Problem Set 3

Skander Garchi Casal

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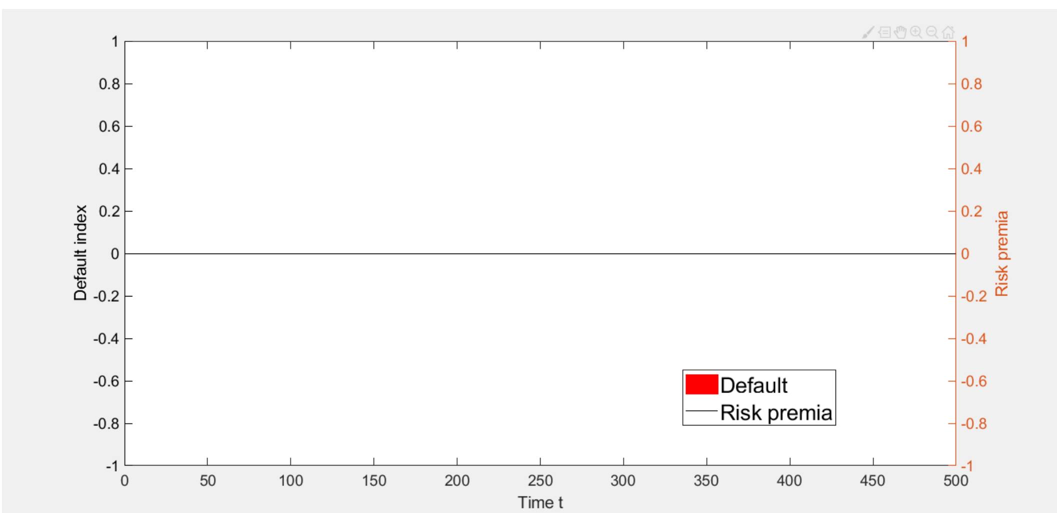
1 Quantitative Macroeconomics, Part 2: Problem set 3

1.1 Quantitative model of sovereign debt

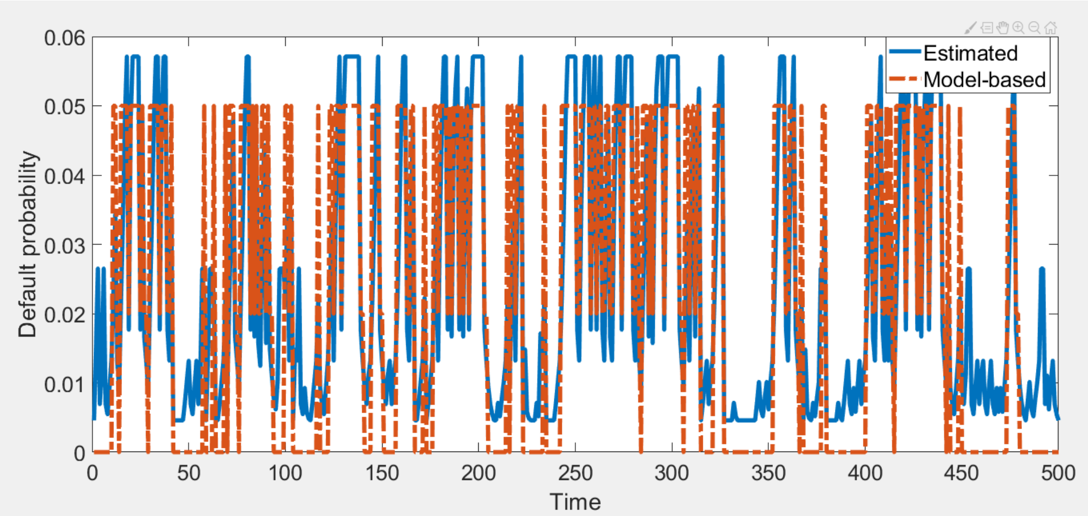
2. Is there default along the equilibrium path



With the parameters proposed in the problem set there is no default in equilibrium. This might come from a cost of defaulting that is too high compared to deciding not to default. As you can see on the graph above, there is no shaded area representing that default has occured. Moreover, the default risk premium is zero, which indicates that investors anticipated not defaulting as being an equilibrium outcome.

