Sitema dinamico Apple Vs Microsoft

Codigo

Cargamos la base de datos

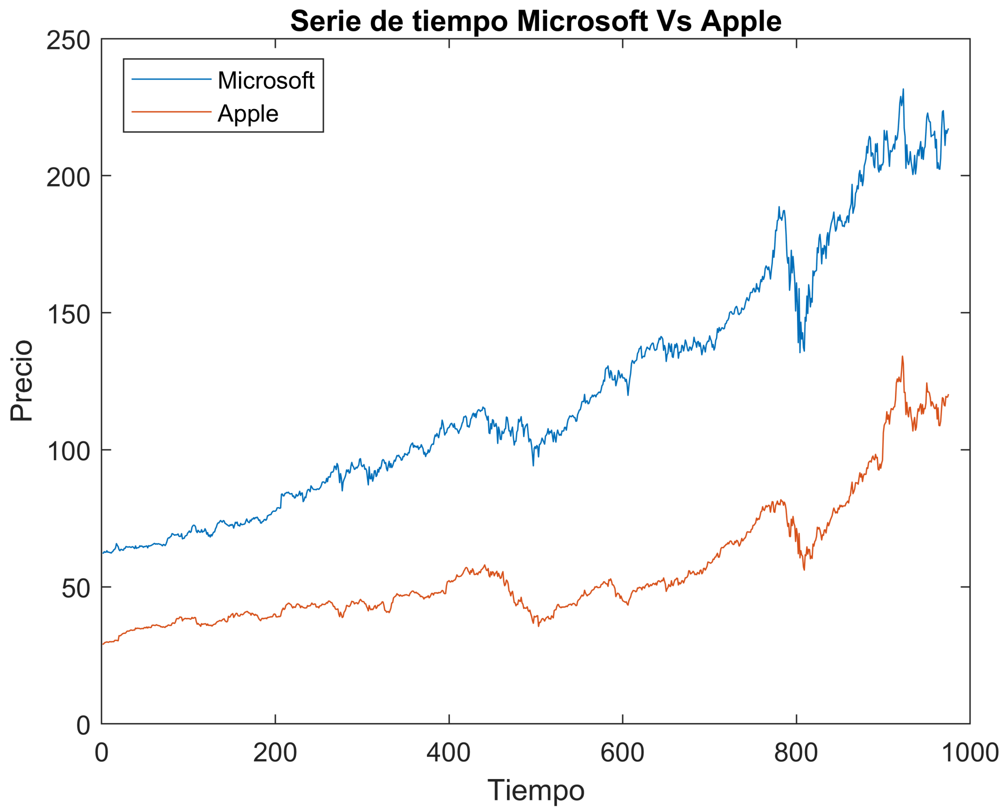
```
close all
clear all

num = xlsread("proyecto.xlsx");
```

Obtenemos los precios de cada serie

```
precio1 = num(:,2); %Precio Microsoft
precio2 = num(:,4); %Preco Apple
%precio3 = num(:,6);
corte = 700;
z = iddata([precio1 precio2]); %Convertimos los datos en iddata, que es un objeto que
%verlo como una serie de tiempo
```

