FF_DS_AZ_CTS_VEC Dynamic Savings Vectorized Continuous Distribution

back to Fan's Intro Math for Econ, Matlab Examples, or Dynamic Asset Repositories

This is the example vignette for function: **ff_ds_az_cts_vec** from the **MEconTools Package.** F(a,z) discrete probability mass function given policy function solution with continuous savings choices, vectorized.

- Distribution for Common Choice and States Grid ***Loop***: ff_ds_az_cts_loop
- Distribution for States Grid + Continuous Exact Savings as Share of Cash-on-Hand ***Loop***: **ff_ds_az_cts_loop**
- Distribution for States Grid + Continuous Exact Savings as Share of Cash-on-Hand ***Vectorized***: **ff_ds_az_cts_vec**

Test FF_DS_AZ_CTS_VEC Defaults

Call the function with defaults. By default, shows the asset policy function summary. Model parameters can be changed by the mp_params.

```
%mp_params
mp_params = containers.Map('KeyType','char', 'ValueType','any');
mp_params('fl_crra') = 1.5;
mp_params('fl_beta') = 0.94;
% call function
ff_ds_az_cts_vec(mp_params);
```

```
Elapsed time is 2.185467 seconds.
----------------------------------------
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
CONTAINER NAME: mp_ffcmd ND Array (Matrix etc)
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
          i    idx    ndim    numel    rowN    colN     sum      mean      std      coefvari    min      max
          _    ___    ____    _____    ____    ____    _____    ______    ______    ________    ___    ______

    ap    1     1      2       3000     200      15     42703    14.234    14.307     1.0051      0     51.591

xxx TABLE:ap xxxxxxxxxxxxxxxxx
              c1        c2        c3        c4        c5        c11       c12       c13       c14       c15
            ______    ______    ______    ______    ______    _______    _______    ______    ______    ______

    r1           0         0         0         0         0    0.58655    0.89911    1.2884    1.7803    2.3861
    r2           0         0         0         0         0    0.58671    0.89914    1.2885    1.7804    2.3862
    r3           0         0         0         0         0     0.5871    0.89961    1.2888    1.7808    2.3867
    r4           0         0         0         0         0    0.58803    0.90058    1.2898    1.7817    2.3877
    r5           0         0         0         0         0    0.58953    0.90208    1.2914    1.7831    2.3891
    r196    45.655    45.699    45.725    45.798    45.889     47.025     47.404    47.828    48.358    49.028
    r197    46.257    46.303    46.326    46.401    46.492     47.626     48.005    48.432    48.965    49.651
    r198    46.863     46.91    46.931    47.007    47.097     48.232     48.611    49.041     49.59    50.294
    r199    47.472    47.521    47.542    47.617    47.711     48.843     49.222    49.658    50.235     50.94
    r200    48.088    48.134    48.157    48.232    48.326     49.459     49.841    50.311    50.885    51.591

FF_DS_AZ_CTS_LOOP finished. Distribution took = 0.13145
----------------------------------------
