In every period t, each firm invests an amount of resources which is proportional to past realized profits, $Z_{n,t-1}$:

$$I_{n,t} = \gamma Z_{n,t-1} \tag{2.1}$$

where $\gamma > 0$, say the *investment accelerator*, is a time-invariant parameter, uniform across firms.

```
model Firm
  parameter Real period_size = 10;
  parameter Real gamma; //investment accelerator
  Real Z; //Profits
  Real I; //Investment
equation
  when sample(0,period_size) then
    I = gamma * pre(Z);
  end when;
end Firm;
```

{Firm}

Based on investment decisions, firms accumulate capital[3]:

$$K_{n,t} = K_{n,t-1} + I_{n,t} \tag{2.2}$$

From the financial point of view, capital is covered by both internal resources – the net worth $A_{n,t}$ – and external finance – a bank loan $B_{n,t}$:

$$B_{n,t} = \begin{cases} K_{n,t} - A_{n,t} & \text{if } K_{n,t} > A_{n,t} \\ B_{n,t} = 0 & \text{otherwise} \end{cases} \tag{2.3}$$

We assume that there is a (passive) banking system which provides credit to firms (then, the supply of credit is equal to the demand of credit by construction).

```
model Firm
  parameter Real period_size = 10;
  parameter Real gamma; //investment accelerator
  Real Z;  //Profits
  Real I;  //Investment
  Real K;  //Capital
  Real B;  //Bank Loans
  Real A;  //Net worth
equation
  when sample(0,period_size) then

    if K - pre(A) < 0 then
      B = 0;
    else
      B = K - pre(A);
    end if;
```

```
    I = gamma * pre(Z);
    K = pre(K) + I;
  end when;
end Firm;
```

{Firm}

Firms produce a homogeneous commodity by using a single input, that is capital. In particular, production is proportional to capital:

$$Y_{n,t} = \phi K_{n,t} \tag{2.4}$$

where $\phi > 0$, say the *capital productivity*, is a time-invariant parameter, uniform across firms.

The price $p_{n,t}$ at which firms sell the homogeneous goods Y is a stochastic variable. For the sake of simplicity, we assume that the price is given by a constant, that is the parameter $\bar{p}$, plus a stochastic variable with unitary mean and a *uniform distribution* in the interval $(0, 2)$. Let's also assume that firms sell all the produced output at the stochastic price:

$$p_{n,t} = \bar{p} + U(0, 2) \tag{2.5}$$

```
model Firm
  parameter Real period_size = 10;
  parameter Real gamma; //investment accelerator
  parameter Real phi; //capital productivity
  parameter Real p; //price constant

  Real Z;  //Profits
  Real I;  //Investment
  Real K;  //Capital
  Real B;  //Bank Loans
  Real A;  //Net worth
  Real P;  //Price
  Real U;  //Stochastic variable
  Real Y;  //Product
equation
  when sample(0,period_size) then

    if K - pre(A) < 0 then
      B = 0;
    else
      B = K - pre(A);
    end if;
```

```
    I = gamma * pre(Z);
    K = pre(K) + I;
    P = p + U;
    Y = phi * K;
  end when;
end Firm;
```

{Firm}

As a first approximation, we assume that the cost of capital $r > 0$, say the *interest rate*, is a time-invariant parameter, uniform across firms.

Then, the *n-th* firm's profit is:

$$Z_{n,t} = p_{n,t}Y_{n,t} - rK_{n,t} = (p_{n,t}\phi - r)K_{n,t} \tag{2.6}$$

which implies that dividends are proportional to the interest paid on the bank loan (that is, the cost of self-finance is equal to the cost of external finance).

Based on the realized profit, firms update their net worth:

$$A_{n,t+1} = A_{n,t} + Z_{n,t} \tag{2.7}$$

```
model Firm
  parameter Real period_size = 10;
  parameter Real gamma;//investment accelerator
  parameter Real phi;  //capital productivity
  parameter Real p;    //price constant
  parameter Real r;    //cost of capital (interest rate)

  Real Z;  //Profits
  Real I;  //Investment
  Real K;  //Capital
  Real B;  //Bank Loans
  Real A;  //Net worth
  Real P;  //Price
  Real U;  //Stochastic variable
  Real Y;  //Product
equation
  when sample(0,period_size) then

    if K - pre(A) < 0 then
      B = 0;
    else
      B = K - pre(A);
    end if;

    I = gamma * pre(Z);
    K = pre(K) + I;
    P = p + U;
    Y = phi * K;
    Z = P * Y - r * K;
    A = pre(A) + pre(Z);
```

```
  end when;
end Firm;
```

