Distribution Grid Search

This is the example vignette for function: **snw_ds_main_grid_search** from the **PrjOptiSNW Package.** This function solves for vfi and gets distribution induced by policy functions and exogenous distributions. Grid Search for VFI and Grid Search also for Distribution. The results are illustrative of the differences between using grid search and exact solution. The grid search solution here is not fully vectorized but loops over the state-space.

Test SNW_DS_MAIN_GRID_SEARCH Defaults More Dense

Rather than solving for "docdense", this solves for "moredense", which has fewer shocks, in order to save time given the relatively slow speed of this algorithm.

```
mp_params = snw_mp_param('default_moredense');
mp_controls = snw_mp_control('default_test');
mp_controls('bl_print_vfi') = false;
mp_controls('bl_print_ds') = false;
mp_controls('bl_print_ds_verbose') = false;
[Phi_true,Phi_adj,A_agg,Y_inc_agg,it,mp_dsvfi_results] = snw_ds_main_grid_search(mp_params, mp_
```

```
Elapsed time is 11762.574665 seconds.
Completed SNW_VFI_MAIN_GRID_SEARCH;SNW_MP_PARAM=default_moredense;SNW_MP_CONTROL=default_test
Elapsed time is 12505.621399 seconds.
Completed SNW_DS_MAIN;SNW_MP_PARAM=;default_moredense;SNW_MP_CONTROL=;default_test
```

```
Phi_true = Phi_true/sum(Phi_true(:));
```

Show All Info in mp_dsvfi_results More Dense

```
mp_cl_mt_xyz_of_s = mp_dsvfi_results('mp_cl_mt_xyz_of_s');
disp(mp_cl_mt_xyz_of_s('tb_outcomes'))
```

	mean	unweighted_sum	sd	coefofvar	gini	min	max	pYis0
a_ss	4.1966	5130.2	8.2211	1.959	0.74586	0	135	0.1847
ap_ss	33.417	11476	25.564	0.765	0.44091	1	151	
cons_ss	1.1837	1.59e+07	1.0186	0.86052	0.40734	0.035637	141.66	
v_ss	-19.282	-9.477e+06	35.18	-1.8245	-0.7793	-867.32	25.519	
n_ss	2.3554	21	1.4375	0.61029	0.3128	1	6	
y_all	1.6288	2.398e+07	1.8953	1.1636	0.49934	0.038108	50.873	
y_head_inc	1.2693	5.6172e+05	1.541	1.2141	0.50187	0.038108	24.357	
y_head_earn	1.0492	2628.2	1.4242	1.3574	0.60462	0	18.957	0.201
y_spouse_inc	0.35948	55577	0.96095	2.6732	0.85293	0	26.627	0.5249
yshr_interest	0.10937	1.0949e+06	0.1698	1.5525	0.711	0	0.99299	0.1847
yshr_wage	0.78519	2.3994e+06	0.34085	0.43409	0.19417	0	1	0.1058
yshr_SS	0.10544	70381	0.24571	2.3303	0.91374	0	1	0.798
yshr_tax	0.17729	7.7889e+05	0.040058	0.22594	0.12851	0.036506	0.2552	
yshr_nttxss	0.071855	7.0851e+05	0.26576	3.6986	1.5402	-0.89184	0.2552	

More Dense Param Results Define Frames

Define the matrix dimensions names and dimension vector values. Probability mass matrixes, Policy and Value Functions share the same ND dimensional structure.

```
% Grids:
```

```
age_grid = 18:100;
agrid = mp_params('agrid')';
eta_H_grid = mp_params('eta_H_grid')';
eta_S_grid = mp_params('eta_S_grid')';
ar_st_eta_HS_grid = string(cellstr([num2str(eta_H_grid', 'hz=%3.2f;'), num2str(eta_S_grid', 'wz
edu_grid = [0,1];
marry_grid = [0,1];
kids_grid = (1:1:mp_params('n_kidsgrid'))';
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
cl_mp_datasetdesc = {};
cl_mp_datasetdesc{1} = containers.Map({'name', 'labval'}, {'age', age_grid});
cl_mp_datasetdesc{2} = containers.Map({'name', 'labval'}, {'savings', agrid});
cl_mp_datasetdesc{3} = containers.Map({'name', 'labval'}, {'eta', 1:length(eta_H_grid)});
cl_mp_datasetdesc{4} = containers.Map({'name', 'labval'}, {'edu', edu_grid});
cl_mp_datasetdesc{5} = containers.Map({'name', 'labval'}, {'marry', marry_grid});
cl_mp_datasetdesc{6} = containers.Map({'name', 'labval'}, {'kids', kids_grid});
```

Analyze Probability Mass Along Age Dimensions

Where are the mass at? Analyze mass given state space components.

```
% Get the Joint distribution over all states
% Define Graph Inputs
mp_support_graph = containers.Map('KeyType', 'char', 'ValueType', 'any');
mp_support_graph('st_legend_loc') = 'best';
mp_support_graph('bl_graph_logy') = false; % do not log
```

Exogenous Permanent States Mass: Life Cycle, Edu and Marraige

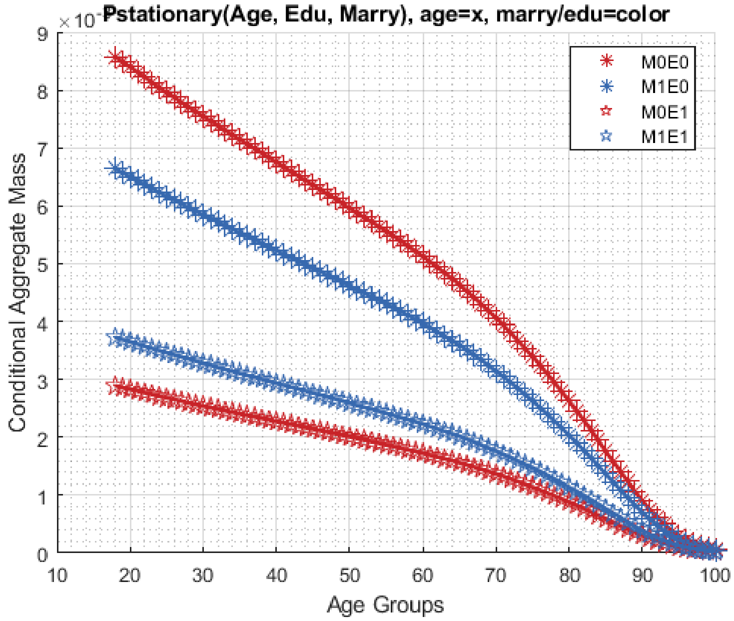
Tabulate value and policies along savings and shocks:

```
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
ar_permute = [2,3,6,1,5,4];
% Value Function
tb_prob_aem = ff_summ_nd_array("P(Age, EDU, MARRY))", Phi_true, true, ["sum"], 3, 1, cl_mp_data
```

```
xxx  P(Age, EDU, MARRY))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
    group    marry    edu    sum_age_18    sum_age_19    sum_age_20    sum_age_21    sum_age_22    sum_age_23    sum
    _____    _____    ___    __________    __________    __________    __________    __________    __________    ___

      1        0       0     0.0085768     0.0084866     0.0083969     0.0083078     0.0082194     0.0081317     0.
      2        1       0     0.0066438     0.0065739     0.0065044     0.0064354     0.0063669      0.006299     0.0
      3        0       1     0.0028875     0.0028571      0.002827      0.002797     0.0027672     0.0027377     0.0
      4        1       1     0.0037292     0.0036899     0.0036509     0.0036122     0.0035738     0.0035356     0.0
```

```
mp_support_graph('cl_st_graph_title') = {'Pstationary(Age, Edu, Marry), age=x, marry/edu=color'
mp_support_graph('cl_st_ytitle') = {'Conditional Aggregate Mass'};
ar_row_grid = ["M0E0", "M1E0", "M0E1", "M1E1"];
mp_support_graph('cl_st_xtitle') = {'Age Groups'};
mp_support_graph('cl_scatter_shapes') = {'*', '*', 'p', 'p' };
mp_support_graph('cl_colors') = {'red', 'blue', 'red', 'blue'};
ff_graph_grid((tb_prob_aem{1:end, 4:end}), ar_row_grid, age_grid, mp_support_graph);
```



