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 13045.688258 seconds.
Completed SNW_VFI_MAIN_GRID_SEARCH;SNW_MP_PARAM=default_moredense;SNW_MP_CONTROL=default_test
Elapsed time is 13841.078692 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	4.2955	5130.2	8.2965	1.9314	0.74079	0	135	0.1766
ap_ss	33.948	11476	25.584	0.75362	0.43382	1	151	
cons_ss	1.1795	1.585e+07	1.0182	0.86318	0.40848	0.035637	141.61	
v_ss	-19.79	-1.1145e+07	35.654	-1.8016	-0.774	-868.79	25.518	
n_ss	2.3554	21	1.4375	0.61029	0.3128	1	6	
y_all	1.6272	2.3969e+07	1.8982	1.1665	0.50121	0.038108	50.873	
y_head_inc	1.2682	5.6172e+05	1.5441	1.2175	0.50432	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	0.35895	55552	0.96039	2.6755	0.85307	0	26.627	0.5249
yshr_interest	0.11509	1.0971e+06	0.17681	1.5363	0.70728	0	0.99299	0.1766
yshr_wage	0.78433	2.4004e+06	0.34004	0.43354	0.19505	0	1	0.1058
yshr_SS	0.10058	67295	0.23745	2.3608	0.91583	0	1	0.798
yshr_tax	0.17694	7.7853e+05	0.040535	0.22909	0.13026	0.036506	0.2552	
yshr_nttxss	0.076363	7.1123e+05	0.25868	3.3875	1.4024	-0.89715	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

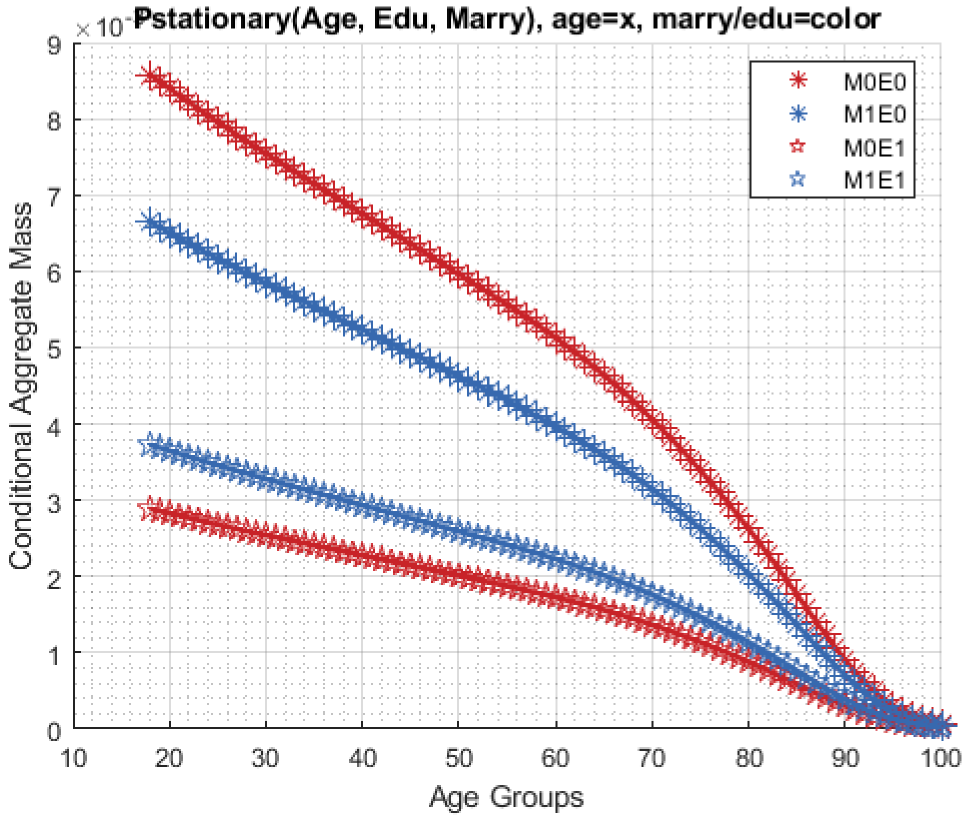
Tabulate value and policies along savings and shocks:

```
% 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

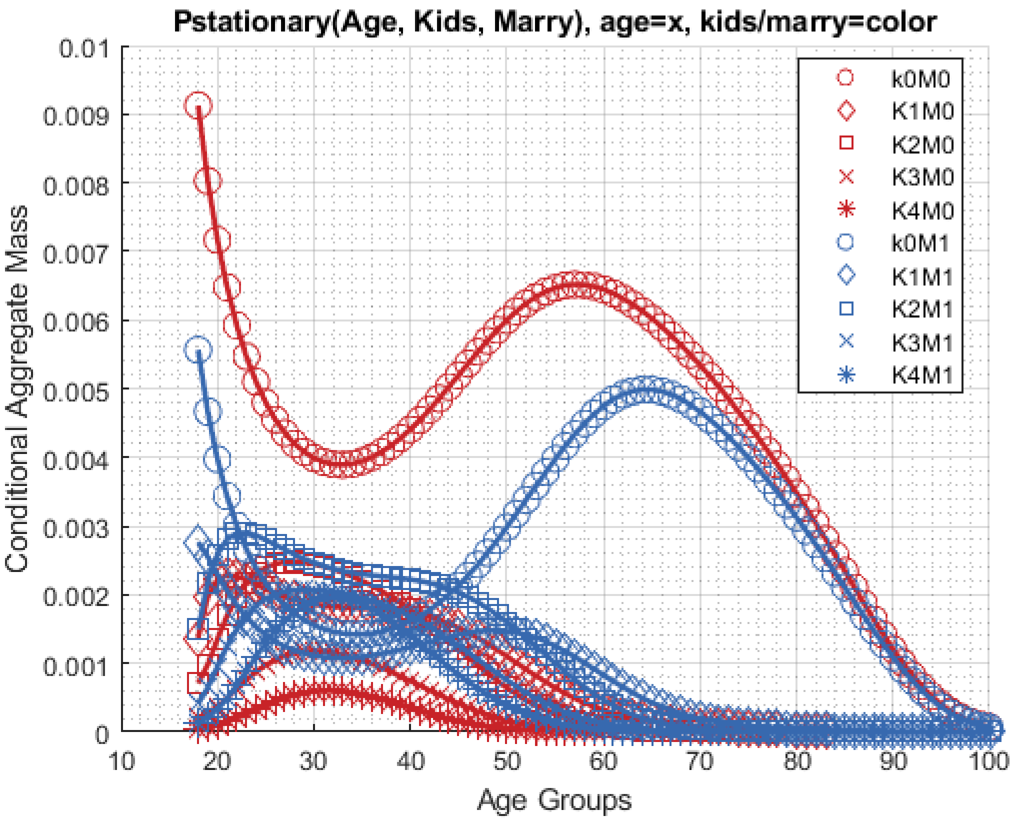
```
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
ar_permute = [2,3,4,1,6,5];
% Value Function
tb_prob_amarrykids = ff_summ_nd_array("P(Age, Kids, Marry))", Phi_true, true, ["sum"], 3, 1, cl
```

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	
8	3	1	0.0014982	0.0021823	0.0025943	0.0028096	0.002896	0.0029031	0
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

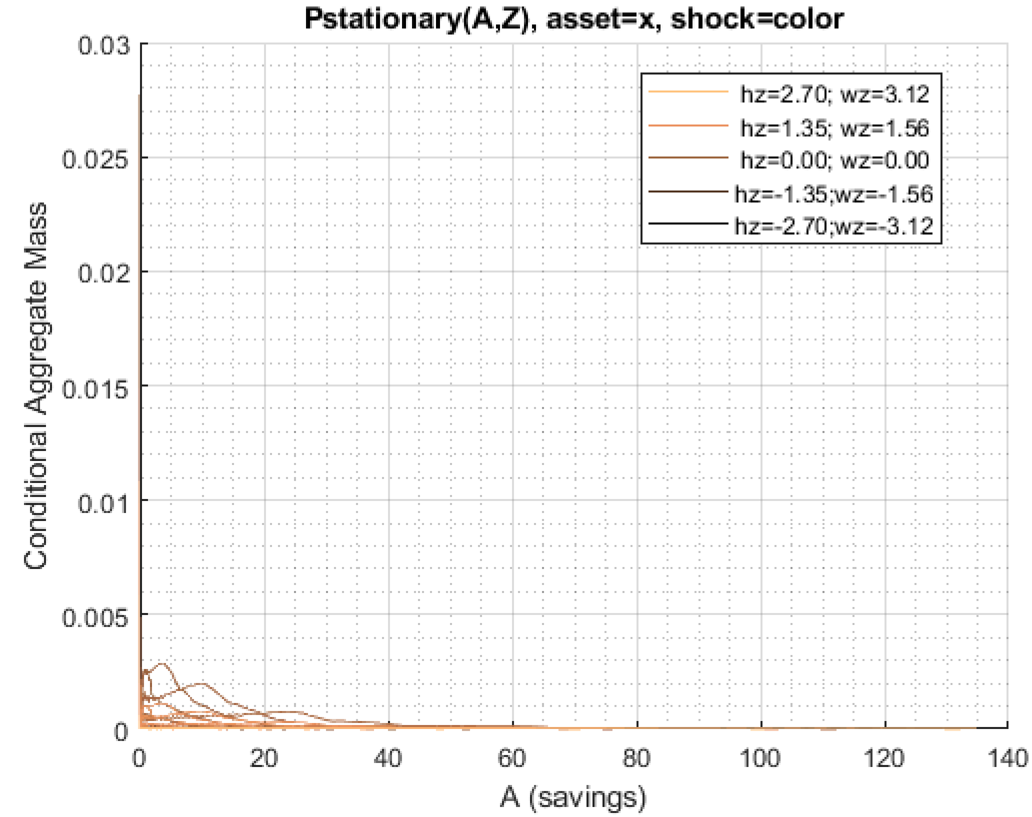
```
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
ar_permute = [1,4,5,6,3,2];
% Value Function
tb_prob_az = ff_summ_nd_array("P(A,Z))", Phi_true, true, ["sum"], 4, 1, cl_mp_datasetdesc, ar_p
```

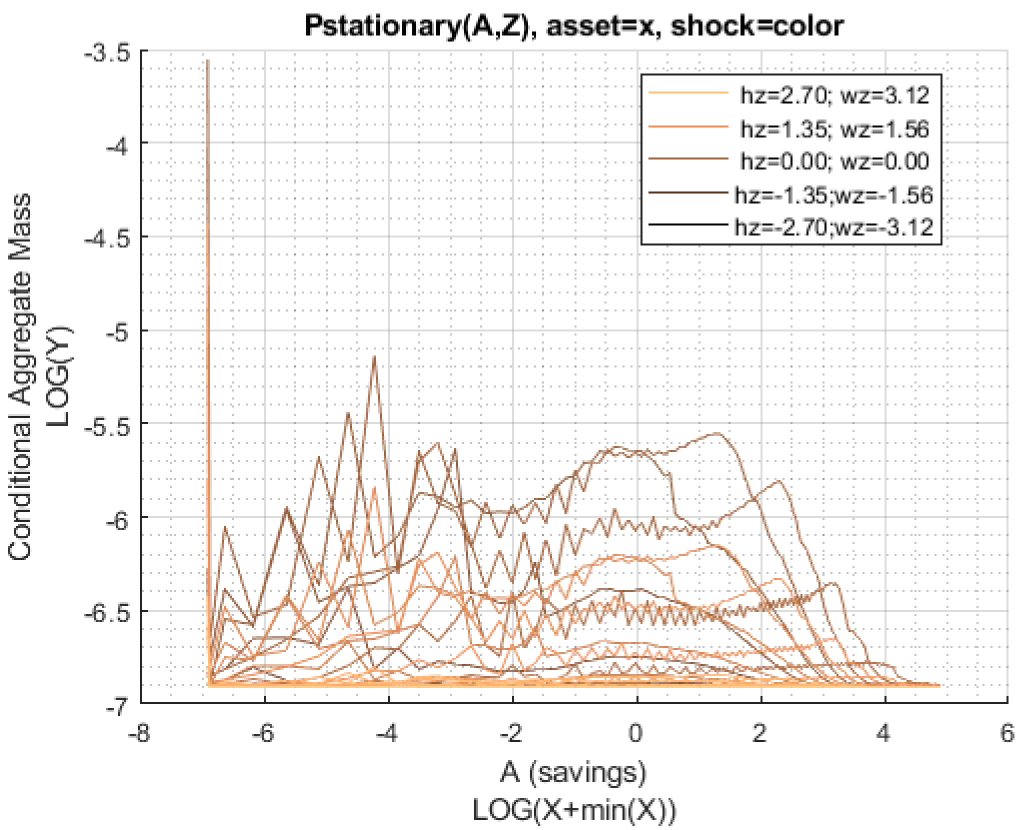
```
xxx  P(A,Z))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
    group    savings    sum_eta_1    sum_eta_2    sum_eta_3    sum_eta_4    sum_eta_5    sum_eta_6    sum_eta_
    _____    _______    _________    _________    _________    _________    _________    _________    ________
```

1	0	1.7754e-05	0.00011362	0.00037708	0.00061913	0.00056244	0.00033244	0.000115
2	4e-05	2.8763e-07	1.3442e-06	4.0195e-06	3.6795e-07	6.5205e-06	1.2822e-06	2.0438e-
3	0.00032	8.5896e-07	2.1837e-06	1.5288e-05	9.7352e-06	3.0233e-05	2.2281e-06	7.9033e-
4	0.00108	2.4168e-06	6.6439e-06	8.5514e-06	8.806e-06	1.0167e-05	3.836e-06	3.4378e-
5	0.00256	7.7644e-07	6.7137e-06	3.5185e-05	3.6273e-05	1.2262e-05	6.4167e-06	5.2691e-
6	0.005	1.615e-07	5.6988e-06	1.2805e-05	1.6079e-05	5.4165e-05	1.0241e-05	1.1273e-
7	0.00864	2.9022e-07	1.5618e-05	1.5907e-05	7.5335e-05	2.1309e-05	1.7692e-05	2.649e-
8	0.01372	9.2058e-08	2.2512e-06	1.6629e-05	2.2447e-05	0.00010906	1.9013e-05	5.201e-
9	0.02048	1.493e-07	5.139e-06	1.987e-05	2.7684e-05	1.8495e-05	2.0213e-05	4.9447e-
