Development: Problem Set 1

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1 QUESTION 1

From line 17 to 270 we construct a function that recieve as inputs an array with the sequence of the seasonal consumption, and the parameter eta of risk aversion. This function will find first the individual utility of every month for 40 years, it will convert every value in discounted terms and it will sum all the periods for every individual, giving a vector of 1000 welfares. This welfares are the individual welfare. We sum the values of this vectors, getting the aggregate welfare. We make this for the combination of 3 types of economy (low, medium and high seasonality) and for 3 types of risk (Everything, no seasonal risk, or no non-seasonal risk). With this welfares we compute the welfare gain.

1.1 Question 1,1

Table 1: Degree of seasonality.

	low	medium	high
january	0.929601	0.863294	0.746022
February	0.831104	0.690734	0.477591
March	1.073581	1.151425	1.325779
April	1.068227	1.139968	1.299527
May	1.046028	1.094174	1.197217
June	1.029425	1.059715	1.122996
July	1.018163	1.036656	1.074655
August	1.018163	1.036656	1.074655
September	1.018163	1.036656	1.074655
October	1.001001	1.002002	1.004008
November	0.983144	0.967539	0.936131
December	0.959829	0.921272	0.848742

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Table 2: Welfare $\eta = 1$.

	low	medium	high
Everything	-77841.765250	-79570.090254	-82894.219061
No seasonal	-76179.783511	-76179.783511	-76179.783511
No Idiosyncratic	-70146.625899	-71874.950902	-75199.079710

Table 3: Welfare gain $\eta = 1$.

	low	medium	high
seasonal	6.566418e+01	5.254228e+03	2.336459e+07
Idiosyncratic	2.784854e+08	2.784854e+08	2.784854e+08

Explanation table 2 and table 3:

In table 2 we can see the values of total welfare for low, medium and high degree of seasonality in the cases of having both seasonal and non seasonal risk (Everything), in the case of having only non-seasonal risk (No seasonal) and in the case of having only seasonal risk (No Idiosyncratic). As expected when we have no seasonal risk welfare is equal in low, medium an high. When we have everything we are worse off w.r.t no seasonal and Idiosyncratic. Also, it is interesting see that the more volatility has the economy, the worse is the welfare in all cases. In table 3 we can see the welfare gains of removing seasonal and non-seasonal risk. we can see that removing non-seasonal risk is always better, nevertheless, the higher is the degree of seasonality the lower is the welfare gap between removing non seasonal and seasonal risk.Another feature of the table is that we can see how the higher is the degree of seasonality the higher is the gain of welfare. Notice that welfare gains are huge, this is obviously a mistake when computing it. Precisely, it is a problem when I aggregate welfares, since individual gains are far much smaller, in an credible scale, to show this I will add a distribution plot per table of gains that I introduced. These plots will be below.

Table 4: Welfare $\eta = 2$.

	low	medium	high
Everything	-505948.540438	-511921.901812	-532853.668777
No seasonal	-502640.983663	-502640.983663	-502640.983663
No Idiosyncratic	-486692.206164	-492438.222197	-512573.328890

Table 4 explanation: We can see how the higher is the degree of seasonality the lower is the welfare as in table 2.

Table 5 explanation: The big difference with table 3 is that now when high degree of seasonality we have that the gain of removing seasonal risk is higher than removing non-seasonal risk.

Table 5: Welfare gain $\eta = 2$.

	low	medium	high
seasonal	4.262636e+03	1.531328e+10	1.432238e+33
Idiosyncratic	1.356104e+21	2.408720e+21	1.803256e+22

Table 6: Welfare $\eta = 4$.

	low	medium	high
Everything	-350750.661860	-383730.046868	-565827.808447
No seasonal	-338605.868772	-338605.868772	-338605.868772
No Idiosyncratic	-276757.402575	-302779.559982	-446462.549038

Table 6 explanation: As before the more degree of seasonality the worse. Nevertheless, notice that the decrements of welfare is really high in comparison with the previous cases.