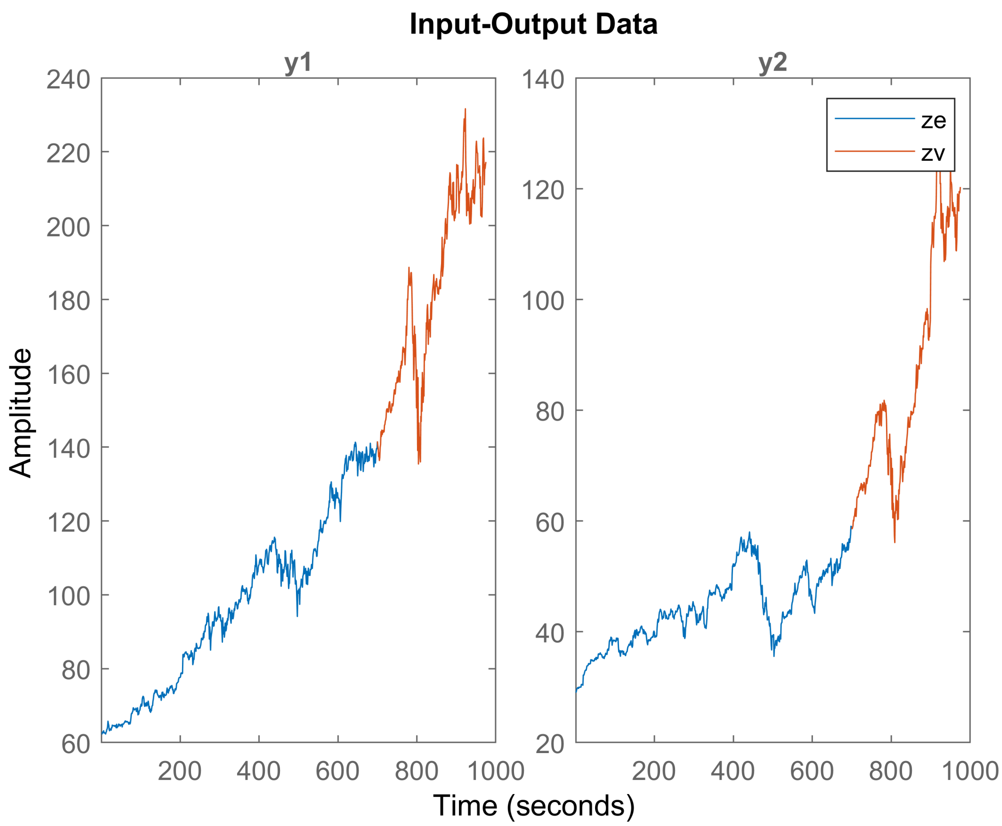
Grafica precios

```
plot(precio1)
hold on
plot(precio2)
title('Serie de tiempo Microsoft Vs Apple')
xlabel('Tiempo')
ylabel('Precio')
legend({'Microsoft','Apple'},'Location','northwest')
hold off
```



Partimos en valores de estimación y de validacion para la identificacion del sistema

```
ze = z(1:corte);    % estimation data
zv = z(corte:end);  % validation data
plot(ze, zv)
legend('ze','zv')
```