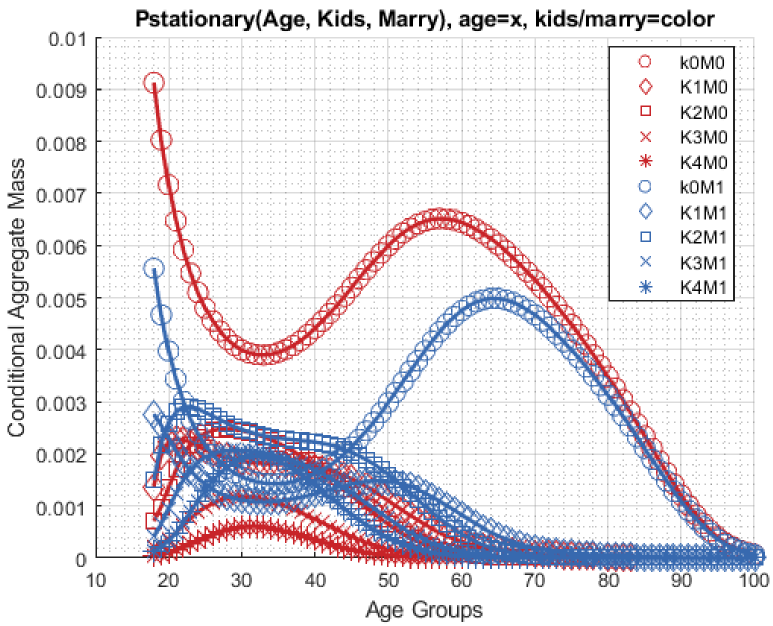
Kids and Marry By Age Mass

```
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
ar_permute = [2,3,4,1,6,5];
% Value Function
tb_prob_amarrykids = ff_summ_nd_array("P(Age, Kids, Marry))", Phi_true, true, ["sum"], 3, 1, cl
```

xxx P(Age, Kids, Marry)) xxxxxxxxxxxxxxxxxxxxxxxxxx

group	kids	marry	sum_age_18	sum_age_19	sum_age_20	sum_age_21	sum_age_22	sum_age_23	su
1	1	0	0.0091249	0.0080278	0.0071652	0.0064765	0.0059205	0.0054683	0
2	2	0	0.0013699	0.0019743	0.0022187	0.0022858	0.0022687	0.0022149	0
3	3	0	0.00071266	0.00098425	0.0013537	0.0016929	0.0019639	0.0021645	0
4	4	0	0.00020622	0.00027865	0.00037326	0.00049476	0.00062818	0.00075864	0.
5	5	0	5.0761e-05	7.8715e-05	0.000113	0.00015485	0.00020534	0.00026306	0.
6	1	1	0.0055624	0.0046679	0.0039774	0.0034368	0.0030088	0.0026667	0
7	2	1	0.0027682	0.0025539	0.0023005	0.0020611	0.0018525	0.0016773	0
8	3	1	0.0014982	0.0021823	0.0025943	0.0028096	0.002896	0.0029031	
9	4	1	0.00041197	0.00064648	0.00095224	0.0012491	0.0015009	0.0016975	0
10	5	1	0.00013221	0.0002132	0.00033097	0.00049097	0.00068255	0.0008901	0

```
mp_support_graph('cl_st_graph_title') = {'Pstationary(Age, Kids, Marry), age=x, kids/marry=colo
mp_support_graph('cl_st_ytitle') = {'Conditional Aggregate Mass'};
ar_row_grid = [...
    "k0M0", "K1M0", "K2M0", "K3M0", "K4M0", ...
    "k0M1", "K1M1", "K2M1", "K3M1", "K4M1"];
mp_support_graph('cl_scatter_shapes') = {...
    'o', 'd' ,'s', 'x', '*', ...
    'o', 'd', 's', 'x', '*'};
mp_support_graph('cl_colors') = {...
    'red', 'red', 'red', 'red', 'red'...
    'blue', 'blue', 'blue', 'blue', 'blue'};
mp_support_graph('cl_st_xtitle') = {'Age Groups'};
ff_graph_grid((tb_prob_amarrykids{1:end, 4:end}), ar_row_grid, age_grid, mp_support_graph);
```



Analyze Probability Mass Asset and Shock Dimensions

Where are the mass at?

```
% Define Graph Inputs
mp_support_graph = containers.Map('KeyType', 'char', 'ValueType', 'any');
mp_support_graph('st_legend_loc') = 'best';
mp_support_graph('bl_graph_logy') = false; % do not log
```

Asset and Shock Mass

```
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
ar_permute = [1,4,5,6,3,2];
% Value Function
tb_prob_az = ff_summ_nd_array("P(A,Z))", Phi_true, true, ["sum"], 4, 1, cl_mp_datasetdesc, ar_p
```