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
CONTAINER NAME: mp_ddcmd ND Array (Matrix etc)
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

	i	idx	ndim	numel	rowN	colN	sum	mean	std	coefvari	min
fa	1	1	2	200	200	1	1	0.005	0.0096174	1.9235	0
faz	2	2	2	3000	200	15	1	0.00033333	0.0011636	3.4908	0
fz	3	3	2	15	15	1	1	0.066667	0.076895	1.1534	6.1035e-05

xxx TABLE:fa xxxxxxxxxxxxxxxxx

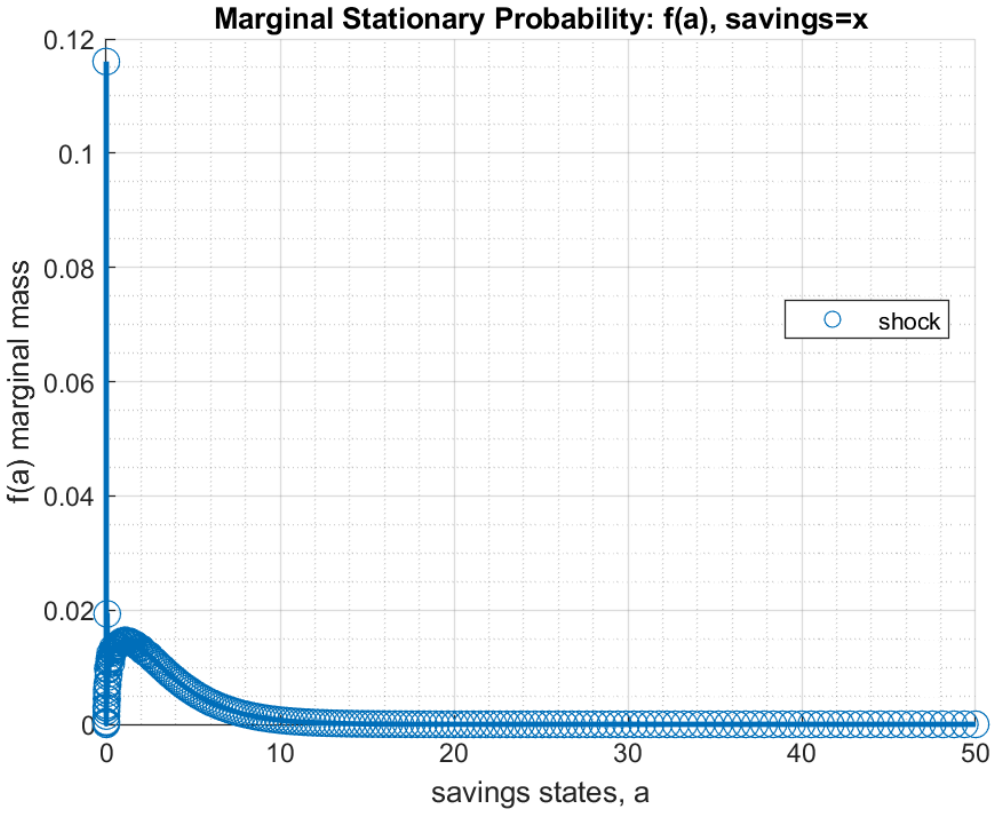
	c1
r1	0.11604
r2	0
r3	0.0004751
r4	0.00026799
r5	0.0029727
r196	3.5618e-14
r197	2.1735e-14
r198	1.329e-14
r199	8.3938e-15
r200	8.2751e-15

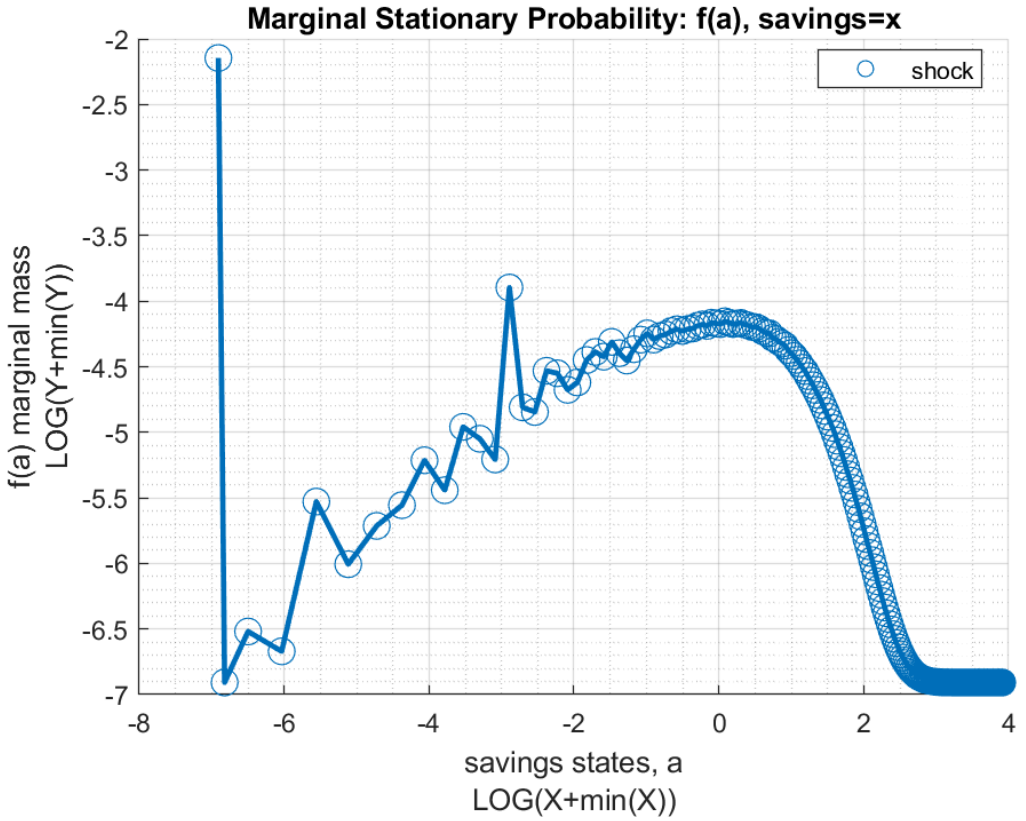
xxx TABLE:faz xxxxxxxxxxxxxxxxx

	c1	c2	c3	c4	c5	c11	c12	c13
r1	4.1559e-05	0.00053618	0.0031141	0.010616	0.023097	9.8338e-05	8.1894e-06	4.3385
r2	0	0	0	0	0	0	0	
r3	2.0452e-10	1.1226e-08	2.5837e-07	3.2065e-06	2.2865e-05	1.2294e-06	1.0693e-07	5.8481
r4	8.6656e-10	2.8074e-08	3.684e-07	2.7287e-06	1.4098e-05	6.831e-07	5.9408e-08	3.249
r5	9.2776e-08	2.9148e-06	3.479e-05	0.00019689	0.00056423	2.3628e-06	1.9305e-07	1.0072
r196	1.6685e-22	7.5909e-21	1.5483e-19	1.8762e-18	1.5117e-17	7.3723e-15	8.1882e-15	6.5347
r197	4.6363e-23	2.3916e-21	5.523e-20	7.5562e-19	6.8327e-18	4.5113e-15	5.0046e-15	4.0053
r198	8.2487e-24	4.9336e-22	1.3328e-20	2.1488e-19	2.2991e-18	2.8157e-15	3.0885e-15	2.4579
r199	6.6913e-25	5.3279e-23	1.9003e-21	4.0019e-20	5.5219e-19	1.9017e-15	2.0244e-15	1.5281
r200	2.8381e-26	2.725e-24	1.1911e-22	3.1319e-21	5.5136e-20	1.4819e-15	2.2618e-15	2.1457

xxx TABLE:fz xxxxxxxxxxxxxxxxx

	c1
r1	6.1035e-05
r2	0.00085449
r3	0.0055542
r4	0.022217
r5	0.061096
r11	0.061096
r12	0.022217
r13	0.0055542
r14	0.00085449
r15	6.1035e-05





xxx tb_outcomes: all stats xxx

OriginalVariableNames	ap	v	c	y	coh	savefraccoh
{'mean' }	1.675	5.0913	1.4673	1.467	3.1423	0.37474
{'unweighted_sum' }	42703	26797	7295.8	6979.8	49998	1657.9

{'sd' }	2.0062	1.7215	0.36267	0.51485	2.3189	0.24932
{'coefofvar' }	1.1977	0.33813	0.24717	0.35095	0.73794	0.66532
{'gini' }	0.59404	0.19113	0.13962	0.19161	0.37632	0.39022
{'min' }	0	-1.2641	0.38052	0.38052	0.38052	0
{'max' }	51.591	16.787	5.0209	6.6099	56.61	0.91805
{'pYis0' }	0.11606	0	0	0	0	0.11606
{'pYls0' }	0	0.00066766	0	0	0	0
{'pYgr0' }	0.88394	0.99933	1	1	1	0.88394
{'pYisMINY' }	0.11606	4.1559e-05	4.1559e-05	4.1559e-05	4.1559e-05	0.11606
{'pYisMAXY' }	3.1409e-16	3.1409e-16	5.148e-16	3.1409e-16	3.1409e-16	2.8381e-26
{'p0_01' }	0	-0.34507	0.45473	0.45473	0.45473	0
{'p0_1' }	0	0.52204	0.54342	0.54342	0.54342	0
{'p1' }	0	1.3412	0.6494	0.6494	0.6494	0
{'p5' }	0	2.1813	0.85431	0.77605	0.88697	0
{'p10' }	0	2.8514	0.96477	0.92741	1.002	0
{'p20' }	0.10665	3.5986	1.1516	1.0358	1.3244	0.083657
{'p25' }	0.21483	3.8501	1.2354	1.1105	1.4524	0.14274
{'p30' }	0.32994	4.2218	1.284	1.129	1.6395	0.20194
{'p40' }	0.60561	4.5759	1.3788	1.3244	1.999	0.30454
{'p50' }	0.9866	5.0443	1.4671	1.363	2.4484	0.39896
{'p60' }	1.4331	5.4957	1.5615	1.5828	2.9924	0.48032
{'p70' }	2.0261	5.9595	1.6562	1.6429	3.671	0.556
{'p75' }	2.4055	6.2377	1.7089	1.7094	4.0981	0.59225
{'p80' }	2.8929	6.5441	1.7669	1.9106	4.6329	0.62436
