

# Home Assignment 2: Growth and Development Economics

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# 1 Praying for Rain: The Welfare Cost of Seasons

The welfare gains of removing the seasonal component are found by satisfying the following equation:

$$\sum_{t=1}^{40} \beta^{12t} \sum_{m=1}^{12} \beta^{m-1} u((1+g)z_i e^{g(m)} e^{-\sigma_\epsilon^2/2} \epsilon_{t,i}) = \sum_{t=1}^{40} \beta^{12t} \sum_{m=1}^{12} \beta_{m-1} u(z_i e^{-\sigma_\epsilon^2/2} \epsilon_{t,i}) \quad (1)$$

Note that from 1 the higher the seasonality, the benefits are greater from removing seasonality. This can be explain by having an  $\eta = 1$  in the CRRA utility function, which reflects risk averse consumers.

Now, if we remove the non seasonal consumption risk, we consider the following equation:

$$\sum_{t=1}^{40} \beta^{12t} \sum_{m=1}^{12} \beta^{m-1} u((1+g)z_i e^{g(m)} e^{-\sigma_\epsilon^2/2} \epsilon_{t,i}) = \sum_{t=1}^{40} \beta^{12t} \sum_{m=1}^{12} \beta_{m-1} u(z_i e^{g(m)} \epsilon_{t,i}) \quad (2)$$

So that table 2 show us that the welfare gains are the same, as we are not considering individual time varying shocks. Now, notice that the distribution of the welfare gains is close to the normal distribution, as shown in figure 1. In this case, given their utility function, individuals will always prefer smooth consumption. In that sense they are better off by removing stochastic components.

Now, for  $\eta = 2$  and  $\eta = 4$ , we can realize that the level of  $\eta$  reflects the level of risk aversion of the individual, where the higher the  $\eta$ , the more risk averse. IN that sense, as you can see from tables 3, 4, and figure 2, the welfare gains of removing seasonality are higher the more risk averse is the person.

For the second part, we are adding an stochastic seasonal component to consumption. So now we consider a consumption defined by:

$$c_{m,t,i} = z_i e^{g(m)} e^{-\sigma_m^2/2} \epsilon_{m,i} e^{-\sigma_\epsilon^2/2} \epsilon_{t,i} \quad (3)$$

So we can find in table 5 the results of welfare gains after removing the deterministic

seasonality. In the case of removing only the stochastic seasonal component, we can consider the results of table 6 and figure 3. Now, for the welfare gains of removing both seasonal components, consider table 7 and figure 4.

This results show us that as the individual is risk averse, the higher the level of  $\sigma_m^2$  the welfare gains are greater.

Because of time I was not able to finish the commenting of the code, but here you can find the rest of the graphs and tables.

	Low	Mid	High
Mean	0.0042	0.0086	0.0171

Table 1: Mean welfare gains of without seasonality ( $\eta = 1$ )

	Low	Mid	High	No season
Mean	0.1077	0.1077	0.1077	0.1077
SD	0.0782	0.0782	0.0782	0.0782

Table 2: Welfare gains of without the nonseasonal consumption risk ( $\eta = 1$ )

	Low	Mid	High
$\eta = 2$	0.0066	0.0185	0.0601
$\eta = 4$	0.0118	0.0426	0.1867

Table 3: Mean welfare gains of without seasonality ( $\eta = 2$  and  $\eta = 4$ )

