Problem Set 2
Development Economics

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February 8, 2019

1 Praying for Rain: The Welfare Cost of Seasons.

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(a) Table 1 reports the welfare gain from removing the seasonal component for each degree of seasonality separately. Notice that these gains are the same for all individuals. Since agents are risk-averse they prefer a smooth consumption stream so by removing stronger seasonality welfare gains are larger.

Table 1: Welfare gains from removing the seasonal component

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Middle	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
High	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044

(b) Table 2 shows the welfare gain from removing the nonseasonal consumption risk. Notice that the results are independent from the degree of seasonality. On average agents gain from the removal of the risk component. However some agents that by chance got a high shock even suffer a welfare loss.

(c) In (a) we compared welfare gains by removing the seasonal component but keeping the idiosyncratic risk. Hence, welfare gains changed across degrees of seasonality but remained constant over individuals. In (b) we compared welfare gains by removing the risk component but kept the seasonal component fixed. Hence, welfare gains vary

Table 2: Welfare gains from removing the risk component

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.104	0.099	−0.028	0.039	0.084	0.121	0.169	0.237
Middle	0.104	0.099	−0.028	0.039	0.084	0.121	0.169	0.237
High	0.104	0.099	−0.028	0.039	0.084	0.121	0.169	0.237

across individuals but not across degrees of seasonality. Removing both seasonal and risk component yields a combination of the two effects: Increasing gains with rising degree of seasonality and varying gains (or losses) across individuals. Still, the majority of individuals gains from the removal and for high degree of seasonality all gain.

Table 3: Welfare gains from removing both seasonal and risk components

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.107	0.102	−0.026	0.041	0.086	0.123	0.172	0.240
Middle	0.114	0.109	−0.020	0.047	0.093	0.130	0.179	0.248
High	0.153	0.147	0.014	0.084	0.131	0.170	0.220	0.291

(d) Tables 4 to 8 show the repetition of the exercise for $\eta = 2$ and $\eta = 4$. Since higher η in the utility function implies higher curvature and therefore higher risk-aversion i.e. consumers prefer more to smooth consumption, welfare gains are always larger compared to the respective case of $\eta = 1$.

Table 4: Welfare gains from removing the seasonal component ($\eta = 2$)

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Middle	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
High	0.111	0.111	0.111	0.111	0.111	0.111	0.111	0.111

Table 5: Welfare gains from removing the risk component ($\eta = 2$)

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.217	0.216	0.073	0.140	0.191	0.236	0.293	0.372
Middle	0.217	0.216	0.073	0.140	0.191	0.236	0.293	0.372
High	0.217	0.216	0.073	0.140	0.191	0.236	0.293	0.372

Table 6: Welfare gains from removing both seasonal and risk components ($\eta = 2$)

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.222	0.221	0.077	0.145	0.196	0.241	0.298	0.378
Middle	0.239	0.238	0.092	0.161	0.213	0.258	0.317	0.397
High	0.352	0.351	0.192	0.267	0.324	0.374	0.437	0.525

Table 7: Welfare gains from removing the seasonal component ($\eta = 4$)

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Middle	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
High	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.347

Table 8: Welfare gains from removing the risk component ($\eta = 4$)

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.470	0.450	0.245	0.338	0.413	0.494	0.591	0.762
Middle	0.470	0.450	0.245	0.338	0.413	0.494	0.591	0.762
High	0.470	0.450	0.245	0.338	0.413	0.494	0.591	0.762

Table 9: Welfare gains from removing both seasonal and risk components ($\eta = 4$)

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.483	0.463	0.256	0.350	0.426	0.507	0.605	0.778
Middle	0.532	0.511	0.297	0.395	0.473	0.557	0.659	0.837
High	0.979	0.953	0.676	0.802	0.903	1.011	1.143	1.373

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(a) Tables 10, 11 and 12 report the welfare gain from removing the deterministic seasonal component, stochastic seasonal component or both respectively for each degree of seasonality separately. Again these gains are the same for all individuals. Notice that the all tables refer to deterministic and stochastic seasonal components of the same degree.

The welfare gains from removing the deterministic or stochastic seasonal component again depend on the degree of seasonality. For higher degree, welfare gains are larger. When removing the stochastic seasonal component results are similar.

Table 10: Welfare gains from removing the deterministic seasonal component

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Middle	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
High	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044

Table 11: Welfare gains from removing the stochastic seasonal component

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.096	0.096	0.096	0.096	0.096	0.096	0.096	0.096
Middle	0.173	0.173	0.173	0.173	0.173	0.173	0.173	0.173
High	0.429	0.429	0.429	0.429	0.429	0.429	0.429	0.429

Table 12: Welfare gains from removing both seasonal components

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.098	0.098	0.098	0.098	0.098	0.098	0.098	0.098
Middle	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183
High	0.492	0.492	0.492	0.492	0.492	0.492	0.492	0.492

(b) In Table 13 we see the welfare gains from removing the nonseasonal consumption risk. Again, these gains are constant over degrees of seasonality but vary across individuals. For some individuals (again those who got a high positive shock) gains are negative but on average across individuals they are positive.