Table 7 explanation: As a result of what we were talking in table6 we have that total gains are much higher removing seasonal risk than non-seasonal risk.

In overall we can say, that it is not only the nature of the season and the variance of the idiosyncratic shock what determines welfare, but also aversion to risk is a big factor which we have to take into account. Since depending on the aversion of risk we have that the optimal policy (removing seasonal risk or non-seasonal risk) change.

1.2 Question 1.2

In this part we introduce volatility in the seasonality degree. I did not do the whole set of combinations between volatility and types of degree of seasonality. I think the most interesting result is in the combination of high volatility and high seasonality, medium volatility and medium seasonality and low volatility and low seasonality, so I computed everything for this case. In the other cases variance of the set of consumption differences of welfare of removing seasonality will be smaller.

Explanation table 8-table13: In this case we can see easily that removing seasonality is generating a high improvement The more volatile is the economy the worse, as usual.Table 11 says exactly the same, removing idiosyncratic shock will generate a lower welfare than removing seasonality. In the following cases the more we increase eta the higher is the gain of removing seasonality. Nevertheless, in the case of eta=2 in the low degree of seasonality we have that removing non-seasonal risk is better. This change when degree of seasonality increases.

Table 7: Welfare gain $\eta = 4$.

	low	medium	high
seasonal	2.127860e+13	3.312767e+49	2.280228e+249
Idiosyncratic	1.591138e+81	6.866111e+88	9.859697e+130

Table 8: Welfare, volatility in exp(gm)$\eta = 1$.

	low	medium	high
Everything	-145500.338648	-206538.891814	-328534.744960
No seasonal	-77995.878870	-77995.878870	-77995.878870
No Idiosyncratic	-137687.039951	-198725.593117	-320721.446263

2 Question 2

Adding Seasonal Labor Supply.

Comments about the labour process and the calibration of κ

We have imposed the exactly same process for labour as for consumption, but assuming a slightly higher standard deviation ($\sigma_L = 0.3$). We calibrate κ fixing it equal to 1.62. This number is the result of the following procedure:

i) Set up the household i program and take FOC. Combine labour and consumption FOC and get:

$$\kappa h_{m,t} c_{m,t} = w_t$$

which is the usual intratemporal condition. Solving it for κ one gets:

$$\kappa = \frac{w_t}{h_{m,t} c_{m,t}}$$

ii) Impute values for w, h, c and recover κ. We normalize w to 1; h, c we're computed as the average value across households, years and months.

a)Assume a deterministic seasonal component and a stochastic seasonal component for labor supply both of which are highly positively correlated with their consumption counterparts. Then, compute the welfare gains of removing seasons isolating the effects of consumption and leisure.

- Deterministic seasonal component: picked from the low degree of seasonality of new table1. - Stochastic seasonal component: picked from the low of table2.

They both have a high positive correlation.

We've solved the problem for a medium degree of seasonality in consumption, and a single degree of seasonality in labour. To solve for other degrees, just copy paste changing the vectors g and s.

Explanation table 14: With the previous calibration of κ, all the gains comes from removing the seasonal component of labour. Notice that this is because κ is quite high and overwheights the role of labour in the utility. Notice also that

Table 9: Welfare gain, volatility in exp(gm)$\eta = 1$.

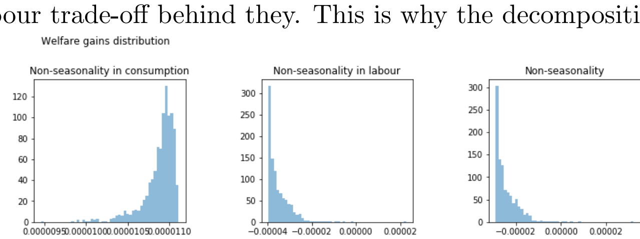
	low	medium	high
seasonal	1.204390e+74	1.163368e+141	8.839905e+274
Idiosyncratic	3.753815e+08	3.753815e+08	3.753815e+08