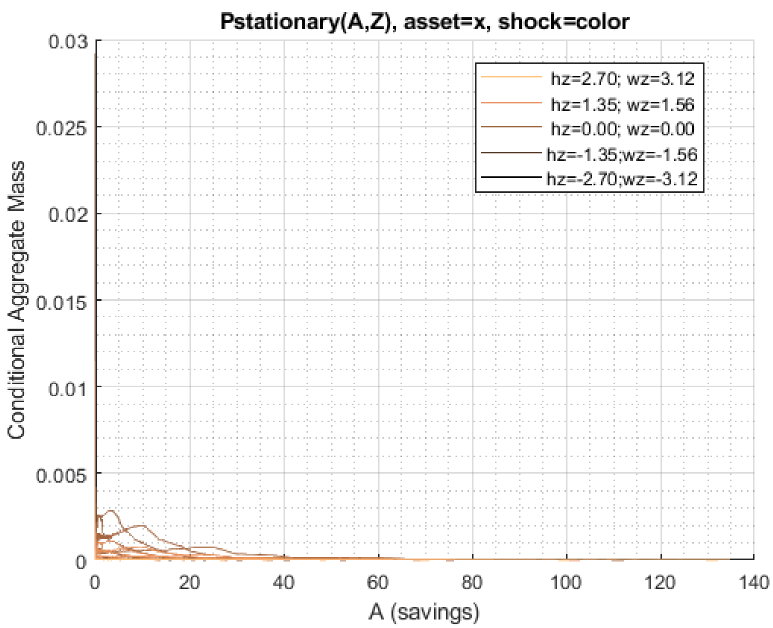
xxx P(A,Z)) xxxxxxxxxxxxxxxxxxxxxxxxxxx

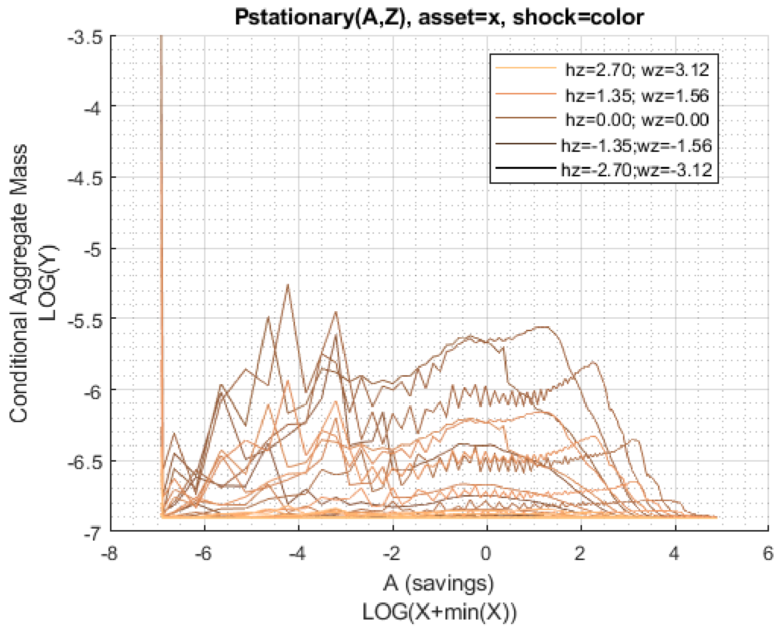
group	savings	sum_eta_1	sum_eta_2	sum_eta_3	sum_eta_4	sum_eta_5	sum_eta_6	sum_eta_
1	0	1.7781e-05	0.00011464	0.00040781	0.00065248	0.00059124	0.00033667	0.000116
2	4e-05	2.8722e-07	1.1649e-06	3.9632e-06	1.1727e-06	9.1594e-06	8.6911e-07	1.9536e-
3	0.00032	8.5865e-07	2.0949e-06	1.3074e-05	9.3326e-06	1.8355e-05	2.7109e-06	1.4881e-
4	0.00108	2.4439e-06	7.4985e-06	7.825e-06	5.1658e-06	4.2511e-06	9.0564e-06	5.0327e-
5	0.00256	7.4917e-07	5.7803e-06	3.1919e-05	3.5332e-05	2.8844e-05	5.4161e-06	1.5346e-
6	0.005	1.6199e-07	5.684e-06	1.1553e-05	2.0567e-05	4.1715e-05	9.3727e-06	1.599e-
7	0.00864	2.9061e-07	1.562e-05	1.4073e-05	7.0288e-05	3.462e-05	1.6548e-05	3.2747e-
8	0.01372	9.5464e-08	2.3479e-06	1.7752e-05	2.4581e-05	9.4236e-05	2.0967e-05	3.8102e-
9	0.02048	1.4979e-07	5.1146e-06	2.195e-05	2.7505e-05	3.1649e-05	2.1267e-05	4.2213e-
10	0.02916	2.2894e-07	2.3319e-06	2.9711e-05	4.1965e-05	4.8965e-05	4.931e-05	9.1317e-
11	0.04	3.76e-07	3.6133e-06	5.9345e-05	4.0368e-05	4.4556e-05	7.3962e-05	7.943e-
12	0.05324	2.756e-07	2.2346e-06	1.4966e-05	3.6227e-05	2.4755e-05	3.695e-05	8.6828e-
13	0.06912	3.3888e-07	2.6932e-06	1.5812e-05	3.8986e-05	3.8211e-05	1.648e-05	1.3703e-