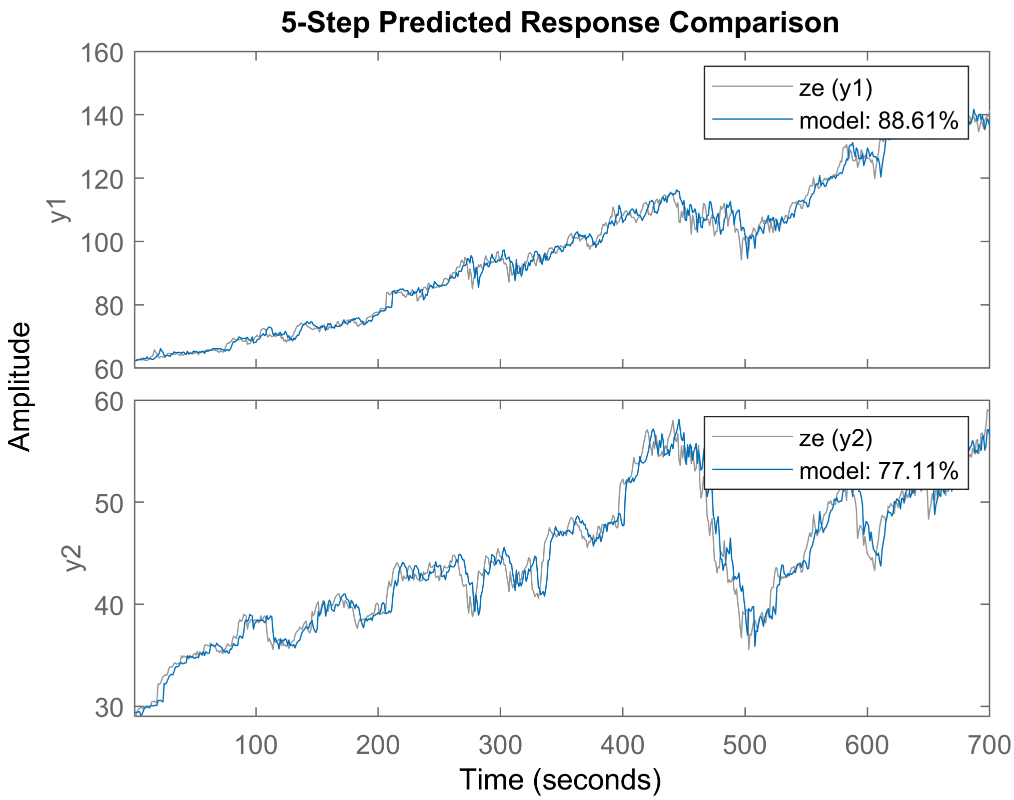
Elegimos el modelo que solo poseen un rezago entre si.

```
% Seleccion Modelo
ny = 2; % number of outputs
nu = 0; % number of inputs
na = [1,1;1,1]; %Solo un rezago
%na = 2*eye(ny); % note: na must be ny-by-ny!
nb = 1*ones(ny,nu); % nb must be ny-by-nu
nk = zeros(ny,nu); % nk must be ny-by-nu
model = arx(ze,[na nb nk])
```

```
model =
Discrete-time AR model:
  Model for output "y1": A(z)y_1(t) = - A_i(z)y_i(t) + e_1(t)
    A(z) = 1 - z^-1

    A_2(z) = -0.002109 z^-1

  Model for output "y2": A(z)y_2(t) = - A_i(z)y_i(t) + e_2(t)
    A(z) = 1 - 0.9963 z^-1

    A_1(z) = -0.002027 z^-1

Sample time: 1 seconds

Parameterization:
   Polynomial orders:   na=[1 1;1 1]
   Number of free coefficients: 4
   Use "polydata", "getpvec", "getcov" for parameters and their uncertainties.
```

```
Status:
Estimated using ARX on time domain data "ze".
Fit to estimation data: [93.79;89.3]% (prediction focus)
FPE: 0.6558, MSE: 2.612
```

```
compare(ze,model,5) % Comparar modelos
```

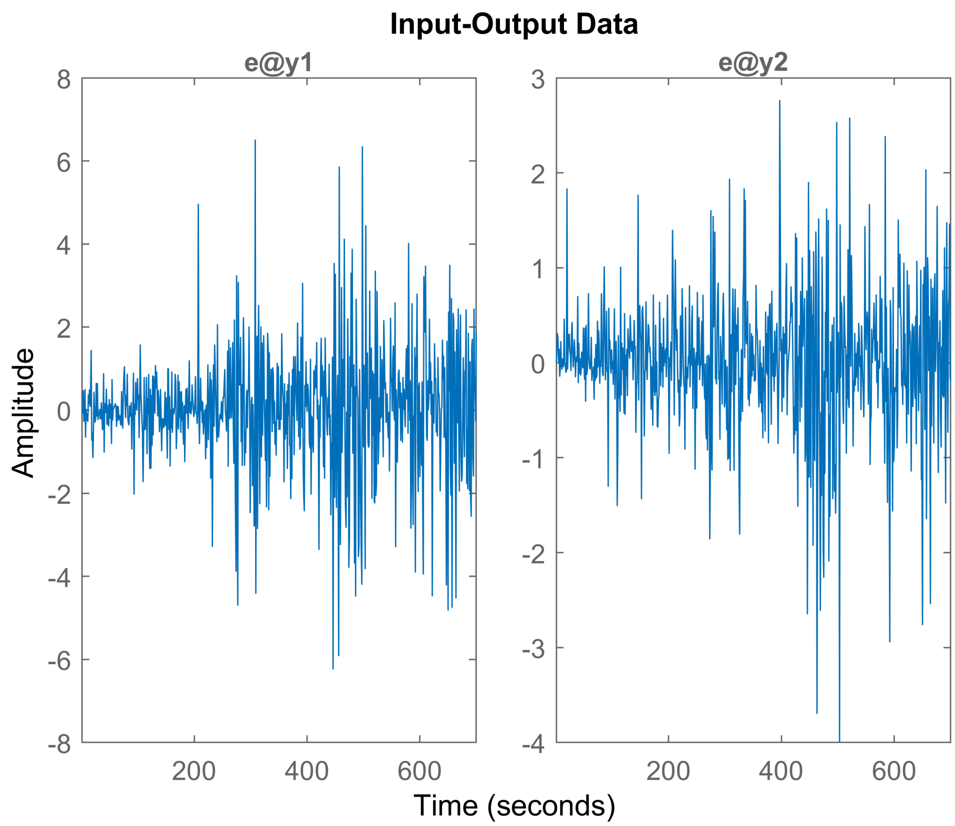



```
% z = iddata(precio1)
% ze = z(1:corte);
% model = arx(z,2)
% compare(ze,model,5)
```