{'p90' }	4.3431	7.3623	1.9254	2.123	6.2699	0.69668
{'p95' }	5.7881	8.0262	2.0625	2.4019	7.7831	0.74075
{'p99' }	8.9453	9.2776	2.3421	2.9539	11.327	0.79763
{'p99_9' }	13.367	10.599	2.6636	3.7357	15.962	0.83767
{'p99_99' }	17.333	11.639	2.9483	4.3328	20.294	0.85903
{'fl_cov_ap' }	4.0248	2.8944	0.61038	0.64355	4.6352	0.41772
{'fl_cor_ap' }	1	0.83807	0.83891	0.62307	0.99637	0.83512
{'fl_cov_v' }	2.8944	2.9636	0.62238	0.79332	3.5168	0.36874
{'fl_cor_v' }	0.83807	1	0.99685	0.89507	0.88097	0.85912
{'fl_cov_c' }	0.61038	0.62238	0.13153	0.16405	0.74192	0.079746
{'fl_cor_c' }	0.83891	0.99685	1	0.87859	0.8822	0.88192
{'fl_cov_y' }	0.64355	0.79332	0.16405	0.26507	0.80761	0.079867
{'fl_cor_y' }	0.62307	0.89507	0.87859	1	0.67647	0.6222
{'fl_cov_coh' }	4.6352	3.5168	0.74192	0.80761	5.3771	0.49746
{'fl_cor_coh' }	0.99637	0.88097	0.8822	0.67647	1	0.86045
{'fl_cov_savefraccoh'}	0.41772	0.36874	0.079746	0.079867	0.49746	0.062162
{'fl_cor_savefraccoh'}	0.83512	0.85912	0.88192	0.6222	0.86045	1
{'fracByP0_01' }	0	-4.8153e-05	0.00017799	0.00018159	8.3115e-05	0
{'fracByP0_1' }	0	0.00027167	0.0013548	0.0014279	0.00063242	0
{'fracByP1' }	0	0.0032852	0.0063125	0.0069982	0.0029338	0
{'fracByP5' }	0	0.016969	0.025021	0.024262	0.011819	0
{'fracByP10' }	0	0.044207	0.05664	0.064855	0.026579	0
{'fracByP20' }	0.0026834	0.1115	0.13073	0.11733	0.067668	0.0099043
{'fracByP25' }	0.0076113	0.14492	0.17311	0.15549	0.086	0.025483
{'fracByP30' }	0.015302	0.19105	0.21762	0.19333	0.11182	0.048984
{'fracByP40' }	0.043894	0.27218	0.30467	0.27748	0.16912	0.11643
{'fracByP50' }	0.089861	0.36738	0.40369	0.36807	0.23805	0.21205
{'fracByP60' }	0.16112	0.46928	0.50828	0.46652	0.3263	0.32962
{'fracByP70' }	0.26525	0.58046	0.61519	0.57507	0.4298	0.46793
{'fracByP75' }	0.33325	0.64122	0.67431	0.63025	0.49166	0.54754
{'fracByP80' }	0.41265	0.70474	0.73277	0.69273	0.56293	0.62653
{'fracByP90' }	0.62139	0.84051	0.85792	0.82668	0.73375	0.80195
{'fracByP95' }	0.77085	0.91406	0.9245	0.90615	0.84324	0.89716
{'fracByP99' }	0.93558	0.98098	0.98317	0.97729	0.95807	0.97822
{'fracByP99_9' }	0.99103	0.99787	0.99814	0.9972	0.99438	0.99775
{'fracByP99_99' }	0.99886	0.99977	0.99979	0.99969	0.99931	0.99977

Test FF_DS_AZ_CTS_VEC Speed Tests

Call the function with different a and z grid size, print out speed:

```
mp_support = containers.Map('KeyType','char', 'ValueType','any');
mp_support('bl_timer') = true;
mp_support('ls_ffcmd') = {};
mp_support('ls_ddcmd') = {};
mp_support('ls_ddgrh') = {};
mp_support('bl_show_stats_table') = false;
% A grid 50, shock grid 5:
mp_params = containers.Map('KeyType','char', 'ValueType','any');
mp_params('it_a_n') = 50;
mp_params('it_z_n') = 5;
ff_ds_az_cts_vec(mp_params, mp_support);
```

```
Elapsed time is 0.459956 seconds.
FF_DS_AZ_CTS_LOOP finished. Distribution took = 0.015748
```

```
% A grid 100, shock grid 7:
mp_params = containers.Map('KeyType','char', 'ValueType','any');
mp_params('it_a_n') = 100;
mp_params('it_z_n') = 7;
ff_ds_az_cts_vec(mp_params, mp_support);
```

```
Elapsed time is 0.938024 seconds.