10	0.02916	2.2636e-07	2.1911e-06	2.2674e-05	4.0829e-05	5.6366e-05	5.2344e-05	8.8742e-
11	0.04	3.6847e-07	3.2622e-06	3.5384e-05	3.9524e-05	3.7428e-05	6.0069e-05	6.175e-
12	0.05324	2.7682e-07	2.8958e-06	5.7484e-05	3.6034e-05	3.501e-05	4.0214e-05	9.433e-
13	0.06912	3.353e-07	2.6767e-06	1.4572e-05	3.8273e-05	2.474e-05	2.563e-05	1.3972e-
14	0.08788	3.0394e-07	2.2742e-06	1.4027e-05	3.4255e-05	3.7729e-05	1.5417e-05	5.5589e-
15	0.10976	2.5858e-07	1.9422e-06	1.2587e-05	3.4742e-05	2.7058e-05	2.4059e-05	3.9792e-
16	0.135	2.7326e-07	1.9079e-06	1.2852e-05	3.438e-05	3.6783e-05	1.6552e-05	1.4835e-
17	0.16384	2.7552e-07	1.9749e-06	1.5066e-05	3.5948e-05	3.0858e-05	2.8702e-05	5.0937e-
18	0.19652	3.0673e-07	2.1238e-06	2.128e-05	3.877e-05	3.75e-05	1.7398e-05	7.7674e-
19	0.23328	3.2755e-07	2.1478e-06	1.0054e-05	3.8731e-05	3.1329e-05	2.6872e-05	1.3415e-
20	0.27436	3.5257e-07	2.2995e-06	1.0938e-05	4.2758e-05	4.3572e-05	1.8163e-05	1.1471e-
21	0.32	4.0641e-07	2.5518e-06	1.1635e-05	4.5919e-05	3.416e-05	3.1068e-05	6.508e-
22	0.37044	4.4361e-07	2.8814e-06	1.2784e-05	4.688e-05	4.9116e-05	2.2826e-05	1.2243e-
23	0.42592	4.7158e-07	3.2535e-06	1.3383e-05	5.1616e-05	4.104e-05	2.9579e-05	8.6872e-
24	0.48668	5.1923e-07	3.4305e-06	1.432e-05	5.2283e-05	5.1981e-05	2.8417e-05	1.3112e-
25	0.55296	5.437e-07	3.6017e-06	1.5469e-05	5.6439e-05	5.2035e-05	3.2783e-05	9.0771e-
26	0.625	5.5347e-07	3.8425e-06	1.5479e-05	5.5965e-05	5.6994e-05	2.7605e-05	1.2764e-
27	0.70304	5.568e-07	3.7614e-06	1.5095e-05	5.8432e-05	5.4503e-05	3.5853e-05	1.0157e-
28	0.78732	5.7466e-07	3.7497e-06	1.502e-05	5.7903e-05	5.6109e-05	2.9314e-05	1.5137e-
29	0.87808	5.7563e-07	3.8005e-06	1.4892e-05	5.6949e-05	5.3853e-05	3.2364e-05	8.6997e-
30	0.97556	5.7132e-07	3.8705e-06	1.5095e-05	5.6906e-05	5.5758e-05	2.9176e-05	1.1682e-
31	1.08	5.726e-07	3.8645e-06	1.5349e-05	5.6413e-05	5.4339e-05	3.1568e-05	9.0865e-
32	1.1916	5.6625e-07	3.7872e-06	1.484e-05	5.448e-05	5.7108e-05	2.7934e-05	1.2906e-
33	1.3107	5.4238e-07	3.6971e-06	1.4269e-05	5.2724e-05	5.4906e-05	3.2967e-05	8.5976e-
34	1.4375	5.3278e-07	3.5724e-06	1.3626e-05	4.9663e-05	5.6325e-05	2.6723e-05	1.1993e-
35	1.5722	5.0996e-07	3.485e-06	1.3686e-05	4.6691e-05	5.5236e-05	3.069e-05	8.7119e-
36	1.715	5.0398e-07	3.4238e-06	1.3137e-05	4.7646e-05	5.6783e-05	2.8995e-05	1.2248e-
37	1.8662	4.767e-07	3.3615e-06	1.2844e-05	3.4086e-05	5.6434e-05	3.0261e-05	8.7292e-
38	2.0261	4.684e-07	3.2063e-06	1.2531e-05	3.2602e-05	5.8615e-05	2.8719e-05	1.0928e-
39	2.1949	4.5256e-07	3.1314e-06	1.2176e-05	3.2249e-05	5.8445e-05	3.0339e-05	8.5903e-
40	2.3728	4.2248e-07	3.093e-06	1.2003e-05	3.0763e-05	6.0571e-05	2.7865e-05	1.1857e-
41	2.56	4.0678e-07	2.958e-06	1.1808e-05	3.0172e-05	6.0706e-05	3.0549e-05	8.5883e-
42	2.7568	3.9214e-07	2.8541e-06	1.1601e-05	2.9569e-05	6.2065e-05	2.9269e-05	1.1257e-
43	2.9635	3.6841e-07	2.7289e-06	1.1074e-05	2.8387e-05	6.2402e-05	3.0802e-05	9.4896e-
44	3.1803	3.4717e-07	2.6124e-06	1.0683e-05	2.5913e-05	6.3791e-05	2.948e-05	1.1039e-
