1 Programs and dataset

Programs and dataset used in the article "When is there more employment, with individual or collective wage bargaining?" by José R. García and Valeri Sorolla.

Both the analysis of the simulation and the numerical solution have been made using Scientific WorkPlace 5.5. The valuesof the parameters that were used in the simulation as input values have been obtained from other works that are fully referenced in the article.

1.1 Calibration for the US

Table 1 summarizes the parameter values for the benchmark case.

Table 1

Calibrated parameter, United States		
Description	Parameter	Value
Real interest rate	r	0.012
Leisure value	b	0.4
Separation rate	λ	0.1
Labour share	α	0.65
Vacancy posting cost	γ	0.213
Workers' bargaining power	β	0.5
Elasticity of X with respect to vacancies	φ	0.5

Figure 5.

Assuming a value of b=0.4 the solution of the system of equations is the following:

$$\begin{aligned} 0.65 * (\frac{1-0.4}{\beta} + 0.4) - 1 - 0.213 * (0.012 + 0.1) * \theta^{(1-0.5)} &= 0 \\ \frac{(1-0.4)}{\beta} + 0.4 - 0.213 * \theta - 1 - 0.213 * (0.012 + 0.1) * \theta^{(1-0.5)} &= 0 \end{aligned}$$

Solution is: $[\theta = 2.625\,7, \beta = 0.500\,86]$

Graphically we can also draw both equations and find the solution of the system.

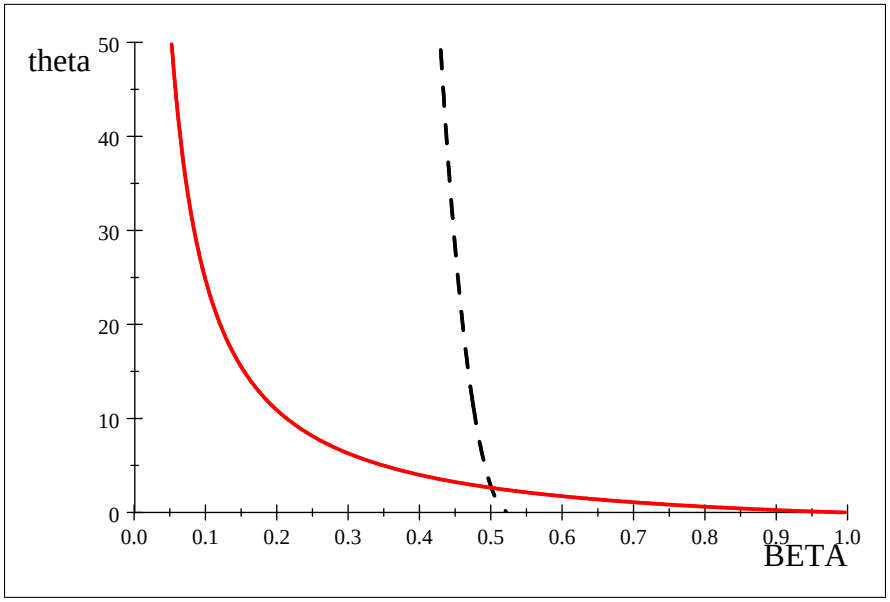

Fig. 5 Changes of labour market tightness with respect to β: US.

Figura 6.
Analysis of the parameter b

$$\begin{aligned} 0.65 * (\frac{1-b}{0.5} + b) - 1 - 0.213 * (0.012 + 0.1) * \theta^{(1-0.5)} &= 0 \\ \frac{(1-b)}{0.5} + b - 0.213 * \theta - 1 - 0.213 * (0.012 + 0.1) * \theta^{(1-0.5)} &= 0 \end{aligned}$$

Solution is: $[b = 0.402\,07, \theta = 2.625\,7]$

Graphically we can also draw both equations and find the solution of the system.