FF_DS_AZ_CTS_LOOP finished. Distribution took = 0.046035
```

```
% A grid 200, shock grid 9:
mp_params = containers.Map('KeyType','char', 'ValueType','any');
mp_params('it_a_n') = 200;
mp_params('it_z_n') = 9;
ff_ds_az_cts_vec(mp_params, mp_support);
```

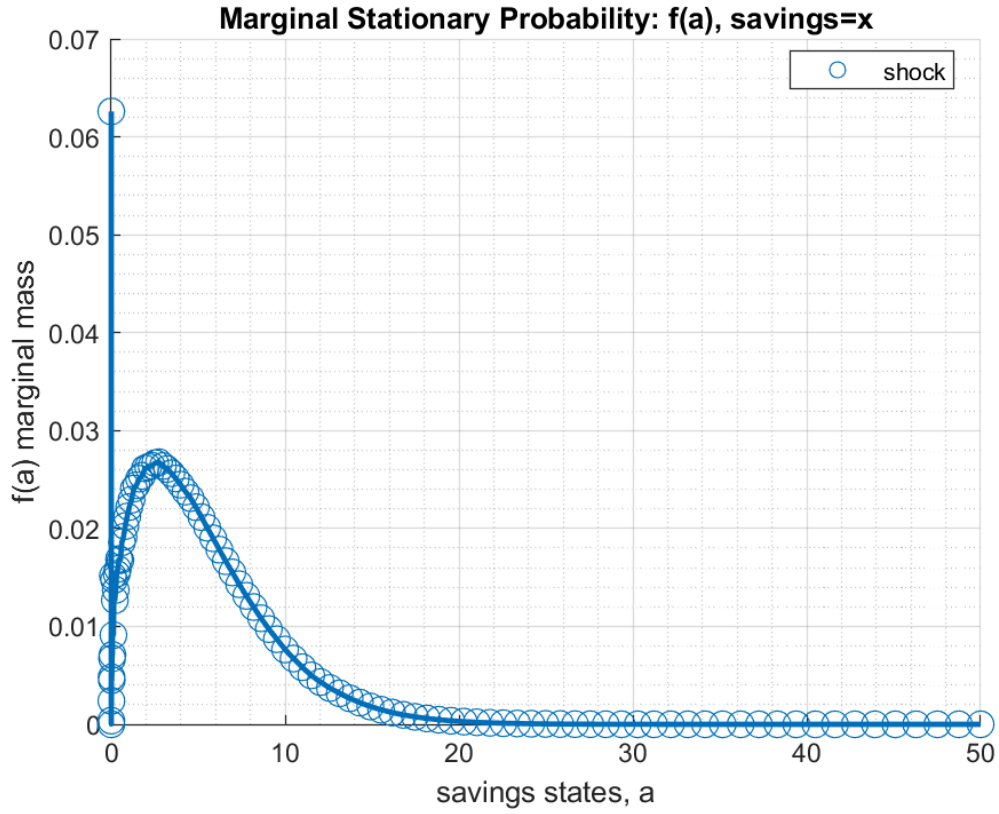
```
Elapsed time is 1.696573 seconds.
FF_DS_AZ_CTS_LOOP finished. Distribution took = 0.12795
```

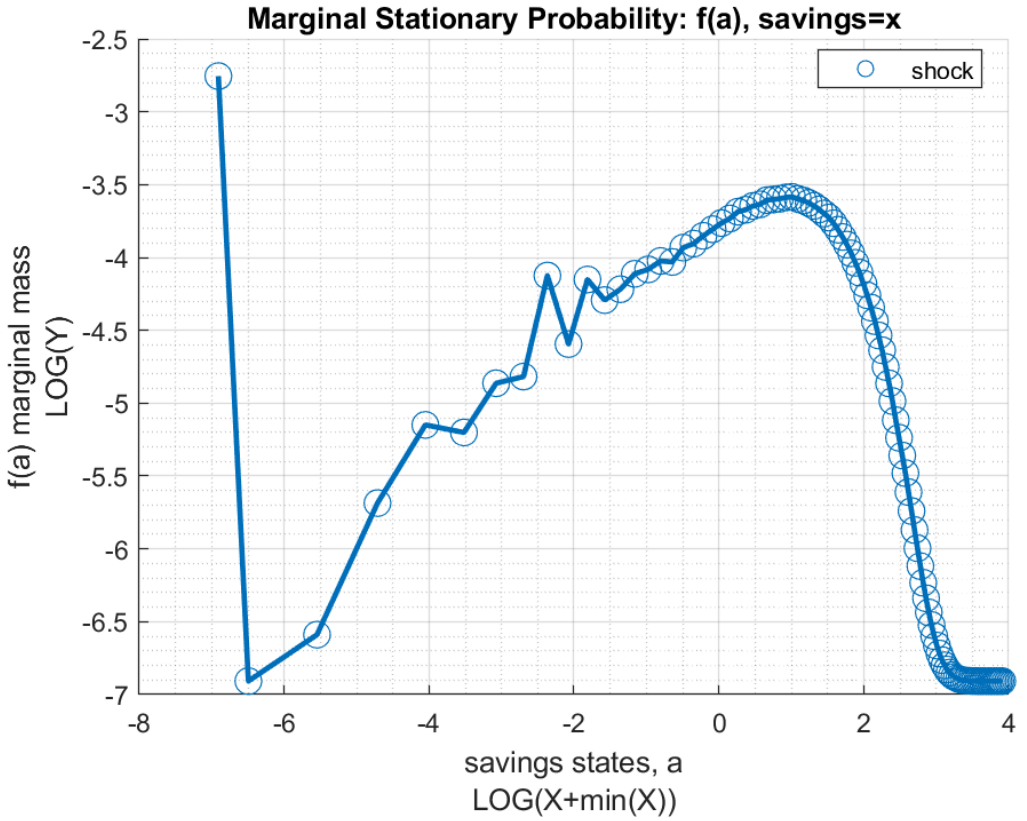
Test FF_DS_AZ_CTS_VEC A grid 100 Shock grid 7

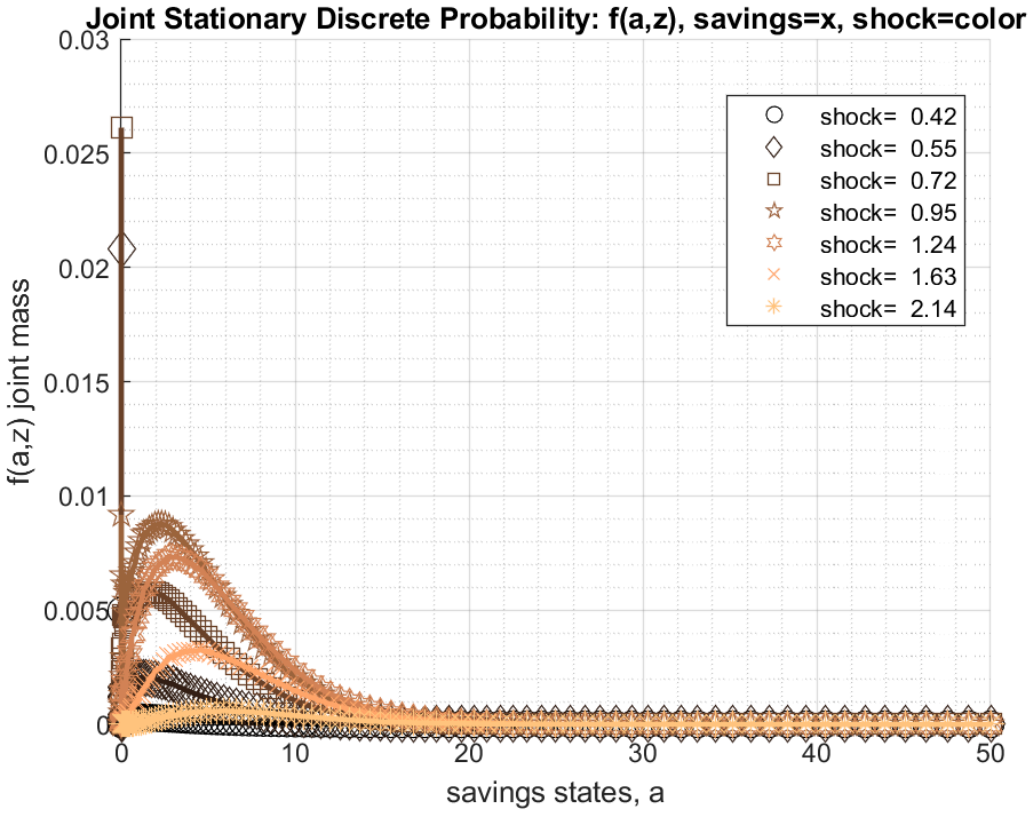