45	3.4074	3.2367e-07	2.453e-06	1.0352e-05	2.5365e-05	6.4051e-05	3.198e-05	9.2027e-
46	3.645	3.0387e-07	2.3261e-06	9.9363e-06	2.5054e-05	6.4312e-05	3.0105e-05	1.1997e-
47	3.8934	2.8153e-07	2.1577e-06	9.4355e-06	2.4465e-05	6.3912e-05	3.2461e-05	9.3007e-
48	4.1529	2.5915e-07	2.0525e-06	8.9454e-06	2.4289e-05	6.2333e-05	3.3681e-05	1.1739e-
49	4.4237	2.3743e-07	1.8857e-06	8.3087e-06	2.2777e-05	6.0276e-05	3.3448e-05	1.015e-
50	4.706	2.1918e-07	1.7288e-06	7.9955e-06	2.2245e-05	5.8169e-05	3.4403e-05	1.1532e-
51	5	1.9952e-07	1.5877e-06	7.4469e-06	2.1203e-05	5.5849e-05	3.516e-05	1.0208e-
52	5.306	1.8097e-07	1.466e-06	6.9877e-06	2.0273e-05	5.2403e-05	3.5974e-05	1.2261e-
53	5.6243	1.6229e-07	1.3297e-06	6.4332e-06	1.9708e-05	4.7628e-05	3.6187e-05	1.0049e-
54	5.9551	1.4898e-07	1.2561e-06	6.0843e-06	1.9174e-05	4.4076e-05	3.7855e-05	1.2105e-
55	6.2986	1.3486e-07	1.128e-06	5.585e-06	1.771e-05	4.0303e-05	3.7916e-05	1.1196e-
56	6.655	1.2261e-07	1.0323e-06	5.2044e-06	1.6634e-05	3.8461e-05	3.8144e-05	1.1796e-
57	7.0246	1.0954e-07	9.419e-07	4.8168e-06	1.5965e-05	3.7804e-05	4.0109e-05	1.0986e-
58	7.4077	9.7875e-08	8.5816e-07	4.4452e-06	1.4933e-05	3.5109e-05	4.0919e-05	1.2814e-
59	7.8045	8.546e-08	7.7452e-07	4.0603e-06	1.4176e-05	3.2431e-05	4.1509e-05	1.1002e-
60	8.2152	7.3682e-08	6.8673e-07	3.7298e-06	1.328e-05	2.9425e-05	4.2677e-05	1.3136e-
61	8.64	6.477e-08	6.1848e-07	3.4011e-06	1.2396e-05	2.7206e-05	4.266e-05	1.1463e-
62	9.0792	5.531e-08	5.4066e-07	3.0693e-06	1.1543e-05	2.5521e-05	4.3977e-05	1.3086e-
63	9.5331	4.7541e-08	4.7103e-07	2.763e-06	1.0681e-05	2.4224e-05	4.4506e-05	1.1644e-
64	10.002	4.0248e-08	4.0902e-07	2.4495e-06	9.8848e-06	2.2907e-05	4.4746e-05	1.3433e-

65	10.486	3.4304e-08	3.5272e-07	2.1931e-06	9.3275e-06	2.2397e-05	4.3939e-05	1.1663e-
66	10.985	2.8818e-08	3.0078e-07	1.8744e-06	8.5509e-06	2.0402e-05	4.185e-05	1.359e-
67	11.5	2.381e-08	2.5613e-07	1.6478e-06	7.8158e-06	1.8976e-05	4.0119e-05	1.2096e-
68	12.031	1.9337e-08	2.1722e-07	1.4123e-06	7.0946e-06	1.7273e-05	3.7509e-05	1.3534e-
69	12.577	1.5777e-08	1.8339e-07	1.2258e-06	6.3824e-06	1.6049e-05	3.4531e-05	1.2334e-
70	13.14	1.2851e-08	1.5121e-07	1.0425e-06	5.5804e-06	1.4547e-05	3.2353e-05	1.3968e-
71	13.72	1.0265e-08	1.2303e-07	8.8363e-07	4.9327e-06	1.3365e-05	2.8115e-05	1.2302e-
72	14.316	7.9662e-09	9.9864e-08	7.4205e-07	4.3605e-06	1.2054e-05	2.5938e-05	1.4114e-
73	14.93	6.2761e-09	8.0975e-08	6.2212e-07	3.8095e-06	1.0943e-05	2.5285e-05	1.2588e-
74	15.561	4.9435e-09	6.4741e-08	5.1199e-07	3.2737e-06	9.9099e-06	2.404e-05	1.4222e-
75	16.209	3.9203e-09	5.1535e-08	4.1842e-07	2.8741e-06	8.6393e-06	2.2512e-05	1.2829e-
76	16.875	3.0965e-09	4.1106e-08	3.4266e-07	2.4563e-06	7.837e-06	2.0909e-05	1.4707e-
77	17.559	2.4345e-09	3.245e-08	2.7852e-07	2.0728e-06	6.9943e-06	1.9281e-05	1.4198e-
78	18.261	1.8995e-09	2.5906e-08	2.2453e-07	1.8078e-06	6.1702e-06	1.838e-05	1.5235e-
79	18.982	1.4113e-09	2.0505e-08	1.7857e-07	1.4705e-06	5.4235e-06	1.6869e-05	1.4901e-
80	19.722	1.0589e-09	1.5945e-08	1.4273e-07	1.2186e-06	4.7175e-06	1.4272e-05	1.5306e-
