# Homework 2

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# 1 Praying for Rain: The Welfare Cost of Seasons

## 1.1 With the deterministic seasonal component of component

### 1.1.1

First, I compute the welfare gains $g$ of removing the seasonal component $e^{g(m)}$. The results(Table 1) show that:

- For all the households, the welfare gains are the same. Because, the seasonal component are deterministic, which means that in the same months, different households in different years will have the same seasonal component. So even for different household, the welfare gains will be the same.
- The welfare gains decrease when the level of seasonality is lower. Because the consumption will less rely on the seasons and the risk of seasonality will be lower.
- When $\eta$ increases, the welfare gain is higher. $\eta$ shows the risk preference of households. A higher level of $\eta$ means a higher level of risk aversion. So it is easy to say that household with higher level of risk aversion will benefit from removing the risk.

| | **Mid** | **High** | **Low** |
|---|---|---|---|
| $\eta$ =**1** | 0.0094 | 0.0464 | 0.0024 |
| $\eta$ =**2** | 0.0196 | 0.1167 | 0.0046 |
| $\eta$ =**4** | 0.0445 | 0.3579 | 0.0093 |

Table 1: The welfare gain when removing deterministic seasonal component.

### 1.1.2

Second, I compute the welfare gains $g$ of removing the nonseasonal consumption risk $e^{-\sigma_\epsilon^2}\epsilon_t$. The welfare gains' distributions with different utility functions are as figure 1 shows. We can see that:

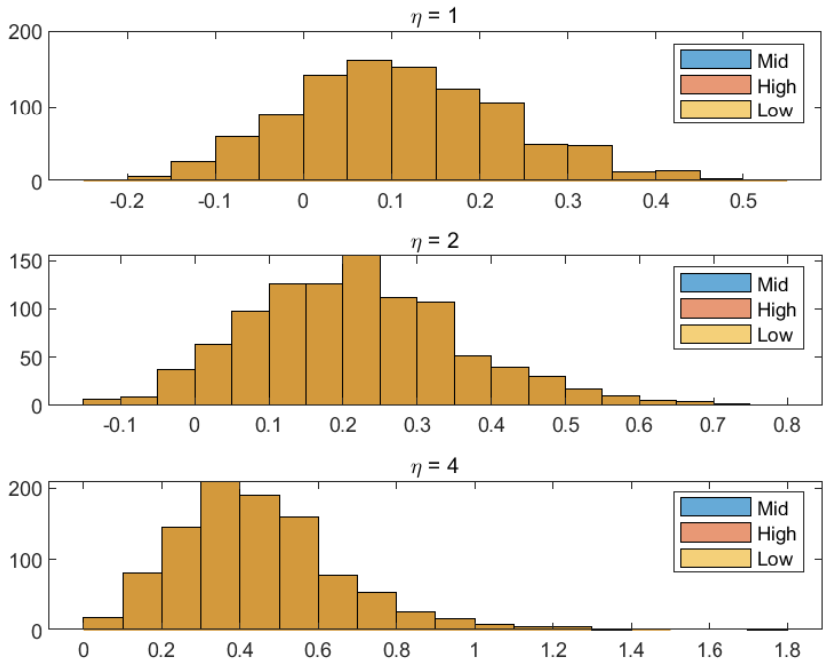


Figure 1: The welfare gain of removing nonseasonal consumption

- The welfare gain do not depend on the seasonality levels. Because for each households, even with the different level of seasonality, the nonseasonal consumption is consistent.
- From the Figure 1, the welfare gain of households are different. Because, in the simulation, some nonseasonal consumption risk may be positive for some households while some may be negative.
- For different $\eta$, the welfare gains are different. The reason is the same as I explain before.

## 1.2 With the deterministic and stochastic seasonal component

In this partthe stochastic seasonal component will be included in consumption. So there will be 9 combinations of deterministic and stochastic seasonal component. //

### 1.2.1

First, remove the seasonal consumption. The figure 2,3 and 4 show the welfare gain of removing seasonal consumption with different combinations. After comparing these figures, we can see that:

- The welfare gains of removing the deterministic component depends on the degree of seasonality of the deterministic component. Similarly, the welfare gains of removing the stochastic component depends on the degree of seasonality of the stochastic component.

