Asset-allocation

Arthur Paolucci

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# 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.

# 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" ...

## 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" ...

## 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" ...

#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.imab5p), mean(Ret.dolar), mean(Ret.di17), mean(Ret.di21)))  
  
ep1 <- with(jan1, cbind(sd(Ret.verde), sd(Ret.ibov), sd(Ret.snp), sd(Ret.imab5), sd(Ret.imab5p), sd(Ret.dolar), sd(Ret.di17), sd(Ret.di21)))  
  
skew1 <- with(jan1, cbind(skewness(Ret.verde), skewness(Ret.ibov), skewness(Ret.snp), skewness(Ret.imab5), skewness(Ret.imab5p), skewness(Ret.dolar), skewness(Ret.di17), skewness(Ret.di21)))  
  
kurt1 <- with(jan1, cbind(kurtosis(Ret.verde), kurtosis(Ret.ibov), kurtosis(Ret.snp), kurtosis(Ret.imab5), kurtosis(Ret.imab5p), kurtosis(Ret.dolar), kurtosis(Ret.di17), kurtosis(Ret.di21)))  
  
corr1 <- with(jan1, cbind(cor(Ret.verde,Ret.verde), cor(Ret.verde,Ret.ibov), cor(Ret.verde,Ret.snp), cor(Ret.verde,Ret.imab5), cor(Ret.verde,Ret.imab5p), cor(Ret.verde,Ret.dolar), cor(Ret.verde,Ret.di17), cor(Ret.verde,Ret.di21)))  
  
## Janela 2:  
media2 <- with(jan2, cbind(mean(Ret.verde), mean(Ret.ibov), mean(Ret.snp), mean(Ret.imab5), mean(Ret.imab5p), mean(Ret.dolar), mean(Ret.di19), mean(Ret.di23)))  
  
ep2 <- with(jan2, cbind(sd(Ret.verde), sd(Ret.ibov), sd(Ret.snp), sd(Ret.imab5), sd(Ret.imab5p), sd(Ret.dolar), sd(Ret.di19), sd(Ret.di23)))  
  
skew2 <- with(jan2, cbind(skewness(Ret.verde), skewness(Ret.ibov), skewness(Ret.snp), skewness(Ret.imab5), skewness(Ret.imab5p), skewness(Ret.dolar), skewness(Ret.di19), skewness(Ret.di23)))  
  
kurt2 <- with(jan2, cbind(kurtosis(Ret.verde), kurtosis(Ret.ibov), kurtosis(Ret.snp), kurtosis(Ret.imab5), kurtosis(Ret.imab5p), kurtosis(Ret.dolar), kurtosis(Ret.di19), kurtosis(Ret.di23)))  
  
corr2 <- with(jan2, cbind(cor(Ret.verde,Ret.verde), cor(Ret.verde,Ret.ibov), cor(Ret.verde,Ret.snp), cor(Ret.verde,Ret.imab5), cor(Ret.verde,Ret.imab5p), cor(Ret.verde,Ret.dolar), cor(Ret.verde,Ret.di19), cor(Ret.verde,Ret.di23)))  
  
## Janela 3:  
  
media3 <- with(jan3, cbind(mean(Ret.verde), mean(Ret.ibov), mean(Ret.snp), mean(Ret.imab5), mean(Ret.imab5p), mean(Ret.dolar), mean(Ret.di21), mean(Ret.di25)))  
  
ep3 <- with(jan3, cbind(sd(Ret.verde), sd(Ret.ibov), sd(Ret.snp), sd(Ret.imab5), sd(Ret.imab5p), sd(Ret.dolar), sd(Ret.di21), sd(Ret.di25)))  
  
skew3 <- with(jan3, cbind(skewness(Ret.verde), skewness(Ret.ibov), skewness(Ret.snp), skewness(Ret.imab5), skewness(Ret.imab5p), skewness(Ret.dolar), skewness(Ret.di21), skewness(Ret.di25)))  
  
kurt3 <- with(jan3, cbind(kurtosis(Ret.verde), kurtosis(Ret.ibov), kurtosis(Ret.snp), kurtosis(Ret.imab5), kurtosis(Ret.imab5p), kurtosis(Ret.dolar), kurtosis(Ret.di21), kurtosis(Ret.di25)))  
  
corr3 <- with(jan3, cbind(cor(Ret.verde,Ret.verde), cor(Ret.verde,Ret.ibov), cor(Ret.verde,Ret.snp), cor(Ret.verde,Ret.imab5), cor(Ret.verde,Ret.imab5p), cor(Ret.verde,Ret.dolar), cor(Ret.verde,Ret.di21), cor(Ret.verde,Ret.di25)))

**Estatisticas Janela 1:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Fator | Mean | Standard Deviation | Skewness | Kurtosis | Corr(Ret.verde) |
| Ret.verde | 7.2914810^{-4} | 0.0025 | 0.17683 | -0.11601 | 1 |
| Ret.ibov | 7.2250210^{-4} | 0.01675 | 0.08879 | -0.32057 | 0.30804 |
| Ret.snp | 4.6262110^{-4} | 0.00834 | -1.10564 | 4.33331 | 0.26019 |
| Ret.imab5 | 4.7373210^{-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 | -4.6807710^{-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 | -1.530810^{-4} | 0.00261 | 0.56725 | 0.74125 | 1 |
| Ret.ibov | -0.00222 | 0.01394 | -0.55792 | 0.33693 | 0.57737 |
| Ret.snp | 3.6164110^{-4} | 0.008 | -0.56696 | 0.6379 | 0.5139 |
| Ret.imab5 | -6.0018910^{-5} | 0.0025 | -0.80765 | 4.94592 | 0.44209 |
| Ret.imab5p | -9.4961310^{-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 | -8.3419210^{-4} | 1.53933 | 0.81666 |
| Ret.imab5 | 7.5527110^{-4} | 0.00263 | -3.06574 | 17.47893 | 0.20285 |
| Ret.imab5p | 0.0012 | 0.01172 | -1.69967 | 10.64168 | 0.40333 |
| Ret.dolar | 8.1872610^{-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 |
| 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 |

# 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)  
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

## 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)  
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

## 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)  
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)

##### 2. Média Condicional Zero

##### 3. Amostra Aleatória (iid)

##### 4. Multicolinearidade não-perfeita

##### 5. Homocedasticidade

### Report Results

### Conclusão