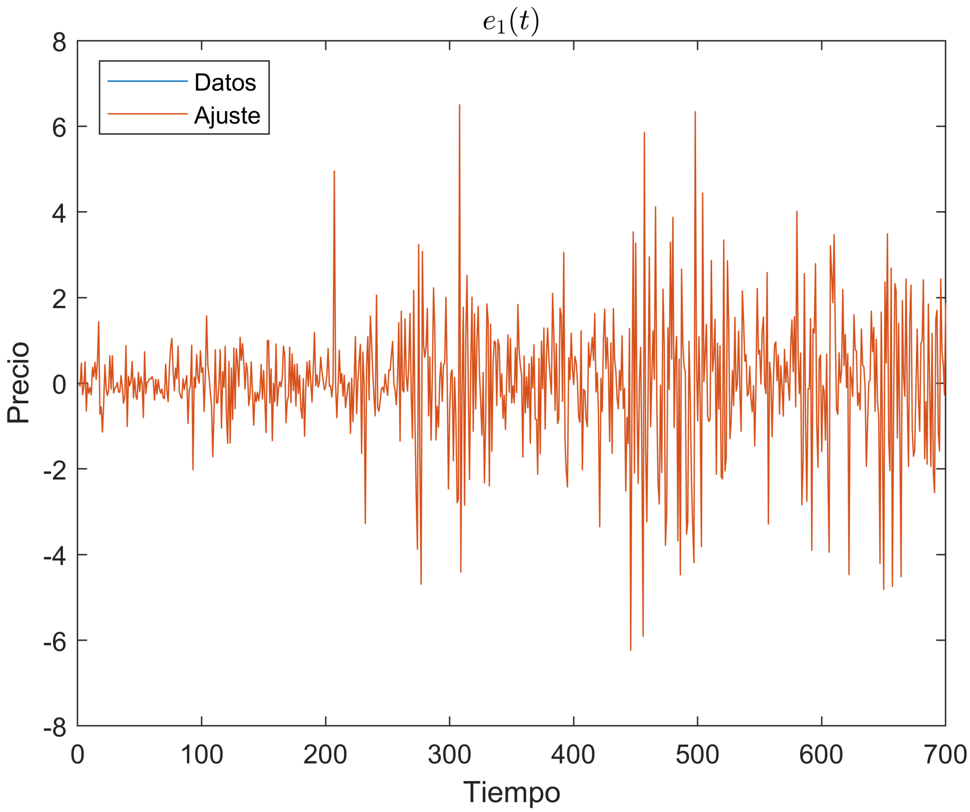
Modelamiento Error $e[k]$

Una vez modelamos la funcion del error, en la cual utilizamos una interpolación linear