{Firm}

```
#PARAMETER SETTING
#Investment accelerator
gamma <- 1.1
#Capital productivity
phi <- 0.1
#Interest rate
r <- 0.1
#Random price constant
Pbar <- 0.01
```

```
model Firm
  parameter Real period_size = 10;
  parameter Real gamma = 1;    //investment accelerator
  parameter Real phi = 0.1;      //capital productivity
  parameter Real p = 0.01;     //price constant
  parameter Real r = 0.1;      //cost of capital (interest rate)

  Real Z;  //Profits
  Real I;  //Investment
  Real K;  //Capital
  Real B;  //Bank Loans
  Real A;  //Net worth
  Real P;  //Price
  Real U;  //Stochastic variable
  Real Y;  //Product
equation
  when sample(0,period_size) then

    if K - pre(A) < 0 then
      B = 0;
    else
      B = K - pre(A);
    end if;

    I = gamma * pre(Z);
    K = pre(K) + I;
    P = p + U;
    Y = phi * K;
    Z = P * Y - r * K;
    A = pre(A) + pre(Z);
  end when;
end Firm;
```

{Firm}

```
#ALLOCATING VARIABLES AND INITIAL CONDITIONS
#Firms’ net worth
A <- matrix(data=1,ncol=1,nrow=Ni)
#Firms’ capital
K <- matrix(data=1,ncol=1,nrow=Ni)
#Firms’ debt
B <- matrix(data=0,ncol=1,nrow=Ni)
#Firms’ investment
I <- matrix(data=0,ncol=1,nrow=Ni)
#Stochastic price
P <- matrix(data=0,ncol=1,nrow=Ni)
#Firms’ production
Y <- matrix(data=0,ncol=1,nrow=Ni)
#Firms’ profit
Z <- matrix(2*runif(Ni)+Pbar,ncol=1,nrow=Ni)
#Aggregate production
YY <- matrix(data=0,ncol=1,nrow=Time)
```

the initial conditions for Z are such that each element of this matrix is picked at random from a uniform distribution with support $(Pbar, Pbar + 2)$.

```
model Firm
  parameter Real period_size = 10;
  parameter Real gamma = 1;    //investment accelerator
  parameter Real phi = 0.1;      //capital productivity
  parameter Real p = 0.01;     //price constant
  parameter Real r = 0.1;      //cost of capital (interest rate)

  Real Z;  //Profits
  Real I (start = 0);  //Investment
  Real K (start = 1);  //Capital
  Real B (start = 0);  //Bank Loans
  Real A (start = 1);  //Net worth
  Real P (start = 0);  //Price
  Real U;              //Stochastic variable
  Real Y (start = 0);  //Product
equation
  when sample(0,period_size) then

    if K - pre(A) < 0 then
      B = 0;
    else
      B = K - pre(A);
    end if;

    I = gamma * pre(Z);
    K = pre(K) + I;
    P = p + U;
    Y = phi * K;
    Z = P * Y - r * K;
    A = pre(A) + pre(Z);
  end when;
end Firm;
```

{Firm}

```
Z[A<0] <- 0 #Entry condition
K[A<0] <- 1 #Entry condition
A[A<0] <- 1 #Entry condition
```

```
model Firm
  parameter Real period_size = 10;
  parameter Real gamma = 1;    //investment accelerator
  parameter Real phi = 0;      //capital productivity
  parameter Real p = 0.01;     //price constant
  parameter Real r = 0.1;      //cost of capital (interest rate)

  Real Z;  //Profits
  Real I (start = 0);  //Investment
  Real K (start = 1);  //Capital
  Real B (start = 0);  //Bank Loans
  Real A (start = 1);  //Net worth
  Real P (start = 0);  //Price
  Real U;              //Stochastic variable
  Real Y (start = 0);  //Product
equation
  when sample(0,period_size) then

    if K - pre(A) < 0 then
      B = 0;
    else
      B = K - pre(A);
    end if;

    if pre(A) < 0 then
      A = 1;
      K = 1;
    else
      A = pre(A) + pre(Z);
      K = pre(K) + I;
    end if;

    I = gamma * pre(Z);
    P = p + U;
    Y = phi * K;
    Z = P * Y - r * K;

  end when;
end Firm;
```

{Firm}

```
model System

  parameter Integer n = 10;
  Firm[n] firms;

  initial equation
    for i in 1:size(firms,1) loop
      firms[i].K = i;
    end for;
end System;
```

{System}

P**roblemas:**
1) No está funcionando el hecho de que cada U de cada empresa, se calcule de forma independiente
2) No sé exactamente dónde setear los valores iniciales de Z para cada empresa en System (initial equation ? initial algorithm?)