14	0.08788	3.0263e-07	2.2683e-06	1.6049e-05	3.5262e-05	2.667e-05	2.515e-05	4.7003e-
15	0.10976	2.6825e-07	2.1043e-06	2.4986e-05	3.6843e-05	3.4559e-05	1.5405e-05	5.4215e-
16	0.135	2.768e-07	1.8377e-06	9.0408e-06	3.5423e-05	3.2867e-05	2.4479e-05	1.3972e-
17	0.16384	2.8181e-07	1.9353e-06	9.257e-06	3.8786e-05	3.6177e-05	1.9607e-05	5.6747e-
18	0.19652	3.067e-07	2.0467e-06	9.1227e-06	3.8618e-05	3.0376e-05	2.7065e-05	8.0364e-
19	0.23328	3.3018e-07	2.1755e-06	1.0247e-05	4.2533e-05	4.2068e-05	1.8014e-05	1.2896e-
20	0.27436	3.6009e-07	2.3328e-06	1.0941e-05	4.3919e-05	3.3639e-05	2.5977e-05	1.1414e-
21	0.32	4.1186e-07	2.5895e-06	1.1659e-05	4.7371e-05	4.4252e-05	2.4973e-05	7.4152e-
22	0.37044	4.4759e-07	2.8965e-06	1.2583e-05	4.8243e-05	4.0516e-05	2.8508e-05	1.2102e-
23	0.42592	4.7723e-07	3.3135e-06	1.3374e-05	5.3569e-05	4.9866e-05	2.3551e-05	8.6802e-
24	0.48668	5.296e-07	3.4623e-06	1.4309e-05	5.3859e-05	5.1087e-05	3.5022e-05	1.3404e-
25	0.55296	5.459e-07	3.6382e-06	1.5329e-05	5.7267e-05	5.3924e-05	2.6534e-05	9.0603e-
26	0.625	5.615e-07	3.878e-06	1.5435e-05	5.7034e-05	5.5588e-05	3.3803e-05	1.2466e-
27	0.70304	5.616e-07	3.8405e-06	1.5148e-05	5.8804e-05	5.7189e-05	3.0223e-05	1.0521e-
28	0.78732	5.8141e-07	3.7688e-06	1.5044e-05	5.7591e-05	5.4784e-05	3.5161e-05	1.4966e-
29	0.87808	5.8397e-07	3.8463e-06	1.504e-05	5.6538e-05	5.6164e-05	2.6669e-05	8.6508e-
30	0.97556	5.7697e-07	3.9047e-06	1.4901e-05	5.5173e-05	5.4358e-05	3.4721e-05	1.2092e-
31	1.08	5.7655e-07	3.8874e-06	1.5177e-05	5.445e-05	5.7049e-05	2.7157e-05	8.8514e-
32	1.1916	5.6606e-07	3.778e-06	1.4865e-05	5.185e-05	5.5565e-05	3.2554e-05	1.2888e-
33	1.3107	5.5291e-07	3.7261e-06	1.43e-05	4.9523e-05	5.7531e-05	2.8096e-05	8.803e-
34	1.4375	5.3074e-07	3.574e-06	1.3682e-05	5.2445e-05	5.5479e-05	3.1707e-05	1.2033e-
35	1.5722	5.0996e-07	3.497e-06	1.3373e-05	3.5566e-05	5.7462e-05	2.7077e-05	8.732e-
36	1.715	5.0049e-07	3.3282e-06	1.3028e-05	3.4521e-05	5.6522e-05	3.2615e-05	1.2279e-
37	1.8662	4.7974e-07	3.329e-06	1.2601e-05	3.3434e-05	5.8509e-05	2.6878e-05	8.6252e-
38	2.0261	4.596e-07	3.1609e-06	1.2343e-05	3.178e-05	5.9485e-05	3.2101e-05	1.1267e-
39	2.1949	4.4954e-07	3.105e-06	1.2095e-05	3.1287e-05	5.9761e-05	2.7128e-05	8.4782e-
40	2.3728	4.1729e-07	3.0323e-06	1.186e-05	3.0175e-05	6.1927e-05	3.2379e-05	1.2107e-
41	2.56	3.9929e-07	2.924e-06	1.1544e-05	2.9921e-05	6.1827e-05	2.7425e-05	8.7221e-
42	2.7568	3.8414e-07	2.7951e-06	1.1251e-05	2.6814e-05	6.3135e-05	3.2763e-05	1.0976e-
43	2.9635	3.616e-07	2.7007e-06	1.0868e-05	2.5813e-05	6.3482e-05	2.7626e-05	9.8638e-
44	3.1803	3.3481e-07	2.5593e-06	1.0429e-05	2.5595e-05	6.3992e-05	3.3047e-05	1.0801e-
45	3.4074	3.131e-07	2.4198e-06	9.99e-06	2.4766e-05	6.3343e-05	2.858e-05	9.477e-
46	3.645	2.9457e-07	2.2754e-06	9.6582e-06	2.4476e-05	6.3967e-05	3.3608e-05	1.1984e-
47	3.8934	2.7703e-07	2.1293e-06	9.1931e-06	2.3981e-05	6.2378e-05	3.2136e-05	9.5584e-
48	4.1529	2.515e-07	2.018e-06	8.6923e-06	2.3738e-05	6.0398e-05	3.4717e-05	1.1182e-
49	4.4237	2.3412e-07	1.8599e-06	8.0926e-06	2.2417e-05	5.8532e-05	3.3219e-05	1.0914e-
50	4.706	2.1348e-07	1.7011e-06	7.6231e-06	2.1465e-05	5.6363e-05	3.5656e-05	1.1006e-
51	5	1.9593e-07	1.5641e-06	7.1764e-06	2.0854e-05	5.2743e-05	3.4502e-05	1.0412e-
52	5.306	1.7768e-07	1.4581e-06	6.7963e-06	2.007e-05	4.821e-05	3.7676e-05	1.2348e-
53	5.6243	1.5982e-07	1.3264e-06	6.2348e-06	1.9171e-05	4.3737e-05	3.5788e-05	1.0314e-
54	5.9551	1.4334e-07	1.204e-06	5.8483e-06	1.8296e-05	4.106e-05	3.8181e-05	1.1835e-
55	6.2986	1.3188e-07	1.1011e-06	5.4121e-06	1.7322e-05	3.901e-05	3.7324e-05	1.125e-
56	6.655	1.1797e-07	9.977e-07	4.9804e-06	1.6132e-05	3.7093e-05	4.0152e-05	1.1839e-
57	7.0246	1.0623e-07	9.1605e-07	4.7007e-06	1.5537e-05	3.4804e-05	4.0289e-05	1.1374e-
58	7.4077	9.4398e-08	8.3453e-07	4.3022e-06	1.4566e-05	3.2665e-05	4.1753e-05	1.2523e-
59	7.8045	8.2422e-08	7.5244e-07	3.9469e-06	1.3777e-05	3.0198e-05	4.183e-05	1.1428e-
60	8.2152	7.1784e-08	6.6939e-07	3.6212e-06	1.3091e-05	2.7445e-05	4.309e-05	1.2825e-
61	8.64	6.1804e-08	5.8987e-07	3.2784e-06	1.2179e-05	2.5843e-05	4.2847e-05	1.185e-
62	9.0792	5.3502e-08	5.1823e-07	2.9635e-06	1.1462e-05	2.4729e-05	4.4278e-05	1.2852e-
63	9.5331	4.5477e-08	4.5311e-07	2.6656e-06	1.0485e-05	2.3755e-05	4.4697e-05	1.2052e-
64	10.002	3.8449e-08	3.8904e-07	2.358e-06	9.5066e-06	2.227e-05	4.4247e-05	1.2916e-
65	10.486	3.2576e-08	3.3716e-07	2.0726e-06	8.8323e-06	2.1148e-05	4.3231e-05	1.2318e-
66	10.985	2.7144e-08	2.8859e-07	1.805e-06	8.1101e-06	1.9267e-05	4.0181e-05	1.3095e-
67	11.5	2.234e-08	2.4458e-07	1.5627e-06	7.3458e-06	1.7795e-05	3.8372e-05	1.2575e-
68	12.031	1.8426e-08	2.0804e-07	1.3548e-06	6.7189e-06	1.6482e-05	3.5562e-05	1.316e-
69	12.577	1.5109e-08	1.7304e-07	1.1665e-06	6.035e-06	1.5039e-05	3.3252e-05	1.2889e-
70	13.14	1.2136e-08	1.4416e-07	9.8771e-07	5.3216e-06	1.3797e-05	2.8982e-05	1.3271e-
71	13.72	9.7439e-09	1.1717e-07	8.4655e-07	4.7591e-06	1.2593e-05	2.5621e-05	1.3062e-
72	14.316	7.6519e-09	9.5696e-08	7.1116e-07	4.1025e-06	1.1341e-05	2.5829e-05	1.3421e-
73	14.93	6.0255e-09	7.71e-08	5.9381e-07	3.5724e-06	1.0484e-05	2.4658e-05	1.3262e-
74	15.561	4.7503e-09	6.2213e-08	4.9108e-07	3.1215e-06	9.5178e-06	2.3245e-05	1.3664e-
75	16.209	3.7139e-09	4.928e-08	4.0026e-07	2.6199e-06	8.2935e-06	2.1991e-05	1.4303e-
76	16.875	2.945e-09	3.8866e-08	3.2717e-07	2.258e-06	7.5498e-06	1.9996e-05	1.4103e-
77	17.559	2.3042e-09	3.075e-08	2.6267e-07	1.8986e-06	6.5071e-06	1.9146e-05	1.5081e-
78	18.261	1.7888e-09	2.4653e-08	2.1261e-07	1.6083e-06	5.7887e-06	1.8096e-05	1.4606e-