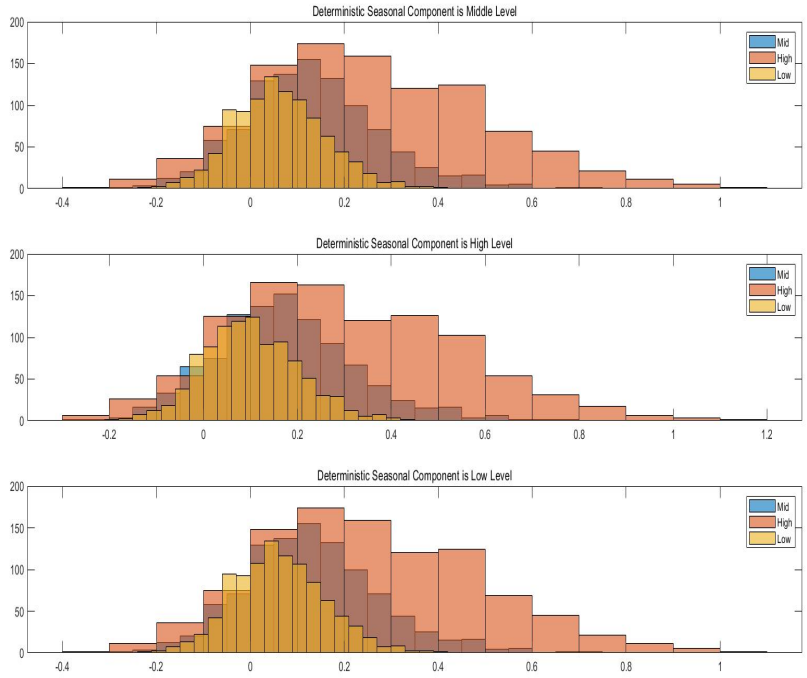


Figure 2: The welfare gain of removing seasonal consumption with median degree deterministic seasonal component.

- The welfare gains of removing total seasonal component is close to the sum of two separate effects. (Although it is hard to see from the figures.)
- Higher degrees of seasonality will lead to higher gains from removing seasonality.
- With different risk preference $\eta$, the welfare gains will be different in levels and distribution, which is similar to the results we see before.

### 1.2.2

Second, remove the nonseasonal consumption. the figure 5,6 and 7 show the welfare gain of removing nonseasonal consumption with different combinations. we can see the similar results as 1.1.2. The welfare gain of removing nonseasonal component will not depend on the degrees of seasonality. And the nonseasonal consumption risk contributes to the heterogeneity in the welfare gain.

## 2 Adding Seasonal Labor Supply

This part adds seasonal labor supply. The relationship between labor and consumption can be positive or negative. To get the contribution of consumption and labor, I will

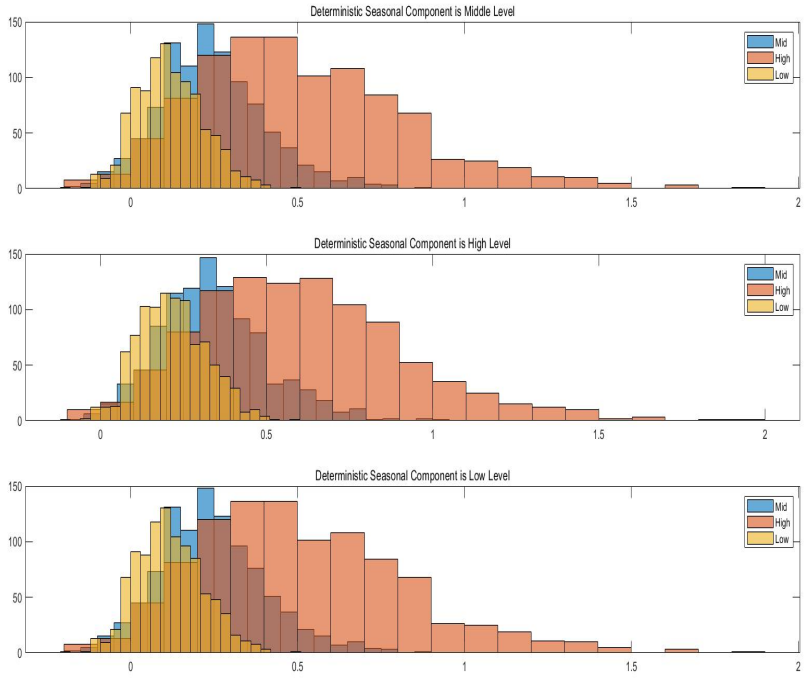


Figure 3: The welfare gain of removing seasonal consumption with high degree deterministic seasonal component.