Call the function with different a and z grid size, print out speed:

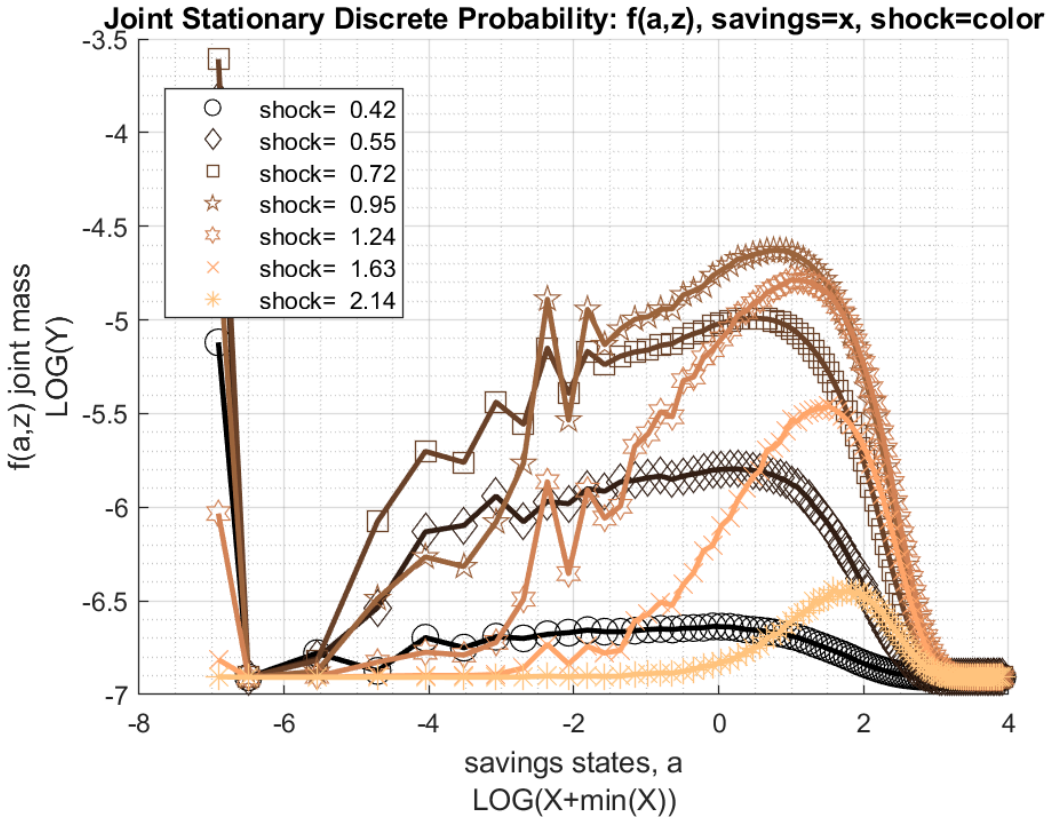
```
mp_support = containers.Map('KeyType','char', 'ValueType','any');
mp_support('bl_timer') = true;
mp_support('ls_ffcmd') = {};
mp_support('ls_ddcmd') = {};
mp_support('ls_ddgrh') = {'faz','fa'};
mp_support('bl_show_stats_table') = true;
mp_params = containers.Map('KeyType','char', 'ValueType','any');
mp_params('it_a_n') = 100;
mp_params('it_z_n') = 7;
ff_ds_az_cts_vec(mp_params, mp_support);
```

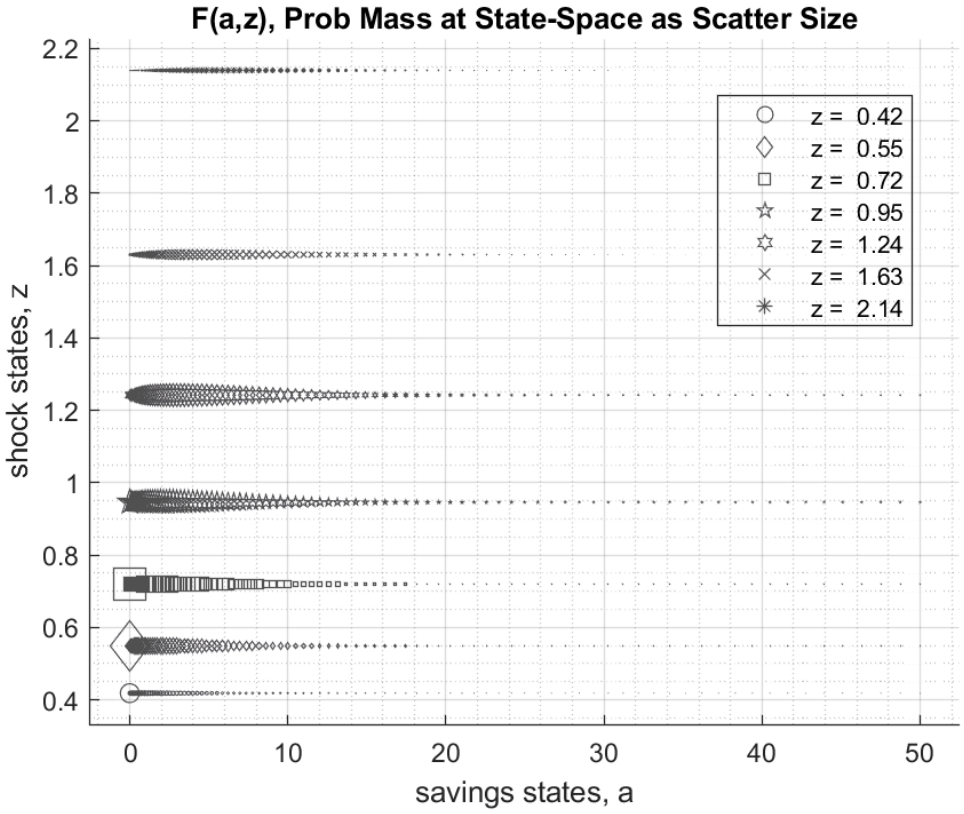
```
Elapsed time is 0.931254 seconds.