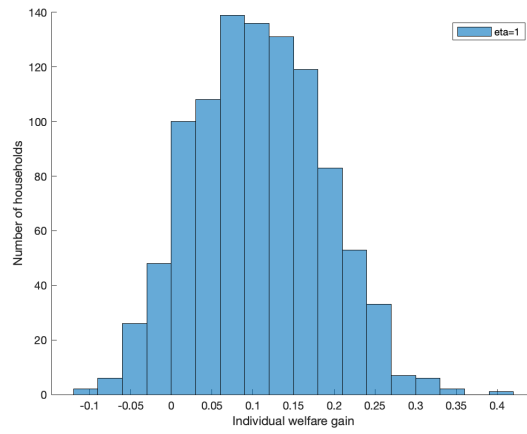


Figure 1: Welfare gains of without non-seasonal consumption risk

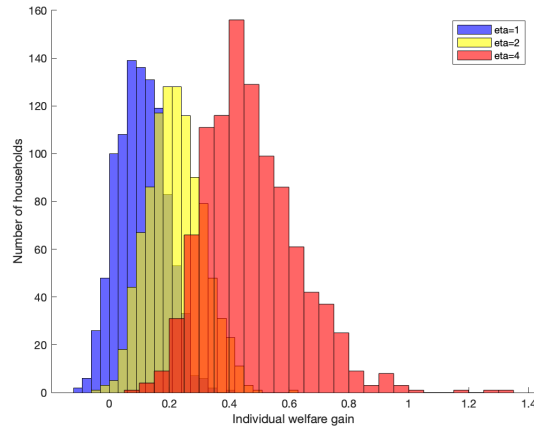


Figure 2: Welfare gains of without non-seasonal consumption risk

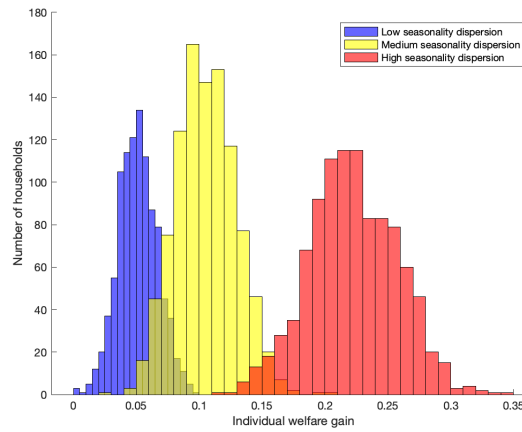


Figure 3: Welfare gains of without both seasonal components

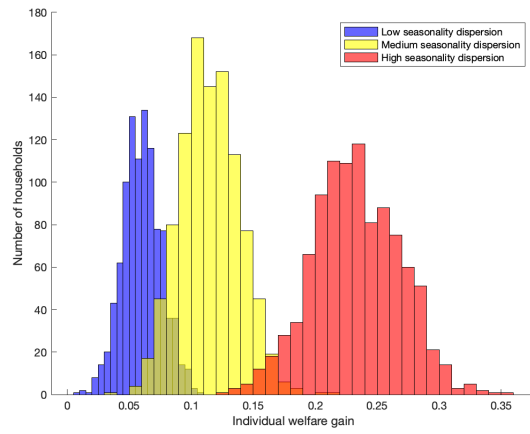


Figure 4: Welfare gains of without non-seasonal consumption risk

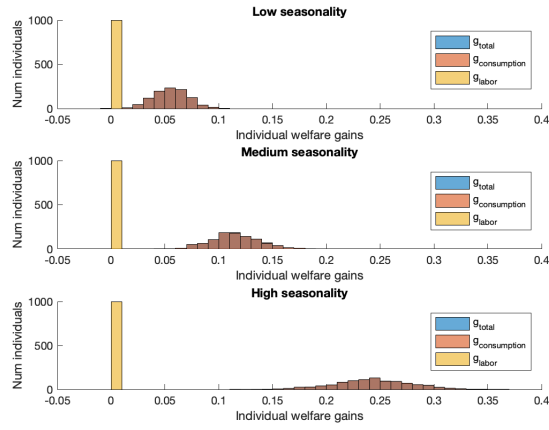


Figure 5: 2A Welfare gains with positive correlation

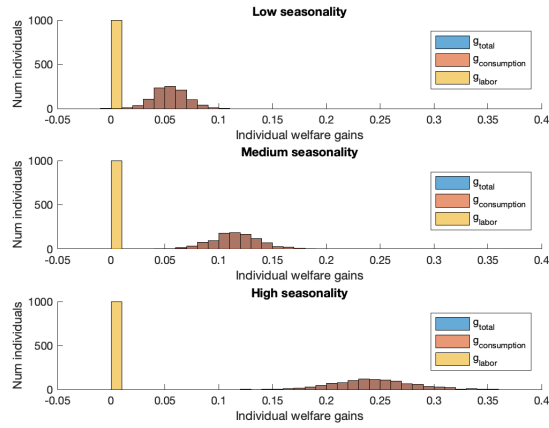


Figure 6: 2B Welfare gains with negative correlation

	Low	Mid	High
$\eta = 2$	0.2211	0.2211	0.2211
$\eta = 4$	0.4742	0.4742	0.4742

Table 4: Welfare gains of without non-seasonal consumption risk

	Low	Mid	High
Mean	0.0086	0.0086	0.0086

Table 5: Welfare gains of without deterministic seasonal component ( $\eta = 1$ )

	Low	Mid	High
Mean	0.0513	0.1055	0.2223
SD	0.0154	0.0237	0.0351

Table 6: Welfare gains of without stochastic seasonal components ( $\eta = 1$ )

	Low	Mid	High
Mean	0.0603	0.1150	0.2329
SD	0.0155	0.0239	0.0354

Table 7: Welfare gains of without both seasonality components ( $\eta = 1$ )

	Low	Mid	High
Mean	0.1077	0.1077	0.1077
SD	0.0782	0.0782	0.0782

Table 8: Welfare gains of without non-seasonal consumption risk ( $\eta = 1$ )

	Low	Mid	High
Mean	0.0137	0.0090	-0.0002

Table 9: Welfare gains of without deterministic seasonal component ( $\eta = 2$ )

	Low	Mid	High
Mean	0.0114	-0.0123	-0.0451

Table 10: Welfare gains of without deterministic seasonal component ( $\eta = 4$ )

	Low	Mid	High
Mean	0.1001	0.2130	0.4794
SD	0.0173	0.0293	0.0545

Table 11: Welfare gains of without stochastic seasonal components ( $\eta = 2$ )