81	20.48	7.4099e-10	1.2449e-08	1.1516e-07	1.0016e-06	4.0402e-06	1.2422e-05	1.5529e-
82	21.258	5.3869e-10	9.3255e-09	9.1737e-08	8.0834e-07	3.454e-06	1.0801e-05	1.6191e-
83	22.055	3.8509e-10	7.0555e-09	7.294e-08	6.5411e-07	2.9309e-06	9.4775e-06	1.6242e-
84	22.871	2.8297e-10	5.0721e-09	5.6197e-08	5.2093e-07	2.5225e-06	8.5883e-06	1.664e-
85	23.708	2.0045e-10	3.6381e-09	4.3661e-08	4.1573e-07	2.1339e-06	7.5613e-06	1.615e-
86	24.565	1.4573e-10	2.6214e-09	3.2964e-08	3.3317e-07	1.8413e-06	7.1167e-06	1.6518e-
87	25.442	1.0412e-10	1.9298e-09	2.4937e-08	2.6889e-07	1.5139e-06	6.1692e-06	1.6074e-
88	26.34	7.2935e-11	1.3869e-09	1.8357e-08	2.1245e-07	1.2556e-06	5.9791e-06	1.5443e-

```
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

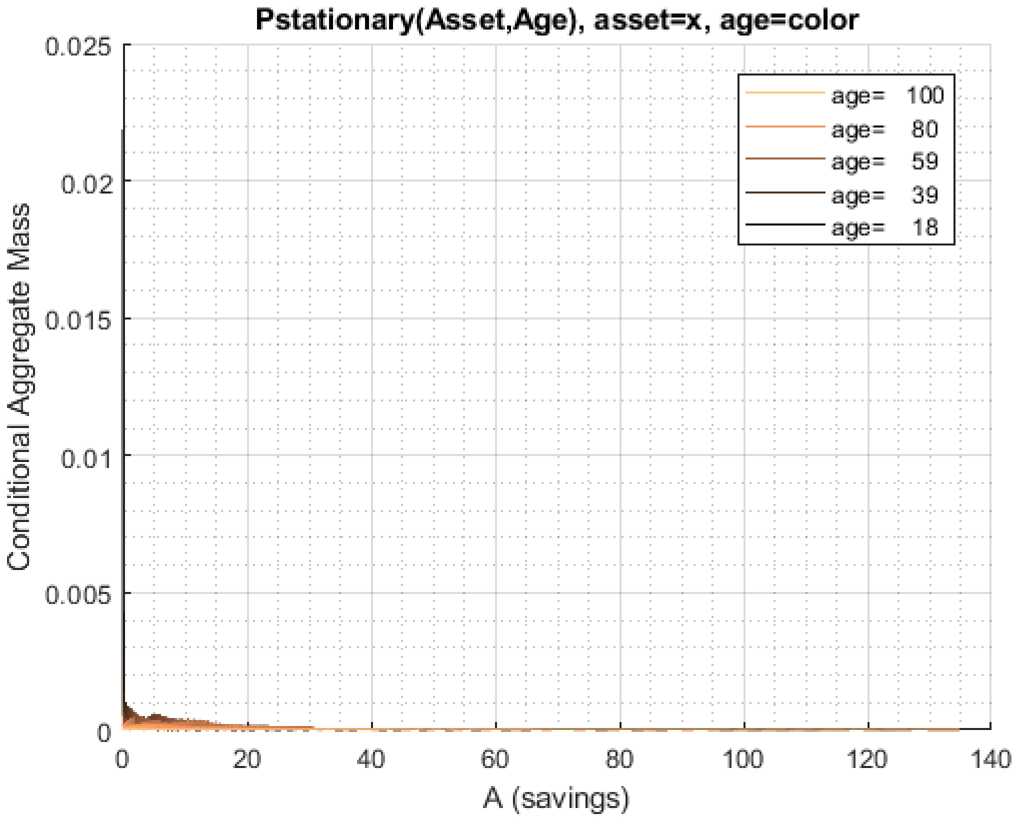
```
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
ar_permute = [3,4,5,6,1,2];
% Value Function
tb_prob_aage = ff_summ_nd_array("P(A,Z))", Phi_true, true, ["sum"], 4, 1, cl_mp_datasetdesc, ar
```

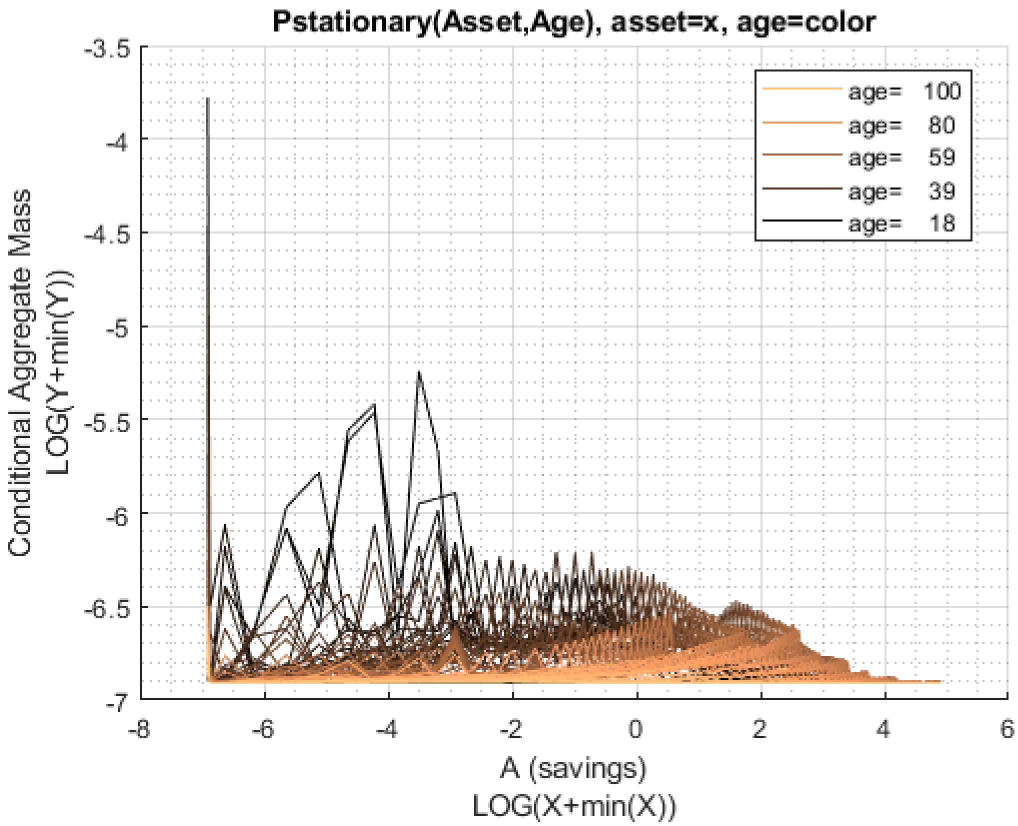
xxx P(A,Z)) xxxxxxxxxxxxxxxxxxxxxxxxxxx

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	0.0064409	0.0087881	0.010534	0.0104
2	4e-05	0	2.3862e-06	2.8257e-06	1.5227e-05	0.0005064	7.2295e-07	4.2993e-
3	0.00032	0	3.749e-05	3.8393e-05	0.00067452	0.0013202	3.5912e-05	3.0603e-
4	0.00108	0	0.00031485	0.0003134	0.00027522	6.8839e-05	0.00011766	1.0826e-
5	0.00256	0	0.0012853	0.0012851	0.0015569	8.2445e-05	6.9654e-05	7.7599e-
6	0.005	0	0.00034215	0.00051426	0.0020793	0.00015903	0.00015172	8.3842e-
7	0.00864	0	0.0028722	0.0026464	0.00031254	0.00033461	0.00019967	0.00015
8	0.01372	0	0.003431	0.003249	0.00031772	0.00028917	0.00016973	0.000192
9	0.02048	0	0.00028503	0.00067598	0.00043826	0.00042815	0.00033024	0.000223
10	0.02916	0	0.004274	0.0016076	0.00077901	0.00039339	0.00032964	0.000329
11	0.04	0	0.0024741	0.0016863	0.0015146	0.0012551	0.00031843	0.000240
12	0.05324	0	0.00012193	0.0017565	0.00025805	0.00022615	0.0011226	0.000258
13	0.06912	0	0.00044563	0.00062939	0.00029172	0.00029416	0.0002238	0.00106
14	0.08788	0	2.7692e-05	0.00011258	0.00015714	0.00018719	0.00024969	0.00023
15	0.10976	0	6.2377e-05	8.9179e-06	7.7238e-05	0.00018316	0.00019603	0.00022
16	0.135	0	0.00067668	0.00016484	0.00010206	0.00022055	0.00021446	0.000203
17	0.16384	0	5.8231e-06	5.0833e-05	0.00019203	0.00023346	0.00025489	0.000201
18	0.19652	0	3.2338e-05	4.7739e-05	0.00021932	0.00024025	0.00027886	0.000268
19	0.23328	0	2.7827e-05	0.00062964	0.00031839	0.00035773	0.00022081	0.000230
20	0.27436	0	3.3098e-06	0.00010242	0.00072231	0.0003499	0.00032682	0.000254
21	0.32	0	4.0326e-05	0.00030725	0.00040297	0.00025423	0.00032626	0.000357
22	0.37044	0	0.00023294	0.00035244	0.00045546	0.00075563	0.00031229	0.000285
23	0.42592	0	0.00029162	0.00046138	0.00031538	0.00034379	0.0003491	0.000318
24	0.48668	0	0.0002901	0.00049108	0.00051896	0.00038724	0.0006911	0.000389
25	0.55296	0	0.00034886	0.00054564	0.0003598	0.00041642	0.00040996	0.000381
26	0.625	0	0.00050916	0.00043448	0.00029056	0.00033958	0.00039168	0.000684