79	18.982	1.3465e-09	1.9495e-08	1.7008e-07	1.3129e-06	5.0003e-06	1.5323e-05	1.5298e-
80	19.722	9.9583e-10	1.5366e-08	1.3569e-07	1.0922e-06	4.3544e-06	1.2912e-05	1.5315e-
81	20.48	7.1218e-10	1.1848e-08	1.0869e-07	9.0647e-07	3.715e-06	1.1136e-05	1.581e-
82	21.258	5.1489e-10	8.9408e-09	8.6675e-08	7.3075e-07	3.2426e-06	1.018e-05	1.6445e-
83	22.055	3.7141e-10	6.6969e-09	6.8391e-08	5.9709e-07	2.8121e-06	9.0229e-06	1.6438e-
84	22.871	2.7136e-10	4.8427e-09	5.3798e-08	4.7428e-07	2.4448e-06	8.136e-06	1.6423e-
85	23.708	1.9274e-10	3.4542e-09	4.184e-08	3.8443e-07	2.0544e-06	7.4782e-06	1.6384e-
86	24.565	1.3871e-10	2.4987e-09	3.1083e-08	3.0722e-07	1.6959e-06	6.7652e-06	1.6412e-
87	25.442	9.9269e-11	1.8401e-09	2.3394e-08	2.4072e-07	1.4171e-06	6.0563e-06	1.5951e-
88	26.34	7.0282e-11	1.338e-09	1.7154e-08	1.9419e-07	1.1731e-06	5.8143e-06	1.4544e-

```
mp_support_graph('cl_st_graph_title') = {'Pstationary(A,Z), asset=x, shock=color'};
mp_support_graph('cl_st_ytitle') = {'Conditional Aggregate Mass'};
mp_support_graph('cl_st_xtitle') = {'A (savings)'};
mp_support_graph('st_rowvar_name') = 'z=';
mp_support_graph('it_legend_select') = 5;
mp_support_graph('st_rounding') = '6.2f';
mp_support_graph('bl_graph_logy') = true;
mp_support_graph('cl_colors') = 'copper';
ff_graph_grid((tb_prob_az{1:end, 3:end})', ar_st_eta_HS_grid, agrid, mp_support_graph);% Consum
```





Asset Mass by Age

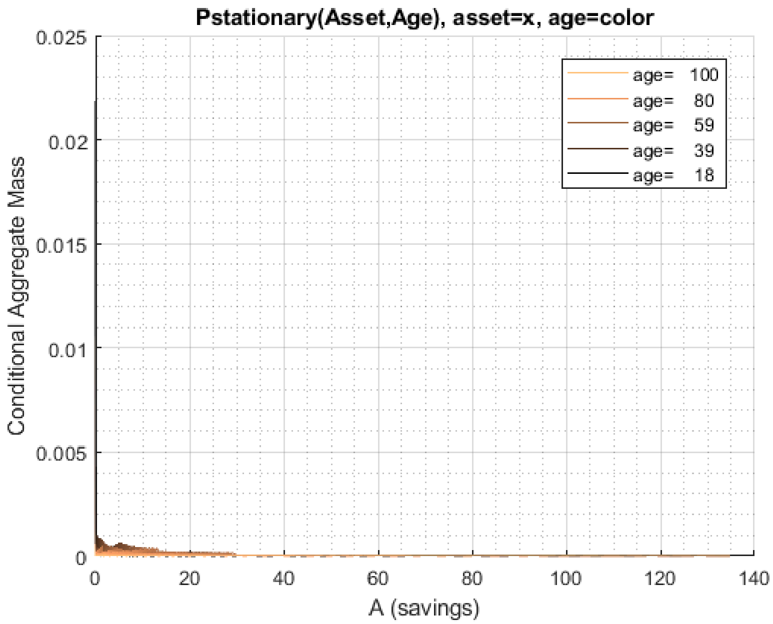
```
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
ar_permute = [3,4,5,6,1,2];
% Value Function
tb_prob_aage = ff_summ_nd_array("P(A,Z))", Phi_true, true, ["sum"], 4, 1, cl_mp_datasetdesc, ar
```

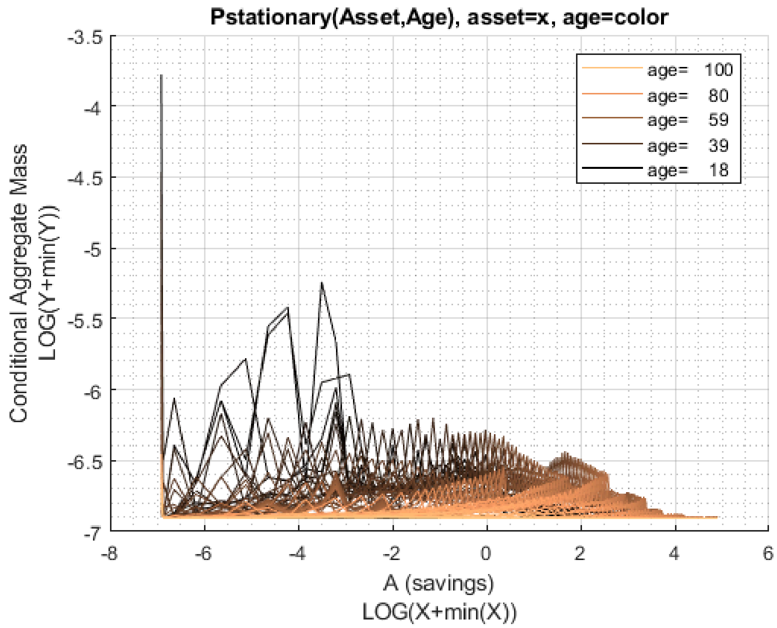
xxx   P(A,Z))   xxxxxxxxxxxxxxxxxxxxxxxxxxx

group	savings	sum_age_18	sum_age_19	sum_age_20	sum_age_21	sum_age_22	sum_age_23	sum_age_
1	0	0.021837	0.002388	0.0018389	0.006441	0.0087965	0.010537	0.0105
2	4e-05	0	2.3862e-06	2.8257e-06	1.5227e-05	0.0005064	7.0852e-07	2.7519e-
3	0.00032	0	3.749e-05	3.8393e-05	0.00067452	0.0013201	3.5849e-05	3.7734e-
4	0.00108	0	0.00031485	0.0003134	0.00027518	6.9704e-05	0.00011755	3.9743e-
5	0.00256	0	0.0012853	0.0012851	0.0015569	8.2105e-05	0.00010095	9.5189e-
6	0.005	0	0.00034215	0.00051426	0.0020794	0.00015795	0.00014559	7.4827e-
7	0.00864	0	0.0028722	0.0026464	0.00033471	0.00033022	0.00018413	0.00016
8	0.01372	0	0.003431	0.003249	0.00029554	0.00030632	0.00018326	0.00018
9	0.02048	0	0.00028503	0.00067599	0.00046576	0.00041506	0.00032709	0.00029
10	0.02916	0	0.004274	0.0016076	0.00075151	0.00038657	0.00034427	0.00028
11	0.04	0	0.0024741	0.0016863	0.0015147	0.0012561	0.0011147	0.00022
12	0.05324	0	0.00012193	0.0017565	0.00025806	0.00022971	0.00029153	0.0010
13	0.06912	0	0.00044563	0.00062939	0.00029172	0.00029386	0.00022298	0.00025
14	0.08788	0	2.7692e-05	0.00011258	0.00016217	0.00018796	0.00024921	0.00023
15	0.10976	0	6.2377e-05	8.9179e-06	7.302e-05	0.00017801	0.00019976	0.00022
16	0.135	0	0.00067668	0.00016485	0.00010669	0.000221	0.00021163	0.00020
17	0.16384	0	5.8231e-06	5.1096e-05	0.00019395	0.00024128	0.0002562	0.00019
18	0.19652	0	3.2338e-05	4.7486e-05	0.00021219	0.000234	0.00027743	0.00027
19	0.23328	0	2.7827e-05	0.00062962	0.00032249	0.00035572	0.00022838	0.00023
20	0.27436	0	3.3098e-06	0.00012226	0.00073141	0.00035073	0.00032271	0.00024
21	0.32	0	4.0326e-05	0.00029658	0.00038943	0.00026142	0.00032984	0.00035
22	0.37044	0	0.00023294	0.00034328	0.00045557	0.00074931	0.00030675	0.00028
23	0.42592	0	0.00029162	0.00046139	0.0003154	0.00034178	0.00035298	0.00031
24	0.48668	0	0.0002901	0.00049107	0.00051926	0.00039455	0.00068504	0.00038
25	0.55296	0	0.00034886	0.00054566	0.00036044	0.00041009	0.00040979	0.00038
26	0.625	0	0.00050916	0.00043446	0.00028992	0.00033921	0.00039148	0.00068
27	0.70304	0	0.00039586	0.00037772	0.00035949	0.00035245	0.00032607	0.00039
28	0.78732	0	0.00020681	0.00035133	0.00037856	0.00031646	0.00036106	0.00030