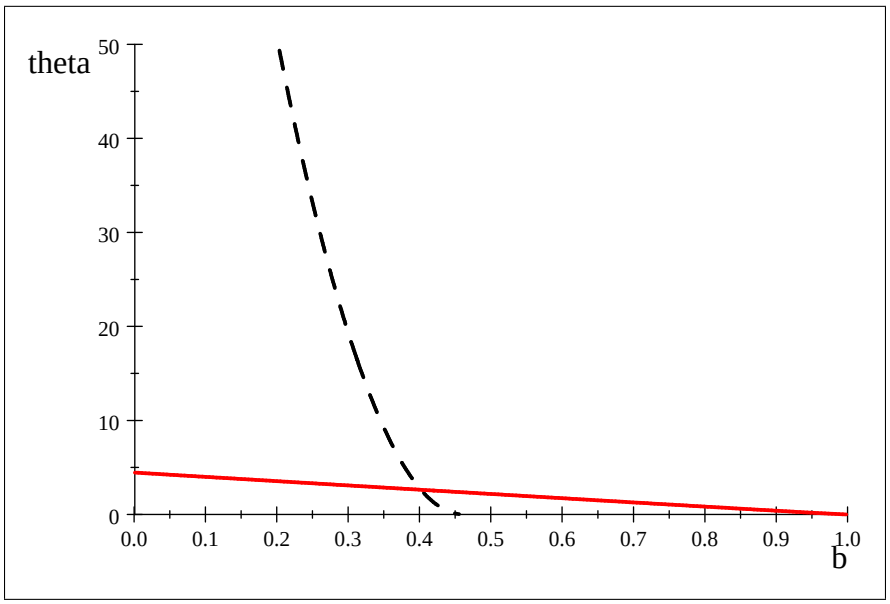

Fig. 6 Changes of labour market tightness with respect to leisure value: US.

Figura 7.
Analysis of the interest rate, r.
Solution collective bargaining
$0.65 * (\frac{1-0.4}{0.5} + 0.4) - 1 - 0.213 * (r + 0.1) * \theta^{(1-0.5)} = 0$
Individual negotiation solution
$\frac{(1-0.4)}{0.5} + 0.4 - 0.21 * \theta - 1 - 0.213 * (r + 0.1) * \theta^{(1-0.5)} = 0$
The system of two equations is

$$\begin{aligned} 0.65 * (\frac{1-0.4}{0.5} + 0.4) - 1 - 0.213 * (r + 0.1) * \theta^{(1-0.5)} &= 0 \\ \frac{(1-0.4)}{0.5} + 0.4 - 0.213 * \theta - 1 - 0.213 * (r + 0.1) * \theta^{(1-0.5)} &= 0 \end{aligned}$$

Solution is: $[r = 1.581\,8 \times 10^{-2}, \theta = 2.629\,1]$
Graphically we can also draw both equations and find the solution of the system.