27	0.70304	0	0.00039586	0.00037749	0.00035324	0.00035324	0.00032519	0.000394
28	0.78732	0	0.00020681	0.00035156	0.00038514	0.00031557	0.00036163	0.00031
29	0.87808	0	1.4297e-05	5.5411e-05	0.00015561	0.00033422	0.00029275	0.00031
30	0.97556	0	1.5592e-05	6.288e-05	0.00029113	0.00022006	0.00028829	0.000292
31	1.08	0	2.009e-06	8.4115e-05	0.00014086	0.00019115	0.00020396	0.000243
32	1.1916	0	2.1045e-05	0.00010101	0.00015504	0.00012678	0.00017981	0.000202
33	1.3107	0	1.4435e-06	6.9572e-05	5.1203e-05	0.00020997	0.00013959	0.000170
34	1.4375	0	5.1689e-07	4.651e-05	7.846e-05	7.725e-05	0.00011616	0.000138
35	1.5722	0	4.7793e-07	4.484e-06	2.0179e-05	8.927e-05	0.00010084	0.000127
36	1.715	0	2.3446e-06	4.8601e-06	2.089e-05	4.4483e-05	0.00017191	9.4146e-
37	1.8662	0	2.6545e-07	5.0217e-06	2.8241e-05	3.3543e-05	5.1577e-05	0.000107
38	2.0261	0	5.4286e-07	3.5584e-06	1.983e-05	3.2623e-05	4.7562e-05	7.1725e-
39	2.1949	0	1.5332e-06	2.2585e-05	9.6032e-06	3.0291e-05	4.164e-05	0.000130
40	2.3728	0	4.1159e-06	1.2542e-05	1.5038e-05	2.1111e-05	4.7981e-05	4.8526e-
41	2.56	0	4.9992e-06	9.9161e-06	2.4244e-05	2.6564e-05	3.3403e-05	5.1081e-
42	2.7568	0	7.7981e-06	1.5369e-05	2.0348e-05	3.8876e-05	3.2557e-05	4.6239e-
43	2.9635	0	1.0694e-05	1.9867e-05	2.6661e-05	3.3652e-05	4.0382e-05	4.2981e-
44	3.1803	0	1.3309e-05	1.8776e-05	4.5294e-05	3.4882e-05	4.4248e-05	4.3244e-
45	3.4074	0	1.3226e-05	2.3002e-05	3.5636e-05	3.4395e-05	4.1287e-05	4.2401e-
46	3.645	0	3.533e-06	2.5709e-05	3.2868e-05	4.0509e-05	3.8809e-05	4.4435e-
47	3.8934	0	1.8503e-05	2.4946e-05	2.6065e-05	3.9174e-05	3.9923e-05	4.3463e-

```
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	-37.592	1.9854	0.84341	0.22902
{'unweighted_sum' }	11476	2.4405e+05	-7.8955e+05	21	4422.1	561.99
{'sd' }	6.9537	0.67774	55.748	1.0848	0.90505	0.5733
{'coefofvar' }	0.68742	0.89486	-1.483	0.54639	1.0731	2.5032
{'gini' }	0.32034	0.41117	-0.64344	0.268	0.41353	0.83721
{'min' }	1	0.035637	-868.79	1	0.038108	0
{'max' }	151	18.059	25.518	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	-746.63	1	0.038108	0
{'p10' }	1	0.24578	-86.517	1	0.14676	0
{'p25' }	7	0.3161	-50.751	1	0.28802	0
{'p50' }	9	0.51551	-25.389	2	0.56523	0
{'p75' }	11	0.88958	-5.527	3	1.1092	0.23956
{'p90' }	23	1.5797	6.0744	4	2.1768	0.8323
{'p99_99' }	52	6.8857	23.692	6	8.3836	8.6488
{'fl_cov_ap_ss' }	48.354	1.9167	116.57	0.29345	1.7747	3.1074
{'fl_cor_ap_ss' }	1	0.4067	0.3007	0.038901	0.28199	0.77947
{'fl_cov_c_ss' }	1.9167	0.45934	20.369	0.067217	0.59824	0.081697

```
    {'fl_cor_c_ss'       }       0.4067            1         0.5391      0.091423          0.9753       0.21026
    {'fl_cov_v_ss'       }       116.57       20.369         3107.8        2.9005          24.615        4.9476
    {'fl_cor_v_ss'       }       0.3007       0.5391              1      0.047962         0.48787       0.15481
    {'fl_cov_n_ss'       }      0.29345     0.067217         2.9005        1.1768      -1.236e-17       0.13364