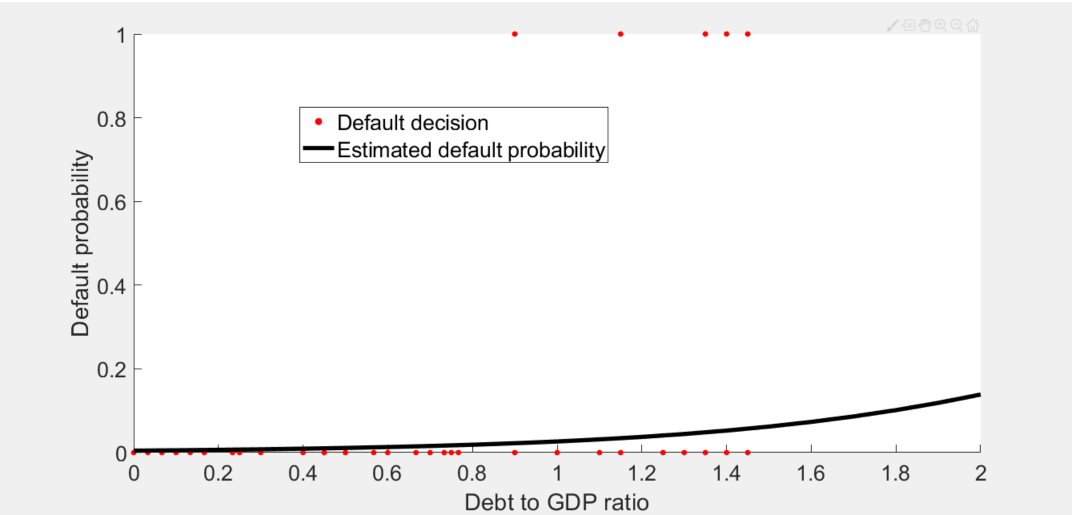
a.

For the following graphs the set of parameters are changed to the values suggested in the code as being an alternative to the ones in the problem set.



The 3 percent average default is easily reached, as you can see on the graph above, the probability of default in the simulation fluctuates around 3 percent.

b.



The graph tells us that the higher the debt to gdp ratio, the higher is the probability of the country to default. It is realistic and consistent with our model. When the debt to gdp ratio increases, the default incentives become more important. If the debt to gdp ratio is high this means that the debt was too high to begin with or that the country is suffering from a bad TFP shock. The government is more likely to default in this situation because the cost of being excluded from financial markets and the loss from gdp generated by an eventual default is not large enough compared to the loss in consumption induced by a high level of debt to gdp ratio.

3. Using Data

a.

The probit with fixed effects is estimated in the file *logit_reg.m*. The probit is estimated for a sub-sample of the data containing mainly countries from Latin America.

$Default_i = \frac{1}{1+exp(-\gamma \frac{B}{Y}_i - \alpha_i)}$

b.

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Error: -0.163294
Logit Simulation: 9.176906
tau: 0.044271
tau: 0.177083
tau: 0.221353
beta: 0.962795
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The calibration of β and τ in the model is performed as follow:
First I perform the estimation of the logit on the true data with fixed effects. Ones I estimated the parameter γ I can proceed to estimate it in the simulation. Let $\hat{\gamma^{(1)}}$ the estimator of the true data, and $\hat{\gamma^{(2)}}$ the estimator of the simulation. To update the parameters β and τ I first define a lower and upper bound for them that will be changing through the iterations. If $\hat{\gamma^{(1)}} \leq \hat{\gamma^{(2)}}$ it means that the probability of default is too high in the model so we need to take measures in order to reduce it. What can be done is to increase the cost of defaulting by increasing β and τ.In the case $\hat{\gamma^{(2)}} < \hat{\gamma^{(1)}}$ the probability of default in the model is too low so we need to lower the cost of defaulting by lowering β and τ. The update of the parameters is done the following way:

Description of the algorithm

Assume that x is the variable we are interested in updating, so we define $\bar{x}$ as being the upper bound of x, and $\underline{x}$ the lower bound. Let η be the speed of convergence.

Assume ϵ to be our error, and that if $\epsilon > 0$ we want to go in the direction of $\underline{x}$. Moreover, if $\epsilon \leq 0$ we want to go in the direction of $\bar{x}$.

$$if\ \epsilon > 0$$
$$\bar{x} = x$$
$$x = (1 - \eta)x + \eta\underline{x}$$
$$else\ if\ \epsilon \leq 0$$
$$\underline{x} = x$$
$$x = (1 - \eta)x + \eta\bar{x}$$