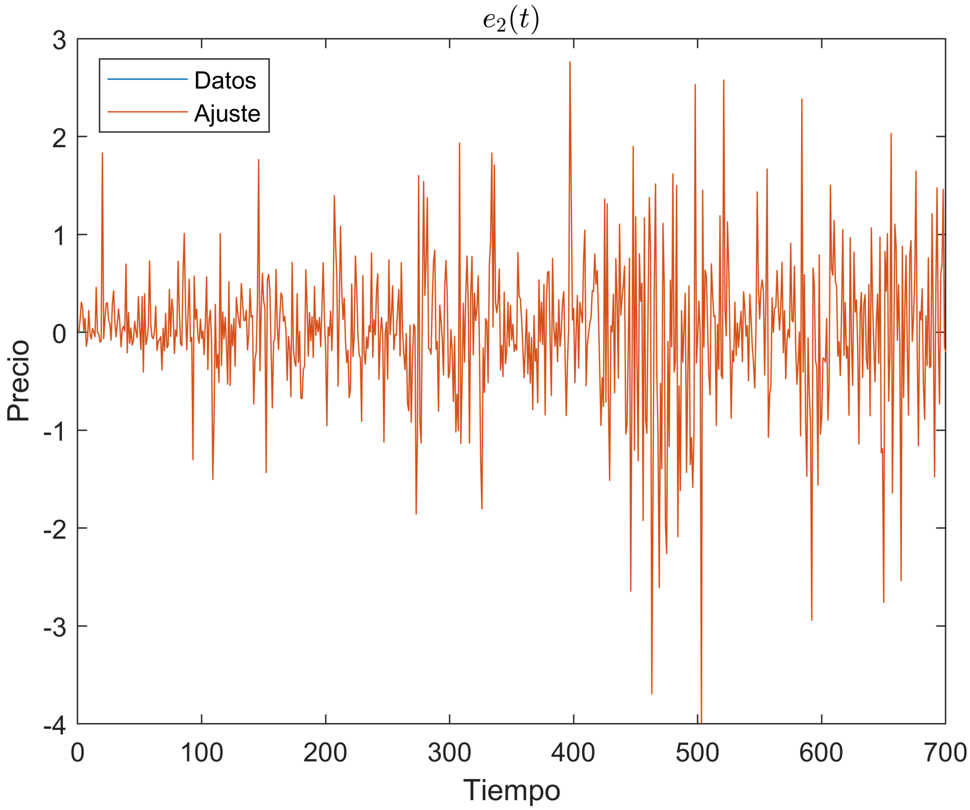
```
[E,R]=resid(ze,model);
plot(E)
```




```
Residuales = E.OutputData;
Re1 = Residuales(:,1);
Re2 = Residuales(:,2);
t = 1:length(Residuales(:,1));
t = t';
f1 = fit(t,Re1,'linearinterp');
f2 = fit(t,Re2,'linearinterp');

plot(t, Re1)
hold on
plot(t,f1(t))
title('$$e_1(t)$$','interpreter','latex')
xlabel('Tiempo')
ylabel('Precio')
legend({'Datos','Ajuste'},'Location','northwest')
hold off
```




```
plot(t, Re2)
hold on
plot(t,f2(t))
title('$$e_2(t)$$','interpreter','latex')
xlabel('Tiempo')
ylabel('Precio')
legend({'Datos','Ajuste'},'Location','northwest')
hold off
```



Analisis del sistema dinamico

A continuacion analizamos el sistema dinamico de manera analitica.

```
syms a1
syms a2

xt = [1 0.002109 ; 0.002027  0.9963]
```

```
xt = 2×2
    1.0000    0.0021
    0.0020    0.9963
```

```
[V,D] = eig(xt)
```

```
V = 2×2
    0.9159   -0.4149
    0.4015    0.9098
D = 2×2
    1.0009         0
         0    0.9954
```

```
syms b1
syms b2
%V=subs(V,[a1 a2], resultado)
%D=subs(D,[a1 a2], resultado)
x0 = [precio1(1);precio2(1)]
```

```
x0 = 2×1
   62.3000
   29.0050
```

```
x0sol = b1*V(:,1)+b2*V(:,2) == x0
```

x0sol =

$$\begin{pmatrix} \frac{8249511666820053\, b_1}{9007199254740992} - \frac{3737465790750417\, b_2}{9007199254740992} = \frac{4383972691899723}{70368744177664} \\ \frac{7231928006723105\, b_1}{18014398509481984} + \frac{2048795192875209\, b_2}{2251799813685248} = \frac{8164181418017601}{281474976710656} \end{pmatrix}$$

```
vars = [b1 b2]
```