FF_DS_AZ_CTS_LOOP finished. Distribution took = 0.069571
```


Marginal Stationary Probability: f(a), savings=x
shock
f(a) marginal mass
savings states, a
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
10
20
30
40
50


Marginal Stationary Probability: f(a), savings=x
shock
f(a) marginal mass
LOG(Y)
savings states, a
LOG(X+min(X))
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
-6
-6.5
-7
-8
-6
-4
-2
0
2
4


Joint Stationary Discrete Probability: f(a,z), savings=x, shock=color
f(a,z) joint mass
savings states, a
shock= 0.42
shock= 0.55
shock= 0.72
shock= 0.95
shock= 1.24
shock= 1.63
shock= 2.14


Joint Stationary Discrete Probability: f(a,z), savings=x, shock=color
f(a,z) joint mass
LOG(Y)
savings states, a
LOG(X+min(X))
shock= 0.42
shock= 0.55
shock= 0.72
shock= 0.95
shock= 1.24
shock= 1.63
shock= 2.14



xxx tb_outcomes: all stats xxx

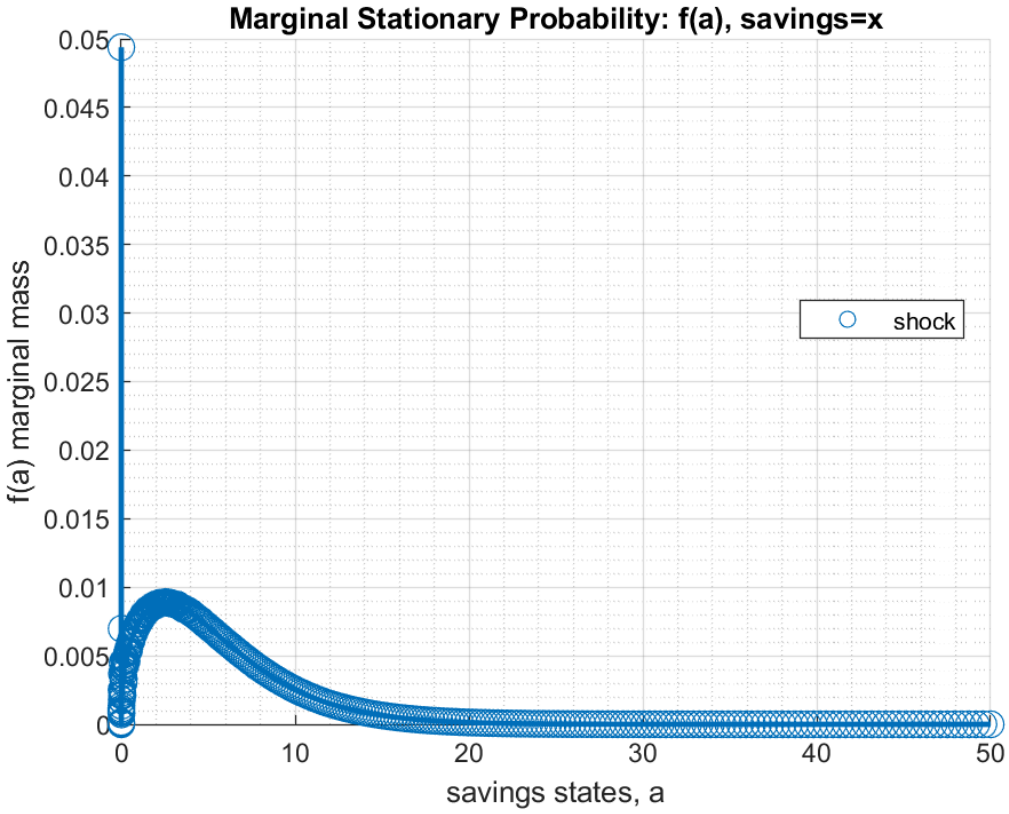
OriginalVariableNames	ap	v	c	y	coh	savefraccoh
{'mean' }	3.2216	6.9329	1.5295	1.5289	4.7511	0.52357
{'unweighted_sum' }	10019	7323.6	1530.6	1473.6	11549	457.17
{'sd' }	3.2562	2.1508	0.34914	0.5307	3.5687	0.25504
{'coefofvar' }	1.0107	0.31024	0.22827	0.34711	0.75113	0.48712
{'gini' }	0.52352	0.17526	0.12797	0.19065	0.3936	0.2723
{'min' }	0	1.7008	0.58543	0.58543	0.58543	0
{'max' }	50.789	19.213	4.21	4.9969	54.997	0.92702
{'pYis0' }	0.062608	0	0	0	0	0.062608
{'pYls0' }	0	0	0	0	0	0
{'pYgr0' }	0.93739	1	1	1	1	0.93739
{'pYisMINY' }	0.062608	0.0049772	0.0049772	0.0049772	0.0049772	0.062608
{'pYisMAXY' }	2.9501e-11	2.9501e-11	3.1223e-11	2.9501e-11	2.9501e-11	1.494e-14
{'p0_01' }	0	1.7008	0.58543	0.58543	0.58543	0
{'p0_1' }	0	1.7008	0.58543	0.58543	0.58543	0