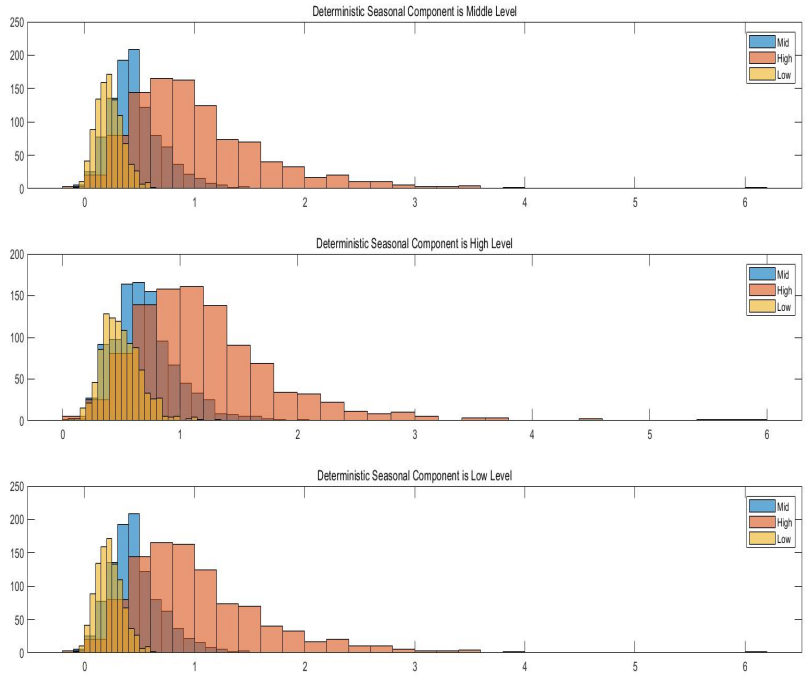


Figure 4: The welfare gain of removing seasonal consumption with low degree deterministic seasonal component.

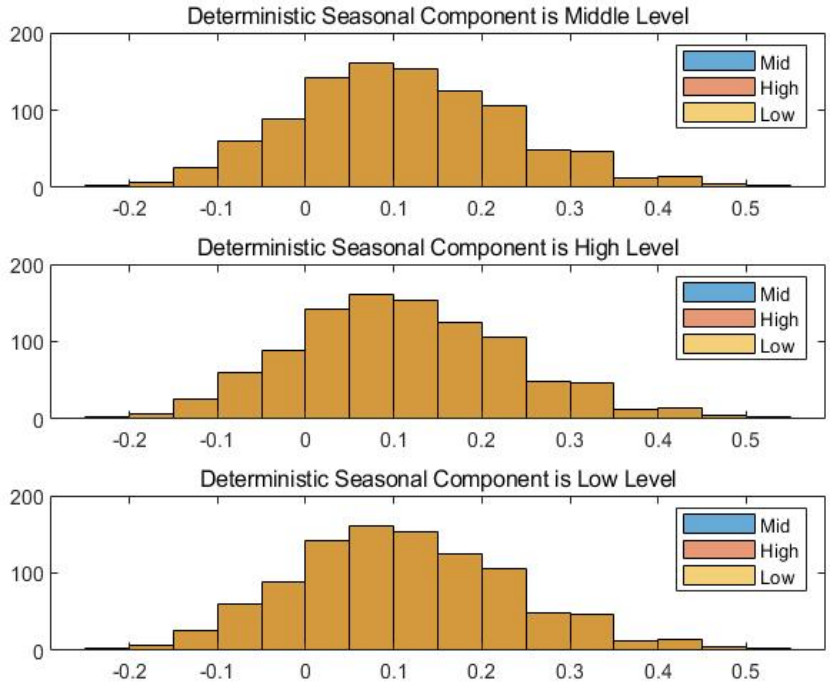


Figure 5: The welfare gain of removing nonseasonal consumption with median degree deterministic seasonal component.