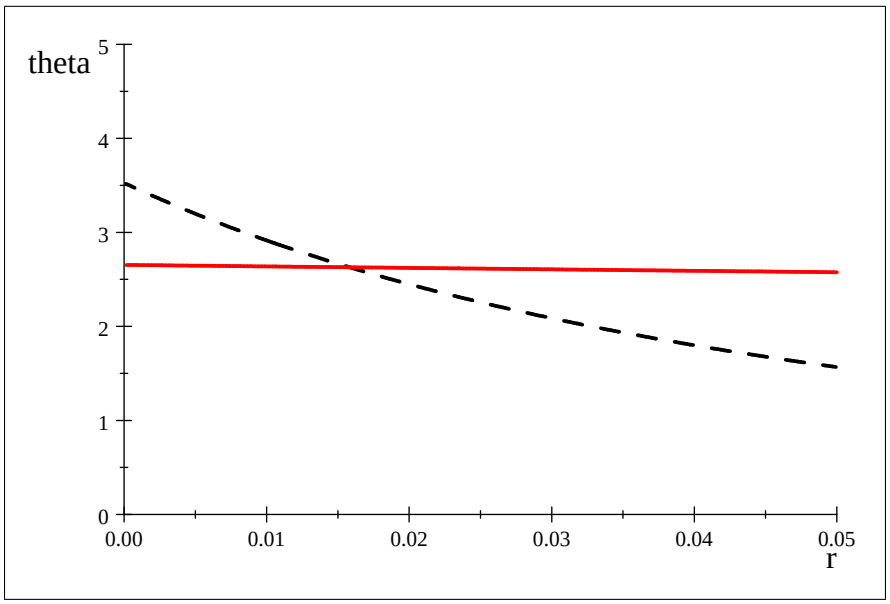

Fig. 7 Changes of labour market tightness with respect to the real interest rate: US.

Figura 8.
Analysis of vacancy costs, γ.
Solution collective bargaining
$0.65 * (\frac{1-0.4}{0.5} + 0.4) - 1 - \gamma * (0.012 + 0.1) * \theta^{(1-0.5)} = 0$
Individual negotiation solution
$\frac{(1-0.4)}{0.5} + 0.4 - \gamma * \theta - 1 - \gamma * (0.012 + 0.1) * \theta^{(1-0.5)} = 0$
The system of two equations is

$$\begin{aligned} 0.65 * (\frac{1-0.4}{0.5} + 0.4) - 1 - \gamma * (0.012 + 0.1) * \theta^{(1-0.5)} &= 0 \\ \frac{(1-0.4)}{0.5} + 0.4 - \gamma * \theta - 1 - \gamma * (0.012 + 0.1) * \theta^{(1-0.5)} &= 0 \end{aligned}$$

Solution is: $[\theta = 2.458\,6, \gamma = 0.227\,77]$

Graphically we can also draw both equations and find the solution of the system.

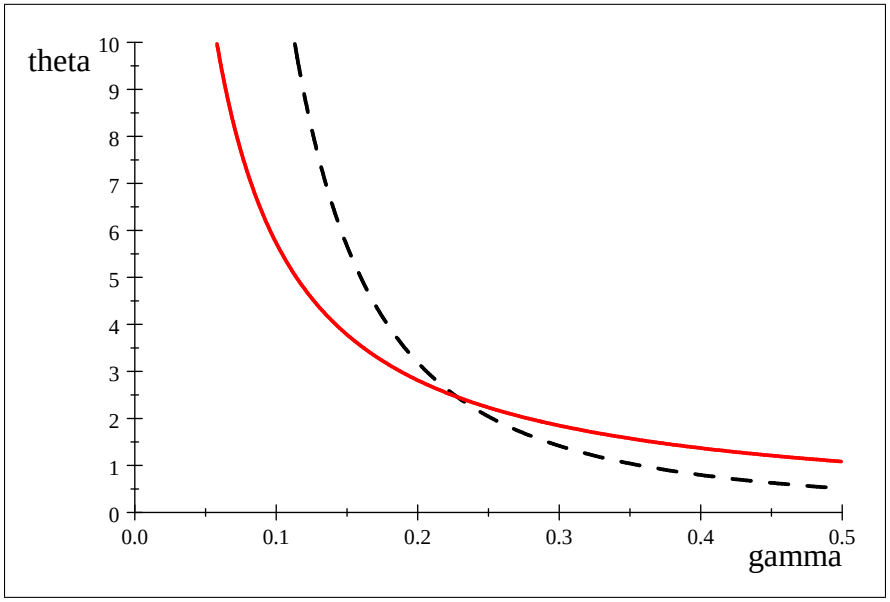

Fig. 8 Changes of labour market tightness with respect to vacancy posting cost: US.

1.2 Calibration for Spain

Table 2 summarizes the benchmark parameter values.

