statistic: 41.2 on 7 and 62 DF,  p-value: <2e-16
```

Metodologia (OLS)

1. Relação Linear (nos coeficientes) O modelo, segundo a teoria do APT e o trabalho do Sharpe, pode ser escrito como:

$$E(ri) = \beta_1 F_1 + \beta_2 F_2 + \beta_3 F_3 + \beta_4 F_4 + \beta_5 F_5 + \beta_6 F_6 + \beta_7 F_7 + \mu$$

Onde os coeficientes.....

2. Média Condicional Zero O erro μ tem zero como valor esperado, dados quaisquer valores das variáveis independentes. Em formula $E(\mu|F_1, F_2, ..., F_7)$ para estimar esta hipotesis vamos calcular a media do residuo para cada uma das janelas de tempo escolhidas, $E(\hat{\mu})$

O valores esperados dos residuos da Janela 1, 2 e 3 sao:

- $E(\hat{\mu_1})$ $= 4.87921 \times 10^{-20}$
- $E(\hat{\mu_2})$ $= 1.21511 \times 10^{-20}$
- $E(\hat{\mu_3})$ $= -2.55505 \times 10^{-19}$

3. Amostra Aleatória (iid)

4. Multicolinearidade não-perfeita

5. Homocedasticidade

Report Results

Conclusão