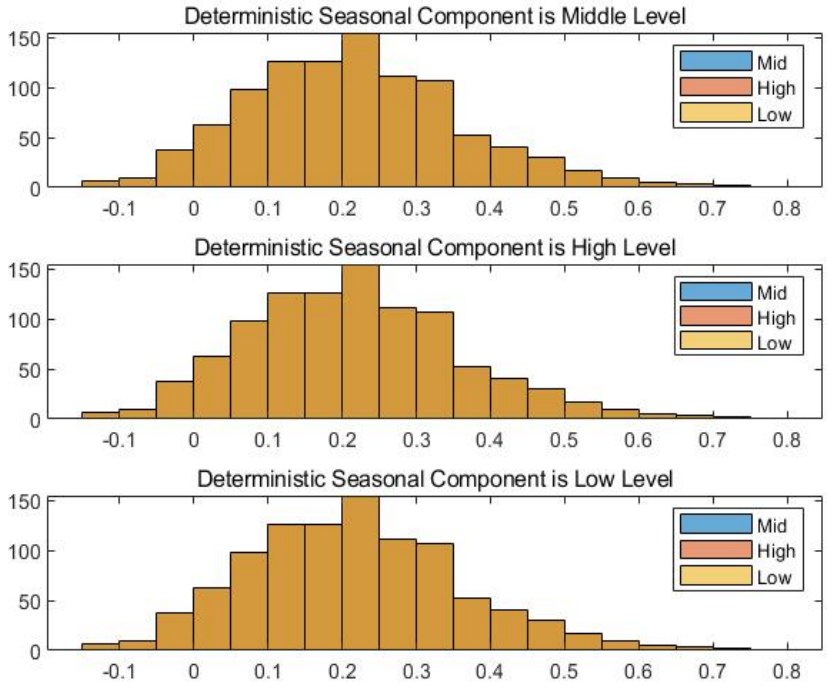


Figure 6: The welfare gain of removing nonseasonal consumption with high degree deterministic seasonal component.

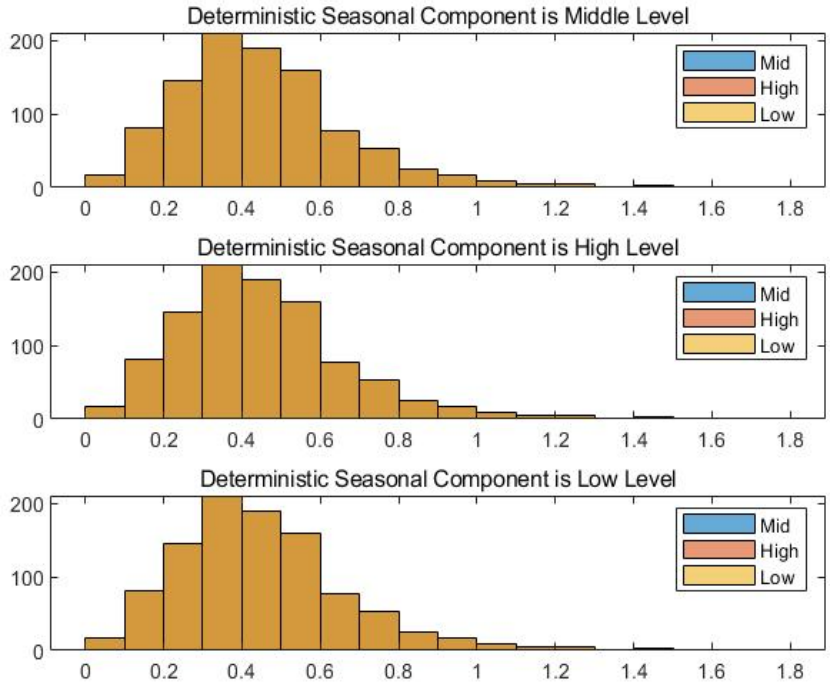


Figure 7: The welfare gain of removing nonseasonal consumption with low degree deterministic seasonal component.

report the total welfare gain, the gain of removing seasonal labor risk from the original welfare(contribution of labor) and the gain of removing seasonal consumption risk(contribution of consumption) from the non seasonal labor risk welfare. And the reason to report median welfare gain is that in the simulation I will get some impossible labor supply. So the distribution of welfare gain and the mean will have some unreasonable points. However, I use the real average labor supply in the question to adjust the labor supply, which can make the median number more reasonable.

## 2.1 Labor and consumption are positively correlated

In this case, we assume labor and consumption are positively correlated in both stochastic and deterministic.In Table 2, I report the median welfare gain of removing seasonality.