{'p1' }	0	2.9492	0.76855	0.62688	0.76855	0
{'p5' }	0	3.4945	0.97884	0.78105	1.009	0
{'p10' }	0.092835	4.1716	1.0603	0.97609	1.223	0.078835
{'p20' }	0.47609	5.1938	1.2588	1.0456	1.7419	0.27652
{'p25' }	0.7311	5.3812	1.3008	1.094	2.0576	0.35312
{'p30' }	0.97803	5.6276	1.351	1.188	2.3618	0.42581
{'p40' }	1.5512	6.3139	1.4528	1.349	3.0158	0.51932
{'p50' }	2.233	6.8328	1.5245	1.4175	3.7588	0.59714
{'p60' }	3.0801	7.416	1.6192	1.5453	4.6604	0.66085
{'p70' }	4.105	8.0461	1.7025	1.7909	5.7649	0.70987
{'p75' }	4.6992	8.4292	1.7544	1.84	6.4292	0.73355
{'p80' }	5.4329	8.7432	1.8159	1.9097	7.3478	0.75277
{'p90' }	7.7004	9.7559	1.9663	2.3407	9.5263	0.79745
{'p95' }	9.7011	10.662	2.1066	2.5036	11.722	0.82522
{'p99' }	14.279	12.148	2.3613	3.1795	16.608	0.85983
{'p99_9' }	19.899	13.734	2.6792	3.5223	22.615	0.8829
{'p99_99' }	25.265	14.885	2.9563	3.7789	28.175	0.8962

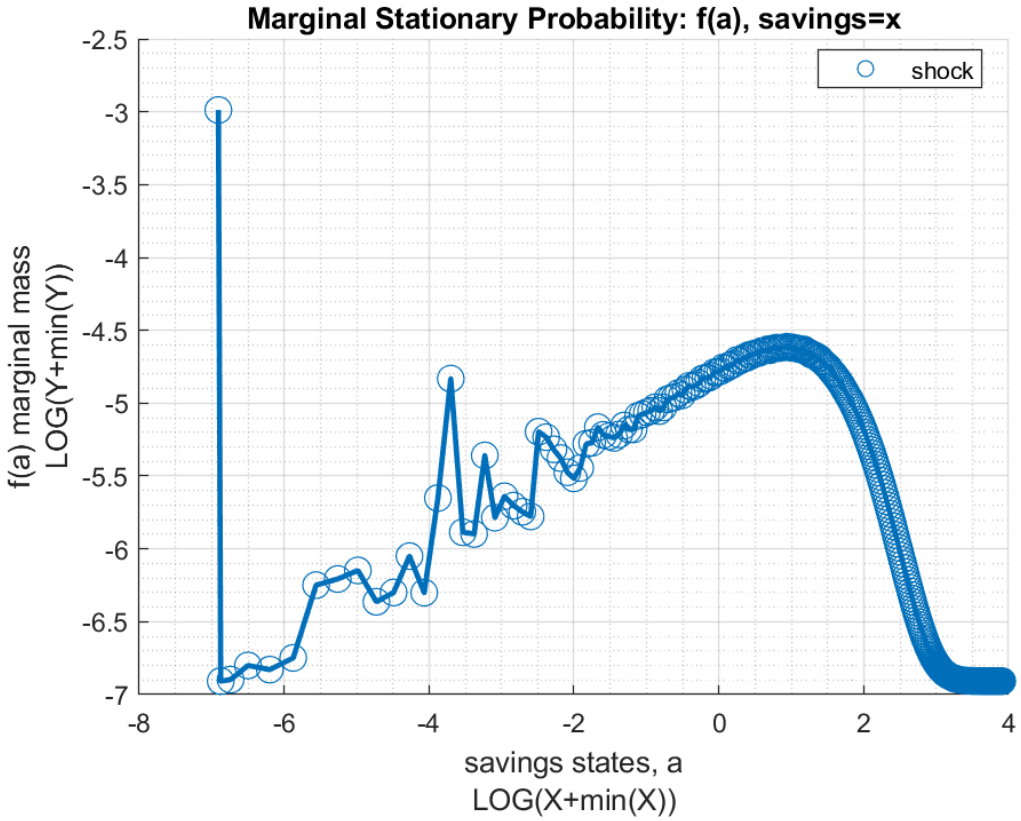
{'fl_cov_ap'}	10.603	6.2617	1.0053	1.0453	11.608	0.65544
{'fl_cor_ap'}	1	0.89408	0.8843	0.60489	0.99896	0.78925
{'fl_cov_v'}	6.2617	4.626	0.74802	0.96794	7.0097	0.47179
{'fl_cor_v'}	0.89408	1	0.99613	0.848	0.91325	0.86007
{'fl_cov_c'}	1.0053	0.74802	0.1219	0.15425	1.1272	0.078595
{'fl_cor_c'}	0.8843	0.99613	1	0.83252	0.9047	0.88265
{'fl_cov_y'}	1.0453	0.96794	0.15425	0.28164	1.1995	0.078136
{'fl_cor_y'}	0.60489	0.848	0.83252	1	0.63337	0.57729
{'fl_cov_coh'}	11.608	7.0097	1.1272	1.1995	12.735	0.73404
{'fl_cor_coh'}	0.99896	0.91325	0.9047	0.63337	1	0.8065
{'fl_cov_savefraccoh'}	0.65544	0.47179	0.078595	0.078136	0.73404	0.065046
{'fl_cor_savefraccoh'}	0.78925	0.86007	0.88265	0.57729	0.8065	1
{'fracByP0_01'}	0	0.001221	0.0019051	0.0019058	0.00061329	0