Table 10: Welfare, volatility in exp(gm)$\eta = 2$.

	low	medium	high
Everything	-653920.449610	-761942.499854	-1.036381e+06
No seasonal	-497924.949637	-497924.949637	-4.979249e+05
No Idiosyncratic	-629041.336603	-732953.570742	-9.969503e+05

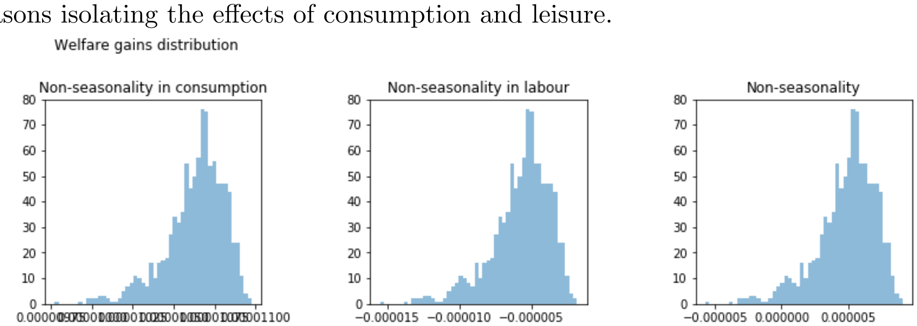
the welfare decreases when we remove the seasonality of labour. Now we repeat the exercise setting κ=0.03.

Explanation Table 15: highlights a very interesting point: removing the seasonality from consumption is welfare-improving whereas removing it from labour is not. Thus, the total gains are negative, but there is a consumption labour trade-off behind they. This is why the decomposition is so important!



The distribution of welfare gains is not homogenous again. Note that the welfare gains coming from non-seasonal consumption are skewed to the right whereas they are skewed to the left for non-seasonality in labour and overall.

b) Assume a deterministic seasonal component and a stochastic seasonal component for labor supply both of which are highly negatively correlated with their consumption counterparts. Then, compute the welfare gains of removing seasons isolating the effects of consumption and leisure.



The distribution of gains across agents is much less skewed than before. (c) How do your answers to (a) and (b) change if the nonseasonal stochastic component of consumption and leisure are correlated? They follow exactly the same pro-

Table 11: Welfare gain, volatility in exp(gm)$\eta = 2$.

	low	medium	high
seasonal	1.558241e+171	5.473054e+289	inf
Idiosyncratic	2.008374e+27	6.501902e+31	1.868646e+43

Table 12: Welfare, volatility in exp(gm)$\eta = 4$.

	low	medium	high
Everything	-1.372767e+06	-2.166389e+06	-5.438882e+06
No seasonal	-3.447292e+05	-3.447292e+05	-3.447292e+05
No Idiosyncratic	-1.086000e+06	-1.713836e+06	-4.302715e+06

cess ($Normal(0, \sigma)$, with different sigmas. As a consequence, they are already positively correlated.

Table 13: Welfare gain, volatility in exp(gm)$\eta = 4$.

	low	medium	high
seasonal	inf	inf	inf
Idiosyncratic	inf	inf	inf

Table 14: Welfare gain.

Welfare	-541.40
Welfare Non-Seasonality C	-540.31
Welfare Non-Seasonality	-991.83
Welfare gains C	0.00
Welfare gains L	-0.68
Total Welfare Gains	-0.68

Table 15: Welfare gain.

Welfare	-158.91
Welfare Non-Seasonality C	-154.61
Welfare Non-Seasonality	-168.55
Welfare gains C	0.01
Welfare gains L	-0.03
Total Welfare Gains	-0.02

Table 16: Welfare gain.

Welfare	-170.49
Welfare Non-Seasonality C	-166.29
Welfare Non-Seasonality	-168.55
Welfare gains C	0.01
Welfare gains L	-0.01
Total Welfare Gains	0.00