Table 13: Welfare gains from removing the risk component

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.104	0.099	−0.028	0.039	0.084	0.121	0.169	0.237
Middle	0.104	0.099	−0.028	0.039	0.084	0.121	0.169	0.237
High	0.104	0.099	−0.028	0.039	0.084	0.121	0.169	0.237

(c) Again, removing any kind of seasonal component yields constant gains across individuals whereas removing the risk component results in constant gains by degree of seasonality. Removing both, as shown in Table 14, yields a combination of the two: Welfare gains increasing in the degree of seasonality and varying across individuals

Table 14: Welfare gains from removing the seasonal and risk component

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.213	0.208	0.067	0.141	0.190	0.231	0.284	0.359
Middle	0.306	0.300	0.149	0.228	0.281	0.326	0.383	0.463
High	0.647	0.640	0.449	0.549	0.616	0.672	0.744	0.845

(d) With higher η we get similar results as before. Welfare gains mostly increase with rising η (not always though).

Table 15: Welfare gains from removing the deterministic seasonal component $\eta = 2$

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Middle	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
High	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033

Table 16: Welfare gains from removing the stochastic seasonal component $\eta = 2$

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.116	0.116	0.116	0.116	0.116	0.116	0.116	0.116
Middle	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.258
High	0.506	0.506	0.506	0.506	0.506	0.506	0.506	0.506

Table 17: Welfare gains from removing both seasonal components $\eta = 2$

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120
Middle	0.280	0.280	0.280	0.280	0.280	0.280	0.280	0.280
High	0.674	0.674	0.674	0.674	0.674	0.674	0.674	0.674

Table 18: Welfare gains from removing the risk component $\eta = 2$

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.217	0.216	0.073	0.140	0.191	0.236	0.293	0.372
Middle	0.217	0.216	0.073	0.140	0.191	0.236	0.293	0.372
High	0.217	0.216	0.073	0.140	0.191	0.236	0.293	0.372

Table 19: Welfare gains from removing the seasonal and risk component $\eta = 2$

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.363	0.362	0.202	0.277	0.334	0.385	0.449	0.537
Middle	0.558	0.557	0.374	0.460	0.525	0.582	0.656	0.757
High	1.037	1.035	0.796	0.908	0.993	1.069	1.164	1.297

Table 20: Welfare gains from removing the deterministic seasonal component $\eta = 4$

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Middle	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
High	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013

Table 21: Welfare gains from removing the stochastic seasonal component $\eta = 4$

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
Middle	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397
High	0.473	0.473	0.473	0.473	0.473	0.473	0.473	0.473

Table 22: Welfare gains from removing both seasonal components $\eta = 4$

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160
Middle	0.456	0.456	0.456	0.456	0.456	0.456	0.456	0.456
High	0.984	0.984	0.984	0.984	0.984	0.984	0.984	0.984

Table 23: Welfare gains from removing the risk component $\eta = 4$

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.470	0.450	0.245	0.338	0.413	0.494	0.591	0.762
Middle	0.470	0.450	0.245	0.338	0.413	0.494	0.591	0.762
High	0.470	0.450	0.245	0.338	0.413	0.494	0.591	0.762

Table 24: Welfare gains from removing the seasonal and risk component $\eta = 4$

	Mean	Median	5%	20%	40%	60%	80%	95%
Low	0.705	0.682	0.444	0.552	0.639	0.732	0.845	1.044
Middle	1.140	1.112	0.813	0.949	1.058	1.175	1.317	1.566
High	1.916	1.877	1.470	1.655	1.804	1.963	2.157	2.496

2 Adding Seasonal Labor Supply.

(a) Table 25 reports the median welfare gains of removing the seasonal component with perfectly positively correlated consumption and labour supply and non-correlated stochastic components. Notice that both contributions from consumption and labour increase in the degree of seasonality, which again reflects risk aversion. The contribution of labour is larger relative to consumption due to the difference in how the two variables enter the utility function (more risk aversion in labour risk).

Table 25: Median welfare gains of removing the seasonal component by consumption and labour contribution (positively correlated consumption and labor supply, non-seasonal stochastic components are not correlated)

	Consumption	Labour	Total
Low	0.053	0.069	0.125
Middle	0.114	0.169	0.299
High	0.274	0.484	0.889

(b) Table 26 shows the median welfare gains of removing the seasonal component with perfectly negatively correlated consumption and labour supply and non-correlated stochastic components. Notice that in this case the contribution of labour is higher than in case with positive correlation. Whereas with positive correlation an increase in utility from consumption is counterbalanced by an increase in disutility from labour, with negative correlation, the two effects "add up". Hence, welfare gains of removing the seasonal component increase.

(c) Tables 27 and 28 report the median welfare gains of removing the seasonal component with perfectly positively and negatively correlated consumption and labour supply for correlated stochastic components. The results are very similar to the case without correlated stochastic components.

Table 26: Median welfare gains of removing the seasonal component by consumption and labour contribution (negatively correlated consumption and labor supply, non-seasonal stochastic components are not correlated)

	Consumption	Labour	Total
Low	0.053	0.065	0.129
Middle	0.114	0.175	0.309
High	0.274	0.804	1.313

Table 27: Median welfare gains of removing the seasonal component by consumption and labour contribution (positively correlated consumption and labor supply, non-seasonal stochastic components are correlated)

	Consumption	Labour	Total
Low	0.053	0.069	0.124
Middle	0.114	0.166	0.295
High	0.274	0.480	0.886

Table 28: Median welfare gains of removing the seasonal component by consumption and labour contribution (negatively correlated consumption and labor supply, non-seasonal stochastic components are correlated)

	Consumption	Labour	Total
Low	0.053	0.064	0.124
Middle	0.114	0.169	0.305
High	0.274	0.824	1.343