29	0.87808	0	1.4297e-05	5.5411e-05	0.00015549	0.0003353	0.00029405	0.00032
30	0.97556	0	1.5592e-05	6.2891e-05	0.00029115	0.00021838	0.00028827	0.00029
31	1.08	0	2.009e-06	8.4112e-05	0.000141	0.00019198	0.00020228	0.00023
32	1.1916	0	2.1045e-05	0.00010104	0.00015492	0.00012578	0.00018109	0.00020
33	1.3107	0	1.4435e-06	6.9531e-05	5.1206e-05	0.0002098	0.00013935	0.00017
34	1.4375	0	5.1689e-07	4.651e-05	7.8499e-05	7.7448e-05	0.00011495	0.00014
35	1.5722	0	4.7793e-07	4.9348e-06	2.019e-05	8.9748e-05	0.00010189	0.00012
36	1.715	0	2.3446e-06	4.4093e-06	2.1355e-05	4.3825e-05	0.00017165	9.6853e-
37	1.8662	0	2.6545e-07	5.0217e-06	2.7683e-05	3.388e-05	5.2151e-05	0.00010
38	2.0261	0	5.4286e-07	3.5584e-06	1.9841e-05	3.2561e-05	4.6305e-05	7.157e-
39	2.1949	0	1.5332e-06	2.2585e-05	9.5902e-06	3.1168e-05	4.1488e-05	0.00013
40	2.3728	0	4.1159e-06	1.2545e-05	1.5104e-05	1.9972e-05	4.8064e-05	4.7455e-
41	2.56	0	4.9992e-06	9.9133e-06	2.4176e-05	2.6663e-05	3.4515e-05	5.0725e-
42	2.7568	0	7.7981e-06	1.537e-05	2.0404e-05	3.8764e-05	3.1904e-05	4.6315e-
43	2.9635	0	1.0694e-05	1.9867e-05	2.6641e-05	3.3667e-05	4.0931e-05	4.3215e-
44	3.1803	0	1.3309e-05	1.8778e-05	4.551e-05	3.4837e-05	4.3432e-05	4.2922e-
45	3.4074	0	1.3226e-05	2.3e-05	3.5495e-05	3.4352e-05	4.101e-05	4.2799e-
46	3.645	0	3.533e-06	2.5708e-05	3.2758e-05	4.0617e-05	3.8932e-05	4.4106e-
47	3.8934	0	1.8503e-05	2.4946e-05	2.607e-05	3.9121e-05	3.9913e-05	4.3419e-

```
mp_support_graph('cl_st_graph_title') = {'Pstationary(Asset,Age), asset=x, age=color'};
mp_support_graph('cl_st_ytitle') = {'Conditional Aggregate Mass'};
mp_support_graph('cl_st_xtitle') = {'A (savings)'};
mp_support_graph('st_rowvar_name') = 'age=';
mp_support_graph('it_legend_select') = 5;
mp_support_graph('st_rounding') = '6.0f';
mp_support_graph('bl_graph_logy') = true;
mp_support_graph('cl_colors') = 'copper';
ff_graph_grid((tb_prob_aage{1:end, 3:end})', age_grid, agrid, mp_support_graph);% Consumption C
```





Probability Statistics A, C and V Conditional on Ages

Where are the mass at?

```
ap_ss = mp_dsvfi_results('ap_ss');
c_ss = mp_dsvfi_results('cons_ss');
v_ss = mp_dsvfi_results('v_ss');
n_ss = mp_dsvfi_results('n_ss');

y_head_inc = mp_dsvfi_results('y_head_inc_ss');
y_spouse_inc = mp_dsvfi_results('y_spouse_inc_ss');

yshr_wage = mp_dsvfi_results('yshr_wage_ss');
yshr_SS = mp_dsvfi_results('yshr_SS_ss');
yshr_nttxss = mp_dsvfi_results('yshr_nttxss_ss');

for it_ctr=1:size(ap_ss, 1)
    if (ismember(it_ctr, round(linspace(1, size(ap_ss, 1), 3))))
        display(['age =' num2str(age_grid(it_ctr))]);

        % construct input data
        Phi_true_age = Phi_true(it_ctr, :, :, : ,: ,:);
        ap_ss_age = ap_ss(it_ctr, :, :, : ,: ,:);
        c_ss_age = c_ss(it_ctr, :, :, : ,: ,:);
        v_ss_age = v_ss(it_ctr, :, :, : ,: ,:);
        n_ss_age = n_ss(it_ctr, :, :, : ,: ,:);

        y_head_inc_age = y_head_inc(it_ctr, :, :, : ,: ,:);
        y_spouse_inc_age = y_spouse_inc(it_ctr, :, :, : ,: ,:);
        yshr_wage_age = yshr_wage(it_ctr, :, :, : ,: ,:);
        yshr_SS_age = yshr_SS(it_ctr, :, :, : ,: ,:);
        yshr_nttxss_age = yshr_nttxss(it_ctr, :, :, : ,: ,:);

        mp_cl_ar_xyz_of_s = containers.Map('KeyType','char', 'ValueType','any');
```

```
        mp_cl_ar_xyz_of_s('ap_ss') = {ap_ss_age(:), zeros(1)};
        mp_cl_ar_xyz_of_s('c_ss') = {c_ss_age(:), zeros(1)};
        mp_cl_ar_xyz_of_s('v_ss') = {v_ss_age(:), zeros(1)};
        mp_cl_ar_xyz_of_s('n_ss') = {n_ss_age(:), zeros(1)};
        mp_cl_ar_xyz_of_s('y_head_inc') = {y_head_inc_age(:), zeros(1)};
        mp_cl_ar_xyz_of_s('y_spouse') = {y_spouse_inc_age(:), zeros(1)};
        mp_cl_ar_xyz_of_s('yshr_wage') = {yshr_wage_age(:), zeros(1)};
        mp_cl_ar_xyz_of_s('yshr_SS') = {yshr_SS_age(:), zeros(1)};
        mp_cl_ar_xyz_of_s('yshr_nttxss') = {yshr_nttxss_age(:), zeros(1)};
        mp_cl_ar_xyz_of_s('ar_st_y_name') = ["ap_ss", "c_ss", "v_ss", "n_ss",...
            "y_head_inc", "y_spouse", "yshr_wage", "yshr_SS", "yshr_nttxss"];

        % controls
        mp_support = containers.Map('KeyType','char', 'ValueType','any');
        mp_support('ar_fl_percentiles') = [0.01 10 25 50 75 90 99.99];
        mp_support('bl_display_final') = true;
        mp_support('bl_display_detail') = false;
        mp_support('bl_display_drvm2outcomes') = false;
        mp_support('bl_display_drvstats') = false;
        mp_support('bl_display_drvm2covcor') = false;

        % Call Function
        mp_cl_mt_xyz_of_s = ff_simu_stats(Phi_true_age(:)/sum(Phi_true_age,'all'), mp_cl_ar_xyz
    end
end
```

```
age =18
xxx tb_outcomes: all stats xxx
```