    {'fl_cor_n_ss'       }     0.038901     0.091423       0.047962             1     -1.2589e-17       0.21488
    {'fl_cov_y_head_inc' }       1.7747      0.59824         24.615    -1.236e-17         0.81911      0.021751
    {'fl_cor_y_head_inc' }      0.28199       0.9753        0.48787   -1.2589e-17               1       0.04192
    {'fl_cov_y_spouse'   }       3.1074     0.081697         4.9476       0.13364        0.021751       0.32867
    {'fl_cor_y_spouse'   }      0.77947      0.21026        0.15481       0.21488         0.04192             1
    {'fl_cov_yshr_wage'  }   3.7471e-30   2.4421e-31    -9.1828e-31    1.0754e-30      8.1847e-31    7.0393e-32
    {'fl_cor_yshr_wage'  }   4.0447e-16   2.7046e-16    -1.2364e-17    7.4411e-16       6.788e-16    9.2163e-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         1.8609     0.0077776        0.025219     0.0090401
    {'fl_cor_yshr_nttxss'}      0.58487      0.77071        0.81728       0.17554         0.68223       0.38607
    {'fracByP0_01'       }     0.010925   6.6761e-05      0.0030452       0.21046      0.00015228             0
    {'fracByP10'         }     0.010925     0.050401        0.44014       0.21046        0.019229             0
    {'fracByP25'         }        0.148     0.072459        0.71161       0.21046        0.096342             0
    {'fracByP50'         }      0.28531      0.21889        0.94673       0.53024         0.29663             0
    {'fracByP75'         }      0.60536      0.47077         1.0363       0.77109         0.59361       0.13003
    {'fracByP90'         }        0.758      0.70215         1.0323       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     y
    _____________________    __________    __________    ___________    __________    __________    __________    _

    {'mean'              }       55.659        1.287        -12.919        1.7239          1.8545       0.45057
    {'unweighted_sum'    }        11476   2.6894e+05    -1.1138e+05            21           13268        1069.5
    {'sd'                }       23.095       1.0938         20.385       0.90777          2.0429        1.1205
    {'coefofvar'         }      0.41494      0.84994        -1.5779       0.52659          1.1016        2.4867
    {'gini'              }      0.22938      0.40011       -0.80515       0.23461         0.47957       0.83345
    {'min'               }            1     0.055882        -235.34             1        0.059541             0
    {'max'               }          151        32.48         14.759             6           23.47        20.112
    {'pYis0'             }            0            0              0             0               0       0.52499
    {'pYls0'             }            0            0        0.74277             0               0             0
    {'pYgr0'             }            1            1        0.25723             1               1       0.47501
    {'pYisMINY'          }    0.0037896   2.9499e-05     3.9537e-07       0.48835      9.9096e-05       0.52499
