1 Lake Model

These are variations on the `https://lectures.quantecon.org/jl/lake_model.html` with annotated code in `https://github.com/jlperla/ECON407_2018/blob/master/notebooks/lake_model_annotated.ipynb`. Recall that in the example, the fiscal policy had a lump-sum tax paid by all in the workforce (i.e. τN_t was the revenue) which paid for the unemployment benefits, and the balanced budget constraint is $\tau N_t = cU_t$.

Taxing Only Workers

Consider a variation where the government only taxes those who are working, but maintains the lump-sum tax. That is, the post-tax income for the unemployed is c and the post-tax income for workers is $w - \tau$. With this, the revenue generated is now τE_t and the balanced budget is now $\tau E_t = cU_t$, or after normalizing by the population $\tau e = cu$

1. Replicate the key figures from the code which show the Unemployment Rate, Employment Rate, Tax, and Welfare as a function of the unemployment benefits in equilibrium.

2. Given your solution above, compare it to the highest welfare in the previous example with a lump-sum paid by the entire workforce. Which policy should a the government implement to maximize welfare? Interpret the results.

(Optional) Proportional Tax

As a bonus, and/or consider it as a final project.

Consider another variation where the tax is a fraction of income for the employed. That is, for some τ_w, the post-tax income of a worker is $(1 - \tau_w)w$ while the unemployed are not taxed. Replicate the key figures from the code, as before, and compare the policy to the others.[1]

You can even consider a variation with a progresive tax. That is, τ_w is a function of w itself. For example, each wage could have its own $\tau_w(w)$ tax-rate, which is typically increasig in w.

2 Asset Pricing

These are variations on the `https://lectures.quantecon.org/jl/markov_asset.html` with annotated code in `https://github.com/jlperla/ECON407_2018/blob/master/notebooks/markov_asset.ipynb`

Pricing a High-Low Markov Chain Assume that the consumer's preferences and parameters are identical to those in the "Asset Prices under Risk Aversion" case `https://lectures.quantecon.org/jl/markov_asset.html#asset-prices-under-risk-aversion`

However, instead of the discretized AR(1) process in that section, assume that aggregate consumption is either c_ℓ or c_h. If aggregate consumption is c_ℓ at time t, then the probability that it is c_ℓ at time $t+1$ is $\lambda_\ell \in (0, 1)$. If it is c_h at time t, then the probability that it remains at c_h at time $t+1$ is $\lambda_h \in (0, 1)$.

[1] Hint: the tricky part of this problem is figuring out what the balanced budget requirement is. The revenue the government spends is still cU_t, but to find the revenue collected you will need to use the distribution of wages conditional on working and use it to find the revenue required.

1. Setup the markov chain P for this stochastic process
2. Adapt the existing code to calculate the price of a claim to the dividends $d_t = c_t$ given the current state ℓ or h
3. Let $\lambda_\ell = \lambda_h = 0.5, c_\ell = 1.0$. Plot the price to dividends ratio for the different states for a grid of $c_h \in [1.0, 2.0]$
4. Now, let $c_h = 1.1$ and $\lambda_\ell = 0.2$. Plot the price to dividend ratio for a grid of $\lambda_h \in [0.5, 0.99)$ and interpret the results.

Pricing a Consol under Log Utility This problem adapts the `https://lectures.quantecon.org/jl/markov_asset.html#a-risk-free-consol` code described in the "Pricing the Consol" code in `https://github.com/jlperla/ECON407_2018/blob/master/notebooks/markov_asset.ipynb`

Take the existing model, with the discretized AR(1) process in the existing code and make a single change to the structure. Recall that the definition of the stochastic discount factor is $m_{t+1} = \beta \frac{u'(c_{t+1})}{u'(c_t)}$.

1. Instead of the stochastic discount factor being CRRA (i.e. $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$)), assume that the utility is $u(c) = \log(c)$. Derive the stochastic discount factor and adapt the code to solve for the price of a consol.
2. Let $\zeta = 1.0$. From an initial condition, simulate the price of the consol with the log utility from an initial condition of your choice, and graph the results