OriginalVariableNames	ap_ss	c_ss	v_ss	n_ss	y_head_inc	y_spouse
{'mean' }	10.116	0.75737	-37.312	1.9854	0.84341	0.22902
{'unweighted_sum' }	11476	2.4434e+05	-7.8101e+05	21	4422.1	561.99
{'sd' }	6.9537	0.67774	55.469	1.0848	0.90505	0.5733
{'coefofvar' }	0.68742	0.89486	-1.4866	0.54639	1.0731	2.5032
{'gini' }	0.32034	0.41117	-0.64451	0.268	0.41353	0.83721
{'min' }	1	0.035637	-867.32	1	0.038108	0
{'max' }	151	18.059	25.519	6	13.784	10.368
{'pYis0' }	0	0	0	0	0	0.52499
{'pYls0' }	0	0	0.8166	0	0	0
{'pYgr0' }	1	1	0.1834	1	1	0.47501
{'pYisMINY' }	0.11052	0.0014188	7.8342e-06	0.41786	0.0033703	0.52499
{'pYisMAXY' }	0	0	0	0.0060544	0	5.3013e-06
{'p0_01' }	1	0.035637	-745.16	1	0.038108	0
{'p10' }	1	0.24578	-86.259	1	0.14676	0
{'p25' }	7	0.3161	-50.56	1	0.28802	0
{'p50' }	9	0.51551	-25.263	2	0.56523	0
{'p75' }	11	0.88958	-5.3994	3	1.1092	0.23956
{'p90' }	23	1.5797	6.1229	4	2.1768	0.8323
{'p99_99' }	52	6.8857	23.695	6	8.3836	8.6488
{'fl_cov_ap_ss' }	48.354	1.9167	115.84	0.29345	1.7747	3.1074
{'fl_cor_ap_ss' }	1	0.4067	0.30034	0.038901	0.28199	0.77947
{'fl_cov_c_ss' }	1.9167	0.45934	20.257	0.067217	0.59824	0.081697
{'fl_cor_c_ss' }	0.4067	1	0.53884	0.091423	0.9753	0.21026
{'fl_cov_v_ss' }	115.84	20.257	3076.8	2.8057	24.488	4.9077
{'fl_cor_v_ss' }	0.30034	0.53884	1	0.046626	0.48778	0.15433
{'fl_cov_n_ss' }	0.29345	0.067217	2.8057	1.1768	-4.9873e-18	0.13364
{'fl_cor_n_ss' }	0.038901	0.091423	0.046626	1	-5.0797e-18	0.21488
{'fl_cov_y_head_inc' }	1.7747	0.59824	24.488	-4.9873e-18	0.81911	0.021751
{'fl_cor_y_head_inc' }	0.28199	0.9753	0.48778	-5.0797e-18	1	0.04192

{'fl_cov_y_spouse' }	3.1074	0.081697	4.9077	0.13364	0.021751	0.32867
{'fl_cor_y_spouse' }	0.77947	0.21026	0.15433	0.21488	0.04192	1
{'fl_cov_yshr_wage' }	-9.6296e-31	-3.1682e-32	5.4234e-31	3.667e-31	3.5697e-31	-5.2241e-33
{'fl_cor_yshr_wage' }	-1.5592e-16	-5.2631e-17	1.1008e-17	3.8058e-16	4.4408e-16	-1.026e-17
{'fl_cov_yshr_SS' }	0	0	0	0	0	0
{'fl_cor_yshr_SS' }	NaN	NaN	NaN	NaN	NaN	NaN
{'fl_cov_yshr_nttxss'}	0.16611	0.021334	1.8502	0.0077776	0.025219	0.0090401
{'fl_cor_yshr_nttxss'}	0.58487	0.77071	0.81669	0.17554	0.68223	0.38607
{'fracByP0_01' }	0.010925	6.6761e-05	0.0030622	0.21046	0.00015228	0
{'fracByP10' }	0.010925	0.050401	0.44077	0.21046	0.019229	0
{'fracByP25' }	0.148	0.072459	0.71224	0.21046	0.096342	0
{'fracByP50' }	0.28531	0.21889	0.94749	0.53024	0.29663	0
{'fracByP75' }	0.60536	0.47077	1.0368	0.77109	0.59361	0.13003
{'fracByP90' }	0.758	0.70215	1.0326	0.92834	0.84502	0.34306
{'fracByP99_99' }	0.99975	0.99993	1	1	1	0.99814