vars = $\begin{pmatrix} b_1 & b_2 \end{pmatrix}$

```
e1 = solve(x0sol,vars)
```

```
e1 = struct with fields:
    b1: [1×1 sym]
    b2: [1×1 sym]
```

```
e1.b1;
e1.b2;
betas = [e1.b1 e1.b2]
```

betas =

$$\begin{pmatrix} \frac{5091452598037230723808473271 6224}{7408290515921848202512684 21979} & \frac{1201176403947857111096648945 6832}{7725788680889927411191799 257781} \end{pmatrix}$$

```
syms k
suma_x = 0
```

suma_x = 0

```
for i = 1:2
    suma_x = suma_x+D(i,i)^k*betas(i)*V(:,i)
end
```

suma_x =

$$\begin{pmatrix} \frac{93754458947699563695914842345199744372170 0089\, \left(\frac{1126940718673809}{1125899906842624}\right)^k}{148946314316776853254346991904701649424 22016} \\ \frac{82189773746983402529236295883232155540202 9365\, \left(\frac{1126940718673809}{1125899906842624}\right)^k}{297892628633553706508693983809403298848 44032} \end{pmatrix}$$

suma_x =

$$\begin{pmatrix} \dfrac{937544589476995636959148423451997443721700089\left(\dfrac{1126940718673809}{1125899906842624}\right)^{k}}{1489463143167768532543469919047016494242 2016} - \dfrac{9609066178107277}{1489463} \\ \dfrac{821897737469834025292362958832321555402029365\left(\dfrac{1126940718673809}{1125899906842624}\right)^{k}}{297892628633553706508693983809403298848440 32} + \dfrac{5267475261565710}{3723657} \end{pmatrix}$$

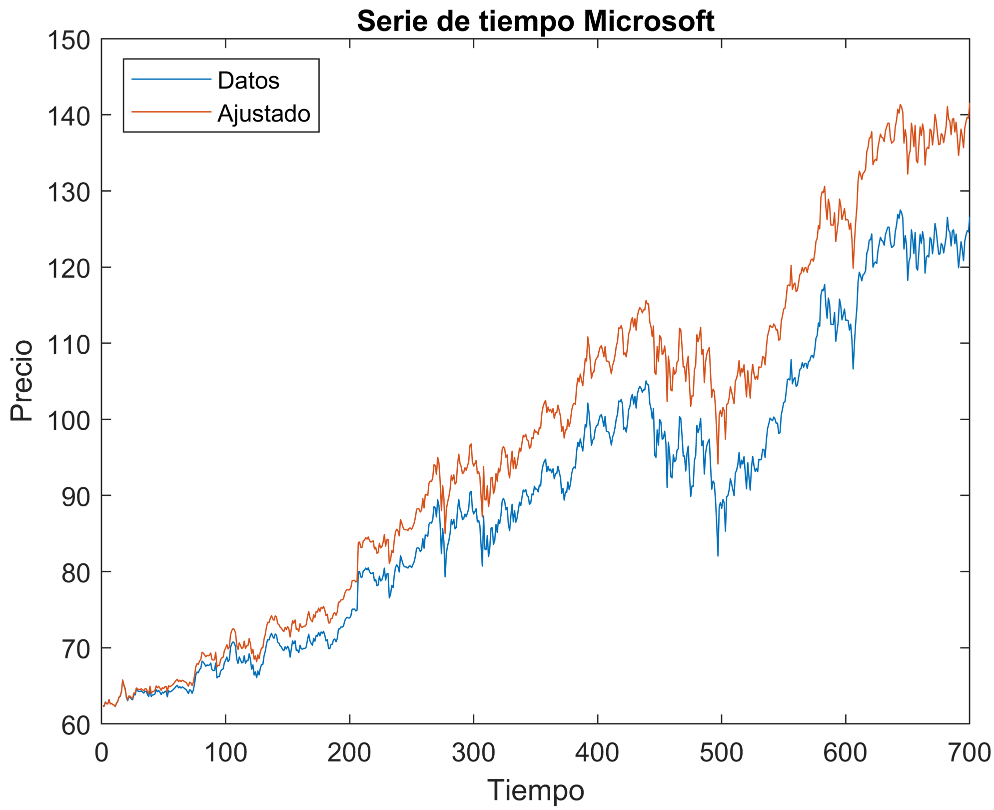
```
suma_x = simplify(suma_x);
sol = subs(suma_x,2);
simplify(sol)
```