    {'pYisMAXY'          }   4.9199e-06   2.3292e-08              0     0.0036816      2.0186e-06    4.8438e-06
    {'p0_01'             }            1      0.05663        -137.64             1        0.059554             0
    {'p10'               }           28      0.31379        -41.113             1         0.39098             0
    {'p25'               }           41      0.59299        -18.867             1          0.6458             0
    {'p50'               }           55        1.065        -7.2226             2          1.1351             0
    {'p75'               }           70       1.6559        0.35778             2          2.1525       0.48062
    {'p90'               }           85       2.4892          6.453             3            4.19        1.7443
    {'p99_99'            }          146       15.179          14.69             6          22.847        16.777
    {'fl_cov_ap_ss'      }       533.38       21.832         417.21        2.9474          37.948        5.9801
    {'fl_cor_ap_ss'      }            1      0.86423        0.88619       0.14059         0.80428        0.2311
    {'fl_cov_c_ss'       }       21.832       1.1965         14.391       0.23796          2.0766       0.27801
    {'fl_cor_c_ss'       }      0.86423            1        0.64539       0.23965         0.92925       0.22684
    {'fl_cov_v_ss'       }       417.21       14.391         415.54        3.8082          23.854        4.7175
    {'fl_cor_v_ss'       }      0.88619      0.64539              1        0.2058          0.5728       0.20654
    {'fl_cov_n_ss'       }       2.9474      0.23796         3.8082       0.82404        0.062177        0.2771    -
    {'fl_cor_n_ss'       }      0.14059      0.23965         0.2058             1        0.033527       0.27244
    {'fl_cov_y_head_inc' }       37.948       2.0766         23.854      0.062177          4.1736        0.1726
    {'fl_cor_y_head_inc' }      0.80428      0.92925         0.5728      0.033527               1      0.075404
    {'fl_cov_y_spouse'   }       5.9801      0.27801         4.7175        0.2771          0.1726        1.2554
    {'fl_cor_y_spouse'   }       0.2311      0.22684        0.20654       0.27244        0.075404             1
    {'fl_cov_yshr_wage'  }      -1.3386    -0.041425        -1.1118    -0.0063156       -0.054208      0.014235
    {'fl_cor_yshr_wage'  }      -0.6493     -0.42426       -0.61101      -0.07794        -0.29725       0.14232
    {'fl_cov_yshr_SS'    }            0            0              0             0               0             0
    {'fl_cor_yshr_SS'    }          NaN          NaN            NaN           NaN             NaN           NaN
    {'fl_cov_yshr_nttxss'}      0.76653     0.028255        0.72181     0.0084863        0.047728      0.014539    -
    {'fl_cor_yshr_nttxss'}      0.88794      0.69107        0.94731        0.2501         0.62501       0.34714
    {'fracByP0_01'       }   6.8085e-05   5.4514e-06      0.0013821       0.28329      4.1425e-06             0    3