Table 2

Calibrated parameter, Spain		
Description	Parameter	Value
Real interest rate	r	0.012
Leisure value	b	0.489
Separation rate	λ	0.06
Labour share	α	0.60
Vacancy posting cost	γ	0.183
Workers' bargaining power	β	0.43
Elasticity of X with respect to vacancies	φ	0.57

Figura 9.
Solution collective bargaining
$0.6 * (\frac{1-0.489\,86}{\beta} + 0.489\,86) - 1 - 0.1841 * (0.012 + 0.06) * \theta^{(1-0.57)} = 0$
Individual negotiation solution
$\frac{(1-0.489\,86)}{\beta} + 0.489\,86 - 0.1841 * \theta - 1 - 0.1841 * (0.012 + 0.06) * \theta^{(1-0.57)} = 0$
The system of two equations is

$$0.6 * (\frac{1 - 0.489\,86}{\beta} + 0.489\,86) - 1 - 0.1841 * (0.012 + 0.06) * \theta^{(1-0.57)} = 0$$

$$\frac{(1 - 0.489\,86)}{\beta} + 0.489\,86 - 0.1841 * \theta - 1 - 0.1841 * (0.012 + 0.06) * \theta^{(1-0.57)} = 0$$

Solution is: $\{[\theta = 3.705\,5, \beta = 0.419\,66]\}$

Graphically we can also draw both equations and find the solution of the system.

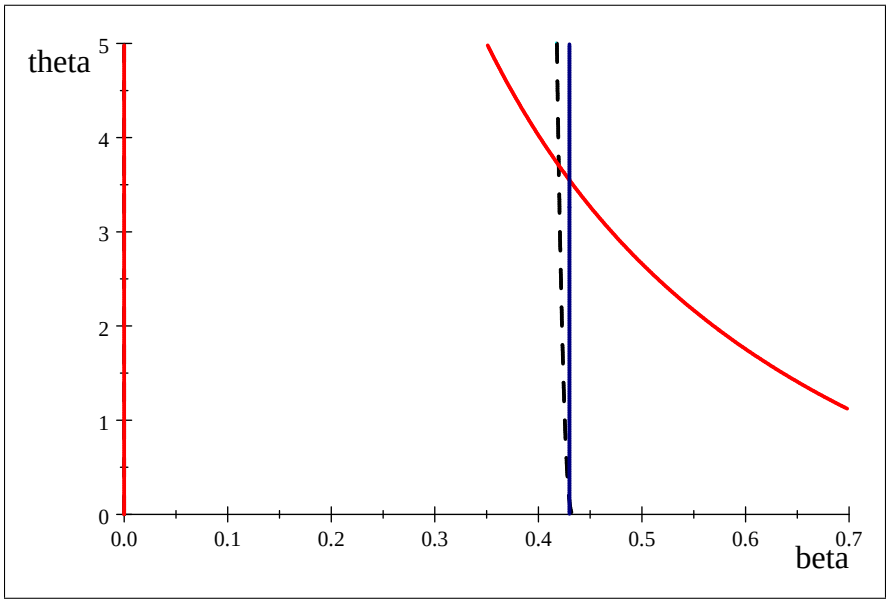

Fig. 9 Changes of labour market tightness with respect to β: Spain.

Figura 10.

Analysis of the parameter b

Solution collective bargaining

$0.6 * (\frac{1-b}{0.43} + b) - 1 - 0.1841 * (0.012 + 0.06) * \theta^{(1-0.57)} = 0$

Individual negotiation solution

$\frac{(1-b)}{0.43} + b - 0.1841 * \theta - 1 - 0.1841 * (0.012 + 0.06) * \theta^{(1-0.57)} = 0$

The system of two equations is

$$0.6 * (\frac{1 - b}{0.43} + b) - 1 - 0.1841 * (0.012 + 0.06) * \theta^{(1-0.57)} = 0$$

$$\frac{(1 - b)}{0.43} + b - 0.1841 * \theta - 1 - 0.1841 * (0.012 + 0.06) * \theta^{(1-0.57)} = 0$$

Solution is: $\{[b = 0.467\,81, \theta = 3.705\,5]\}$

Graphically we can also draw both equations and find the solution of the system.