ans =

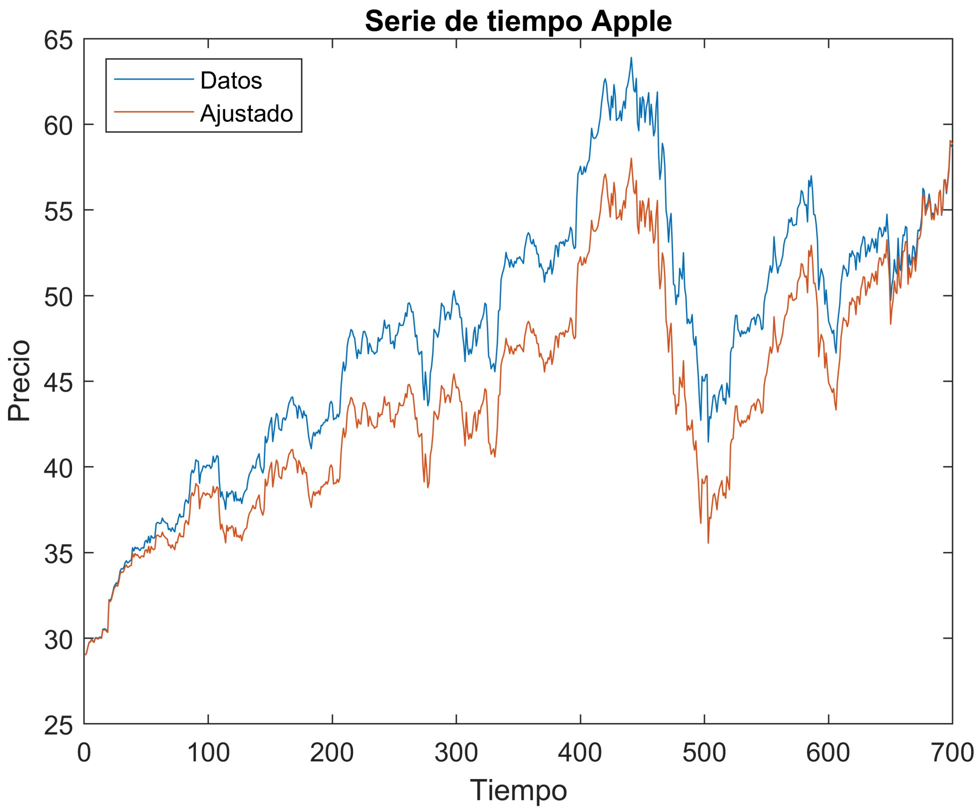
$$\begin{pmatrix} \dfrac{754309607093021111077738992025998629593487162154654542658423974939316483814 29}{120839606237084605610011349833714538103373551854532220673848664499916531302 4} \\ \dfrac{877385567776869767733327242140373767627863973074275040220835433275671559733 9}{302099015592711514025028374584286345258433879636330551684621661249791328256} \end{pmatrix}$$

```
temp = zeros(2,10);
sum_f = [0;0];

for i = 1:700
    sum_f = [f1(i)+sum_f(1);f2(i)+sum_f(2)];
    temp(:,i)= subs(suma_x,i)+sum_f;
end
```

```
comparacion= ze.OutputData;
comparacion1 = comparacion(:,1);
plot(temp(1,:))
hold on
plot(comparacion1)
title('Serie de tiempo Microsoft')
xlabel('Tiempo')
ylabel('Precio')
legend({'Datos','Ajustado'},'Location','northwest')
hold off
```




```
comparacion2 = comparacion(:,2);
plot(temp(2,:))
hold on
plot(comparacion2)
title('Serie de tiempo Apple')
xlabel('Tiempo')
ylabel('Precio')
legend({'Datos','Ajustado'},'Location','northwest')
hold off
```


Serie de tiempo Apple
Datos
Ajustado
Precio
Tiempo
65
60
55
50
45
40
35
30
25
0
100
200
300
400
500
600
700