	Low	Mid	High
Mean	0.1907	0.4415	1.1863
SD	0.0414	0.0983	0.3809

Table 12: Welfare gains of without stochastic seasonal components ( $\eta = 4$ )

	Low	Mid	High
Mean	0.1204	0.2354	0.5067
SD	0.0176	0.0299	0.0555

Table 13: Welfare gains of without both seasonality components ( $\eta = 2$ )

	Low	Mid	High
Mean	0.2414	0.5029	1.2794
SD	0.0432	0.1024	0.3971

Table 14: Welfare gains of without both seasonality components ( $\eta = 4$ )

	Low	Mid	High
Mean	0.2206	0.2210	0.2203
SD	0.0907	0.0906	0.0926

Table 15: Welfare gains of without non-seasonal consumption risk ( $\eta = 2$ )

	Low	Mid	High
Mean	0.4716	0.4681	0.4513
SD	0.1621	0.1771	0.2438

Table 16: Welfare gains of without non-seasonal consumption risk ( $\eta = 4$ )

	Low	Mid	High
Mean	0.0137	0.0090	-0.0002

Table 17: Welfare gains of without deterministic seasonal component ( $\eta = 2$ )

	Low	Mid	High
Mean	0.0114	-0.0123	-0.0451

Table 18: Welfare gains of without deterministic seasonal component ( $\eta = 4$ )

	Low	Mid	High
Mean	0.0553	0.1150	0.2434
SD	0.0157	0.0230	0.0359

Table 19: Positive correlation: Total effects

	Low	Mid	High
Mean	0.0553	0.1150	0.2433
SD	0.0157	0.0230	0.0359

Table 20: Positive correlation: Consumption effects

	Low	Mid	High
Mean	0.0271	0.0456	0.1013
SD	0.0152	0.0371	0.1079

Table 21: Positive correlation: Labor effects

	Low	Mid	High
Mean	0.0549	0.1158	0.2439
SD	0.0150	0.0223	0.0355

Table 22: Negative correlation: Total effects

	Low	Mid	High
Mean	0.0549	0.1157	0.2438
SD	0.0150	0.0223	0.0355

Table 23: Negative correlation: Consumption effects

	Low	Mid	High
Mean	0.2837	0.4532	0.9720
SD	0.1573	0.3371	0.8738

Table 24: Negative correlation: Labor effects