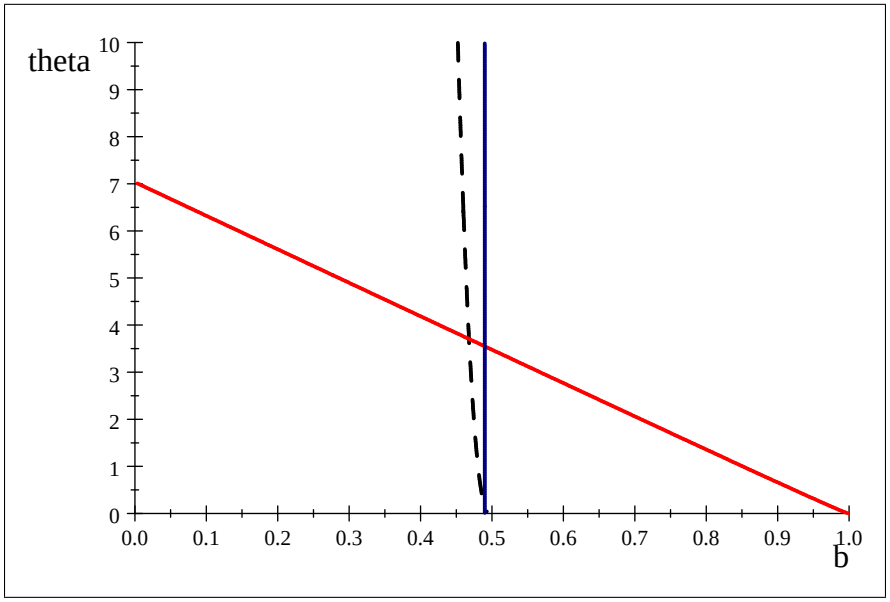

Fig. 10 Changes of labour market tightness with respect to leisure value: Spain.

Figura 11.

Analysis of the interest rate, r.
Solution collective bargaining
$0.6 * (\frac{1-0.489\,86}{0.43} + 0.489\,86) - 1 - 0.1841 * (r + 0.06) * \theta^{(1-0.57)} = 0$
Individual negotiation solution
$\frac{(1-0.489\,86)}{0.43} + 0.489\,86 - 0.1841 * \theta - 1 - 0.1841 * (r + 0.06) * \theta^{(1-0.57)} = 0$
The system of two equations is

$$\begin{aligned} 0.6 * (\frac{1 - 0.489\,86}{0.43} + 0.489\,86) - 1 - 0.1841 * (r + 0.06) * \theta^{(1-0.57)} &= 0 \\ \frac{(1 - 0.489\,86)}{0.43} + 0.489\,86 - 0.1841 * \theta - 1 - 0.1841 * (r + 0.06) * \theta^{(1-0.57)} &= 0 \end{aligned}$$

Solution is: $\{[r = -4.211\,8 \times 10^{-2}, \theta = 3.642]\}$

Graphically we can also draw both equations and find the solution of the system.