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{'fracByP10' }	0.031672	0.019903	0.46352	0.28329	0.013283	0
{'fracByP25' }	0.1219	0.075667	0.79865	0.28329	0.054393	0
{'fracByP50' }	0.34388	0.22765	1.0532	0.72028	0.1806	0
{'fracByP75' }	0.62522	0.48161	1.1105	0.72028	0.41873	0.15283
{'fracByP90' }	0.8294	0.71297	1.0711	0.85389	0.65167	0.3418
{'fracByP99_99' }	0.9998	0.99881	1	1	0.99935	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	0.33746	-3.2579	1.4797	0.23579	0.09988
{'unweighted_sum' }	1	2.8049e+05	789.51	21	483.8	33.1
{'sd' }	1.088e-14	0.23923	1.2254	0.50567	0.022052	0.2444
{'coefofvar' }	1.088e-14	0.70891	-0.37615	0.34173	0.093527	2.4469
{'gini' }	0	0.29996	-0.20031	0.12034	0.044484	0.78724
{'min' }	1	0.19737	-11.197	1	0.22	0
{'max' }	1	141.61	0.99282	6	5.666	3.0753
{'pYis0' }	0	0	0	0	0	0.52499
{'pYls0' }	0	0	0.99204	0	0	0
{'pYgr0' }	1	1	0.007965	1	1	0.47501
{'pYisMINY' }	1	0.34474	1.4552e-10	0.5232	0.48869	0.52499
{'pYisMAXY' }	1	0	0	4.2206e-08	0	1.0335e-08
{'p0_01' }	1	0.19737	-7.038	1	0.22	0
{'p10' }	1	0.19737	-4.0665	1	0.22	0
{'p25' }	1	0.19737	-4.0665	1	0.22	0
{'p50' }	1	0.23607	-3.7707	1	0.2202	0
{'p75' }	1	0.36676	-2.6758	2	0.266	0.10166
{'p90' }	1	0.59408	-1.2803	2	0.26717	0.48427
{'p99_99' }	1	2.9028	0.51281	4	0.31843	2.9082
{'fl_cov_ap_ss' }	1.1838e-28	4.4139e-31	3.5754e-30	4.121e-29	2.8489e-30	-3.2619e-31
{'fl_cor_ap_ss' }	1	1.6958e-16	2.6816e-16	7.4904e-15	1.1874e-14	-1.2267e-16
{'fl_cov_c_ss' }	4.4139e-31	0.057229	0.23842	0.059118	0.0016668	0.050594
{'fl_cor_c_ss' }	1.6958e-16	1	0.81327	0.48871	0.31595	0.86534
{'fl_cov_v_ss' }	3.5754e-30	0.23842	1.5017	0.20689	0.012148	0.17973
{'fl_cor_v_ss' }	2.6816e-16	0.81327	1	0.33387	0.44951	0.60012
{'fl_cov_n_ss' }	4.121e-29	0.059118	0.20689	0.2557	0.0018516	0.052581
{'fl_cor_n_ss' }	7.4904e-15	0.48871	0.33387	1	0.16604	0.42546
{'fl_cov_y_head_inc' }	2.8489e-30	0.0016668	0.012148	0.0018516	0.0004863	0.00064389
{'fl_cor_y_head_inc' }	1.1874e-14	0.31595	0.44951	0.16604	1	0.11947
{'fl_cov_y_spouse' }	-3.2619e-31	0.050594	0.17973	0.052581	0.00064389	0.059731
{'fl_cor_y_spouse' }	-1.2267e-16	0.86534	0.60012	0.42546	0.11947	1
{'fl_cov_yshr_wage' }	-6.2277e-32	0.040102	0.18489	0.087766	0.00067273	0.043238
{'fl_cor_yshr_wage' }	-2.5076e-17	0.73439	0.66096	0.76038	0.13365	0.77505
{'fl_cov_yshr_SS' }	-3.036e-30	-0.041567	-0.19392	-0.089099	-0.00074396	-0.043211
{'fl_cor_yshr_SS' }	-1.2162e-15	-0.75734	-0.68973	-0.768	-0.14704	-0.77064
{'fl_cov_yshr_nttxss'}	-3.8383e-30	0.045721	0.21331	0.096069	0.00089733	0.047619
{'fl_cor_yshr_nttxss'}	-1.4131e-15	0.76558	0.69726	0.76104	0.163	0.78049
{'fracByP0_01' }	1	0.20164	0.00049502	0.35357	0.45597	0
{'fracByP10' }	1	0.20164	0.5347	0.35357	0.45597	0
{'fracByP25' }	1	0.20164	0.5347	0.35357	0.45597	0
{'fracByP50' }	1	0.31034	0.64676	0.35357	0.46775	0
{'fracByP75' }	1	0.52813	0.89014	0.99419	0.87014	0.19248
{'fracByP90' }	1	0.73972	0.97784	0.99419	0.88578	0.62777
{'fracByP99_99' }	1	0.9992	1	0.99999	0.99992	0.9996