- Removing seasonality will get a welfare gain and the higher seasonality there is, the higher the welfare gain will be.
- And the seasonality degrees of stochastic component will have more effect on the welfare gain than the deterministic component.
- The total welfare gain is close to the sum of the contributions of consumption and labor.

| Deterministic | Stochastic | Median welfare gain of removing seasonality | | |
|---|---|---|---|---|
| | | Contribution of Consumption | Contribution of Labor | Total |
| Middle | Middle | 0.1198 | 0.0779 | 0.2137 |
| Middle | High | 0.2278 | 0.1662 | 0.4710 |
| Middle | Low | 0.0563 | 0.0503 | 0.1168 |
| High | Middle | 0.1609 | 0.0997 | 0.2877 |
| High | High | 0.2728 | 0.1936 | 0.5519 |
| High | Low | 0.0950 | 0.0804 | 0.1882 |
| Low | Middle | 0.1120 | 0.0686 | 0.2006 |
| Low | High | 0.2192 | 0.1502 | 0.4537 |
| Low | Low | 0.0489 | 0.0406 | 0.1032 |

Table 2: When consumption and labor are positive correlated.

## 2.2 Labor and consumption are negatively correlated

In this case, we assume labor and consumption are negatively correlated in both stochastic and deterministic.In Table 2, I report the median welfare gain of removing seasonality.

- Compared to table 2, the distribution of consumption is the same.
- Compared to table 2, the contribution of labor and total welfare gain are higher than first case. The reason may be that because in the utility function, the higher labor will lead to a lower utility. So when they are negatively correlated, the effect will be more strong to the utility.

| Deterministic | Stochastic | Median welfare gain of removing seasonality | | |
|---|---|---|---|---|
| | | Contribution of Consumption | Contribution of Labor | Total |
| Middle | Middle | 0.1198 | 0.0931 | 0.2652 |
| Middle | High | 0.2278 | 0.1649 | 0.5192 |
| Middle | Low | 0.0563 | 0.0423 | 0.1162 |
| High | Middle | 0.1609 | 0.1221 | 0.3408 |
| High | High | 0.2728 | 0.2061 | 0.6166 |
| High | Low | 0.0950 | 0.0662 | 0.1863 |
| Low | Middle | 0.1120 | 0.0853 | 0.2406 |
| Low | High | 0.2192 | 0.1566 | 0.4878 |
| Low | Low | 0.0489 | 0.0381 | 0.1004 |

Table 3: When consumption and labor are negative correlated.

## 2.3 Nonseasonal component of consumption and leisure are correlated.

This part I report the nonseasonal components of consumption and leisure are correlated. The figure 4 is positively correlated and the figure 5 is the negatively correlated. The pattern are similar as before and the contribution of consumption are also same.

| Deterministic | Stochastic | Median welfare gain of removing seasonality | | |
|---|---|---|---|---|
| | | Contribution of Consumption | Contribution of Labor | Total |
| Middle | Middle | 0.1198 | 0.1609 | 0.2714 |
| Middle | High | 0.2278 | 0.3725 | 0.6538 |
| Middle | Low | 0.0563 | 0.1020 | 0.1497 |
| High | Middle | 0.1609 | 0.2061 | 0.3851 |
| High | High | 0.2728 | 0.4152 | 0.8050 |
| High | Low | 0.0950 | 0.1623 | 0.2569 |
| Low | Middle | 0.1120 | 0.1460 | 0.2521 |
| Low | High | 0.2192 | 0.3587 | 0.6110 |
| Low | Low | 0.0489 | 0.0813 | 0.1239 |

Table 4: When consumption and labor are positive correlated with positively correlated nonseasonal component.

| Deterministic | Stochastic | Median welfare gain of removing seasonality | | |
|---|---|---|---|---|
| | | Contribution of Consumption | Contribution of Labor | Total |
| Middle | Middle | 0.1198 | 0.1519 | 0.3169 |
| Middle | High | 0.2278 | 0.3700 | 0.7949 |
| Middle | Low | 0.0563 | 0.0594 | 0.1275 |
| High | Middle | 0.1609 | 0.1987 | 0.4329 |
| High | High | 0.2728 | 0.4735 | 0.9285 |
| High | Low | 0.0950 | 0.1203 | 0.2348 |
| Low | Middle | 0.1120 | 0.1412 | 0.2919 |
| Low | High | 0.2192 | 0.3559 | 0.7561 |
| Low | Low | 0.0489 | 0.0493 | 0.1050 |

Table 5: When consumption and labor are negative correlated with negatively correlated nonseasonal component.