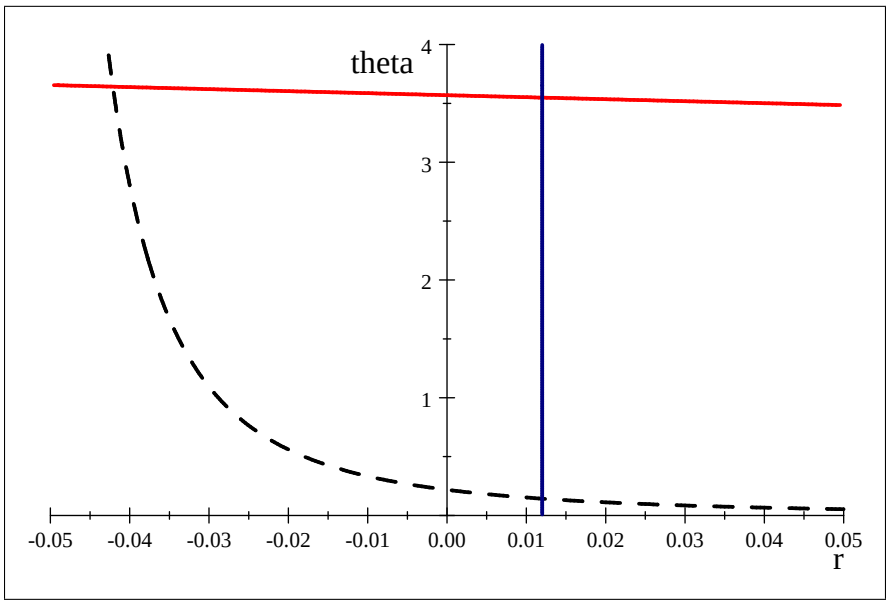

Fig. 11 Changes of labour market tightness with respect to the real interest rate: US.

Figura 12.
Analysis of vacancy costs, γ.
Solution collective bargaining
$0.6 * (\frac{1-0.489\,86}{0.43} + 0.489\,86) - 1 - \gamma * (0.012 + 0.06) * \theta^{(1-0.57)} = 0$
Individual negotiation solution
$\frac{(1-0.489\,86)}{0.43} + 0.489\,86 - \gamma * \theta - 1 - \gamma * (0.012 + 0.06) * \theta^{(1-0.57)} = 0$
The system of two equations is

$$\begin{aligned} 0.6 * (\frac{1 - 0.489\,86}{0.43} + 0.489\,86) - 1 - \gamma * (0.012 + 0.06) * \theta^{(1-0.57)} &= 0 \\ \frac{(1 - 0.489\,86)}{0.43} + 0.489\,86 - \gamma * \theta - 1 - \gamma * (0.012 + 0.06) * \theta^{(1-0.57)} &= 0 \end{aligned}$$

Solution is: $\{[\theta = 41.935, \gamma = 1.598\,9 \times 10^{-2}]\}$
Graphically we can also draw both equations and find the solution of the system.

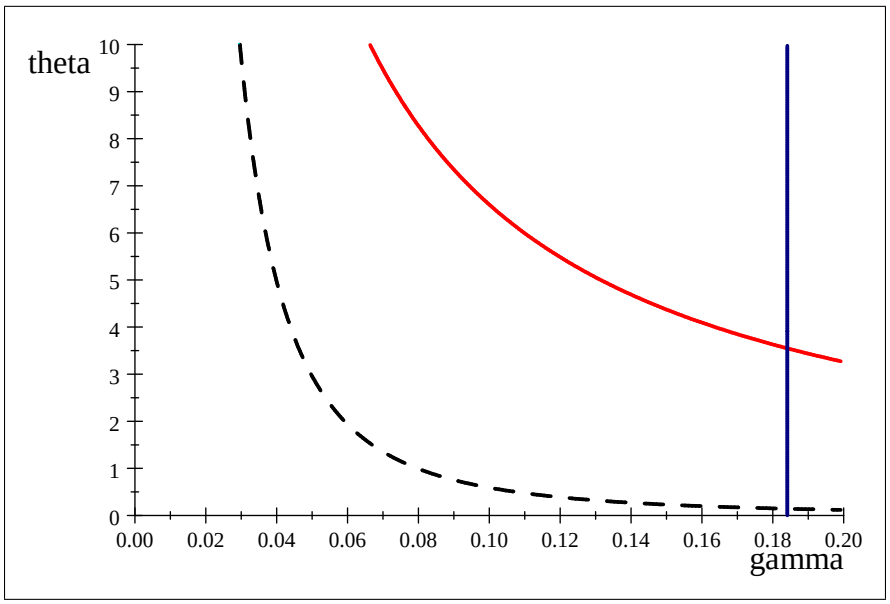

Fig. 12 Changes of labour market tightness with respect to vacancy posting cost: Spain.