age =59
xxx tb_outcomes: all stats xxx

OriginalVariableNames	**ap_ss**	**c_ss**	**v_ss**	**n_ss**	**y_head_inc**	**y_spouse**	**ys**
{'mean' }	54.878	1.2923	-12.279	1.7239	1.8459	0.45057	
{'unweighted_sum' }	11476	2.7092e+05	-80406	21	13268	1069.5	
{'sd' }	23.415	1.0959	19.332	0.90777	2.0412	1.1205	
{'coefofvar' }	0.42667	0.84801	-1.5745	0.52659	1.1058	2.4867	
{'gini' }	0.23612	0.3991	-0.81005	0.23461	0.48077	0.83345	
{'min' }	1	0.055882	-229.42	1	0.059541	0	
{'max' }	151	32.48	14.764	6	23.47	20.112	
{'pYis0' }	0	0	0	0	0	0.52499	
{'pYls0' }	0	0	0.73941	0	0	0	
{'pYgr0' }	1	1	0.26059	1	1	0.47501	
{'pYisMINY' }	0.0042169	2.9508e-05	3.9539e-07	0.48835	9.9253e-05	0.52499	
{'pYisMAXY' }	4.8703e-06	2.3072e-08	0	0.0036816	1.9995e-06	4.8438e-06	0
{'p0_01' }	1	0.05663	-132.27	1	0.059554	0	
{'p10' }	26	0.31762	-39.004	1	0.38493	0	
{'p25' }	40	0.59646	-18.282	1	0.63825	0	
{'p50' }	54	1.0652	-7.1081	2	1.1351	0	
{'p75' }	70	1.6718	0.46981	2	2.1332	0.48062	
{'p90' }	85	2.4861	6.4893	3	4.1604	1.7443	
{'p99_99' }	146	15.179	14.695	6	22.847	16.777	
{'fl_cov_ap_ss' }	548.26	22.158	403.41	3.0428	38.333	6.1095	
{'fl_cor_ap_ss' }	1	0.86352	0.8912	0.14315	0.80205	0.23287	
{'fl_cov_c_ss' }	22.158	1.201	13.858	0.23973	2.0792	0.27813	-
{'fl_cor_c_ss' }	0.86352	1	0.6541	0.24098	0.92951	0.22651	
{'fl_cov_v_ss' }	403.41	13.858	373.74	3.5819	22.934	4.5119	
{'fl_cor_v_ss' }	0.8912	0.6541	1	0.20411	0.58118	0.2083	
{'fl_cov_n_ss' }	3.0428	0.23973	3.5819	0.82404	0.062213	0.2771	-0
{'fl_cor_n_ss' }	0.14315	0.24098	0.20411	1	0.033576	0.27244	-
{'fl_cov_y_head_inc' }	38.333	2.0792	22.934	0.062213	4.1664	0.17233	-
{'fl_cor_y_head_inc' }	0.80205	0.92951	0.58118	0.033576	1	0.07535	
{'fl_cov_y_spouse' }	6.1095	0.27813	4.5119	0.2771	0.17233	1.2554	
{'fl_cor_y_spouse' }	0.23287	0.22651	0.2083	0.27244	0.07535	1	
{'fl_cov_yshr_wage' }	-1.3956	-0.043321	-1.0776	-0.0071751	-0.056896	0.013069	0
{'fl_cor_yshr_wage' }	-0.66407	-0.44044	-0.62107	-0.088065	-0.31056	0.12996	
{'fl_cov_yshr_SS' }	0	0	0	0	0	0	
{'fl_cor_yshr_SS' }	NaN	NaN	NaN	NaN	NaN	NaN	
{'fl_cov_yshr_nttxss'}	0.77952	0.028412	0.68735	0.0085362	0.047811	0.014612	-
{'fl_cor_yshr_nttxss'}	0.88801	0.69155	0.94837	0.25083	0.62479	0.34785	
{'fracByP0_01' }	7.6842e-05	5.431e-06	0.001404	0.28329	4.1671e-06	0	3.
{'fracByP10' }	0.027337	0.019346	0.47531	0.28329	0.013211	0	
{'fracByP25' }	0.11727	0.077024	0.79795	0.28329	0.054199	0	
{'fracByP50' }	0.33388	0.22863	1.0581	0.72028	0.18178	0	
{'fracByP75' }	0.62869	0.48302	1.117	0.72028	0.41537	0.15283	
{'fracByP90' }	0.83409	0.72082	1.0748	0.85389	0.64728	0.3418	
{'fracByP99_99' }	0.9998	0.99882	1	1	0.99936	0.99834	

age =100
xxx tb_outcomes: all stats xxx

OriginalVariableNames	ap_ss	c_ss	v_ss	n_ss	y_head_inc	y_spouse
{'mean' }	1	0.35551	-2.9555	1.4797	0.26067	0.10125
{'unweighted_sum' }	1	2.807e+05	1215	21	491.5	33.546
{'sd' }	1.7875e-14	0.23928	1.0697	0.50567	0.023035	0.24772
{'coefofvar' }	1.7875e-14	0.67307	-0.36194	0.34173	0.088367	2.4467
{'gini' }	0	0.28119	-0.18783	0.12034	0.041657	0.7872
{'min' }	1	0.2179	-10.065	1	0.24433	0
{'max' }	1	141.66	0.99282	6	5.6926	3.115
{'pYis0' }	0	0	0	0	0	0.52499
{'pYls0' }	0	0	0.99182	0	0	0
{'pYgr0' }	1	1	0.0081757	1	1	0.47501
{'pYisMINY' }	1	0.35002	1.5074e-10	0.5232	0.50379	0.52499
{'pYisMAXY' }	1	0	0	4.2206e-08	0	1.0335e-08
{'p0_01' }	1	0.2179	-6.3349	1	0.24433	0
{'p10' }	1	0.2179	-3.6603	1	0.24433	0
{'p25' }	1	0.2179	-3.5892	1	0.24433	0
{'p50' }	1	0.25824	-3.5892	1	0.24433	0
{'p75' }	1	0.37165	-2.5873	2	0.29263	0.10311
{'p90' }	1	0.6134	-1.2288	2	0.29283	0.49115
{'p99_99' }	1	2.9509	0.52075	4	0.3403	2.9458
{'fl_cov_ap_ss' }	3.195e-28	6.5284e-30	-2.443e-29	3.5367e-29	2.9775e-31	6.9736e-31
{'fl_cor_ap_ss' }	1	1.5264e-15	-1.2777e-15	3.9129e-15	7.2317e-16	1.5749e-16
{'fl_cov_c_ss' }	6.5284e-30	0.057256	0.20779	0.059046	0.0016896	0.051708
{'fl_cor_c_ss' }	1.5264e-15	1	0.81181	0.488	0.30655	0.87235
{'fl_cov_v_ss' }	-2.443e-29	0.20779	1.1443	0.15982	0.010842	0.16183
{'fl_cor_v_ss' }	-1.2777e-15	0.81181	1	0.29547	0.44002	0.61072
{'fl_cov_n_ss' }	3.5367e-29	0.059046	0.15982	0.2557	0.0018939	0.0533
{'fl_cor_n_ss' }	3.9129e-15	0.488	0.29547	1	0.1626	0.4255
{'fl_cov_y_head_inc' }	2.9775e-31	0.0016896	0.010842	0.0018939	0.00053059	0.00067244
{'fl_cor_y_head_inc' }	7.2317e-16	0.30655	0.44002	0.1626	1	0.11785
{'fl_cov_y_spouse' }	6.9736e-31	0.051708	0.16183	0.0533	0.00067244	0.061365
{'fl_cor_y_spouse' }	1.5749e-16	0.87235	0.61072	0.4255	0.11785	1
{'fl_cov_yshr_wage' }	1.4253e-30	0.039337	0.15536	0.083876	0.00066872	0.042905
{'fl_cor_yshr_wage' }	3.6093e-16	0.74409	0.65738	0.75078	0.1314	0.78395
{'fl_cov_yshr_SS' }	1.2113e-29	-0.040637	-0.16221	-0.085115	-0.00073196	-0.042905
{'fl_cor_yshr_SS' }	3.0517e-15	-0.76482	-0.68289	-0.75803	-0.1431	-0.78001
{'fl_cov_yshr_nttxss'}	-1.3389e-29	0.044612	0.17828	0.091702	0.00088432	0.047166
{'fl_cor_yshr_nttxss'}	-3.1042e-15	0.77263	0.69067	0.75153	0.1591	0.78904
{'fracByP0_01' }	1	0.21454	0.00051608	0.35357	0.47222	0
{'fracByP10' }	1	0.21454	0.21323	0.35357	0.47222	0
{'fracByP25' }	1	0.21454	0.64329	0.35357	0.47222	0
{'fracByP50' }	1	0.32886	0.64329	0.35357	0.47222	0
{'fracByP75' }	1	0.54497	0.88331	0.99419	0.87831	0.19257
{'fracByP90' }	1	0.75075	0.97695	0.99419	0.88528	0.62793
{'fracByP99_99' }	1	0.99925	1	0.99999	0.99987	0.9996