{'fracByP0_1'}	0	0.001221	0.0019051	0.0019058	0.00061329	0
{'fracByP1'}	0	0.011511	0.013437	0.0039104	0.0042425	0
{'fracByP5'}	0	0.021279	0.026546	0.024488	0.012268	0
{'fracByP10'}	0.0006892	0.05109	0.059758	0.051739	0.020676	0.0036864
{'fracByP20'}	0.0099846	0.12278	0.1366	0.12131	0.052438	0.038521
{'fracByP25'}	0.019425	0.15429	0.17945	0.15485	0.072434	0.070039
{'fracByP30'}	0.032212	0.19399	0.22206	0.19029	0.094665	0.10974
{'fracByP40'}	0.0737	0.28144	0.31482	0.27941	0.15063	0.20042
{'fracByP50'}	0.1321	0.3768	0.41124	0.37234	0.22365	0.30981
{'fracByP60'}	0.21336	0.48025	0.51513	0.4642	0.31463	0.42631
{'fracByP70'}	0.3254	0.59015	0.62157	0.57794	0.42288	0.55601
{'fracByP75'}	0.39769	0.65462	0.67967	0.6363	0.48537	0.62983
{'fracByP80'}	0.47503	0.71232	0.73844	0.70062	0.56134	0.69967
{'fracByP90'}	0.67403	0.84445	0.86104	0.82867	0.73331	0.84375
{'fracByP95'}	0.80886	0.92029	0.92647	0.90776	0.84668	0.92112
{'fracByP99'}	0.95057	0.98162	0.98401	0.97831	0.96163	0.98352
{'fracByP99_9'}	0.99336	0.99797	0.99826	0.99778	0.99494	0.99833
{'fracByP99_99'}	0.99924	0.99979	0.99981	0.99977	0.9994	0.99984

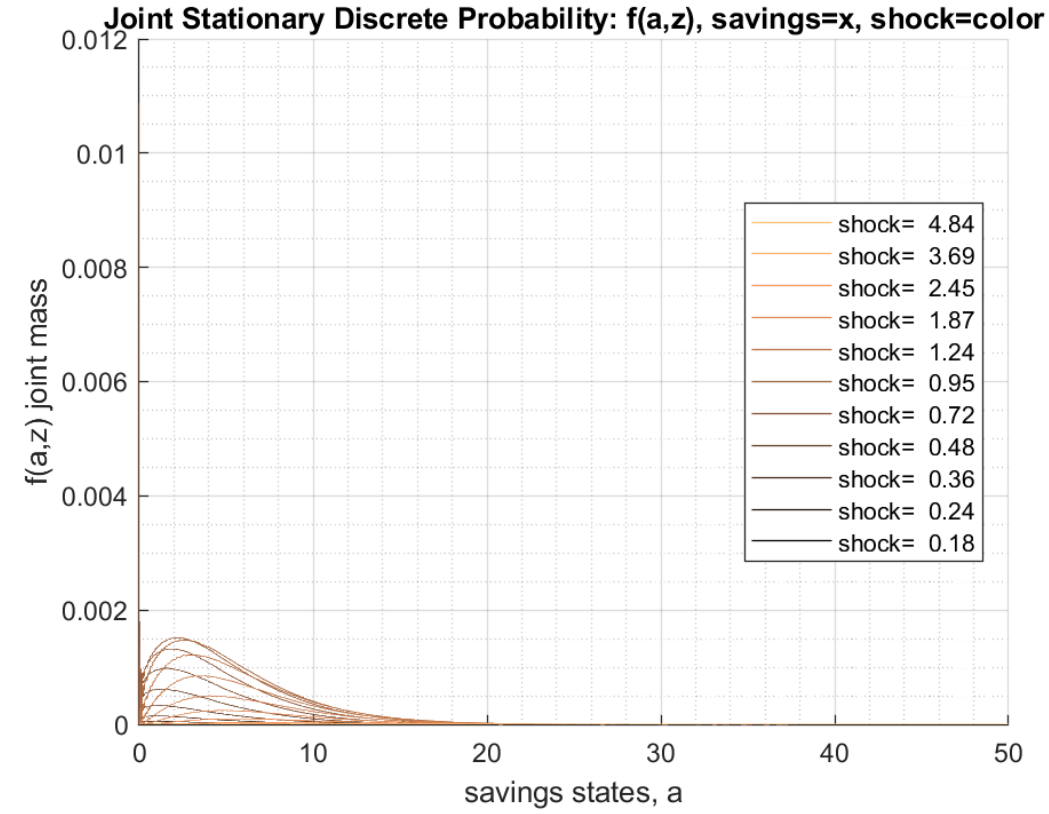
Test FF_DS_AZ_CTS_VEC A grid 300 Shock grid 25

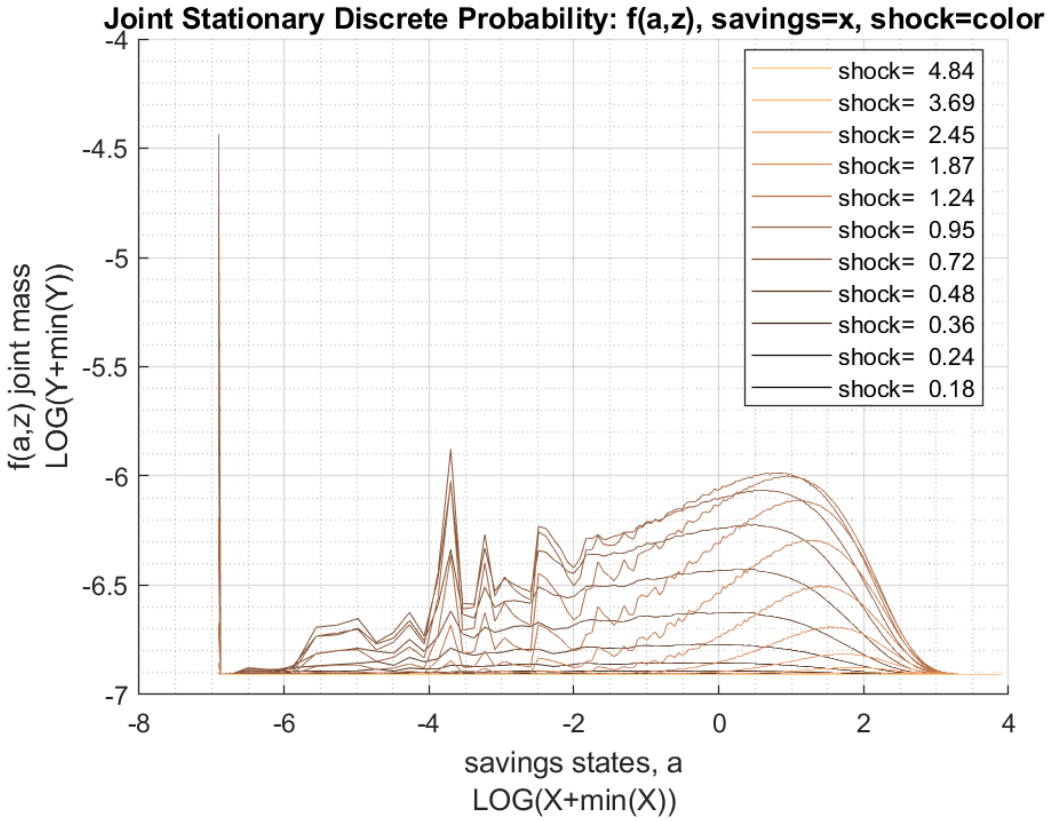
```
mp_support = containers.Map('KeyType','char', 'ValueType','any');
mp_support('bl_timer') = true;
mp_support('ls_ffcmd') = {};
mp_support('ls_ddcmd') = {};
mp_support('ls_ddgrh') = {'faz','fa'};
mp_support('bl_show_stats_table') = true;
mp_params = containers.Map('KeyType','char', 'ValueType','any');
mp_params('it_a_n') = 300;
mp_params('it_z_n') = 25;
ff_ds_az_cts_vec(mp_params, mp_support);
```

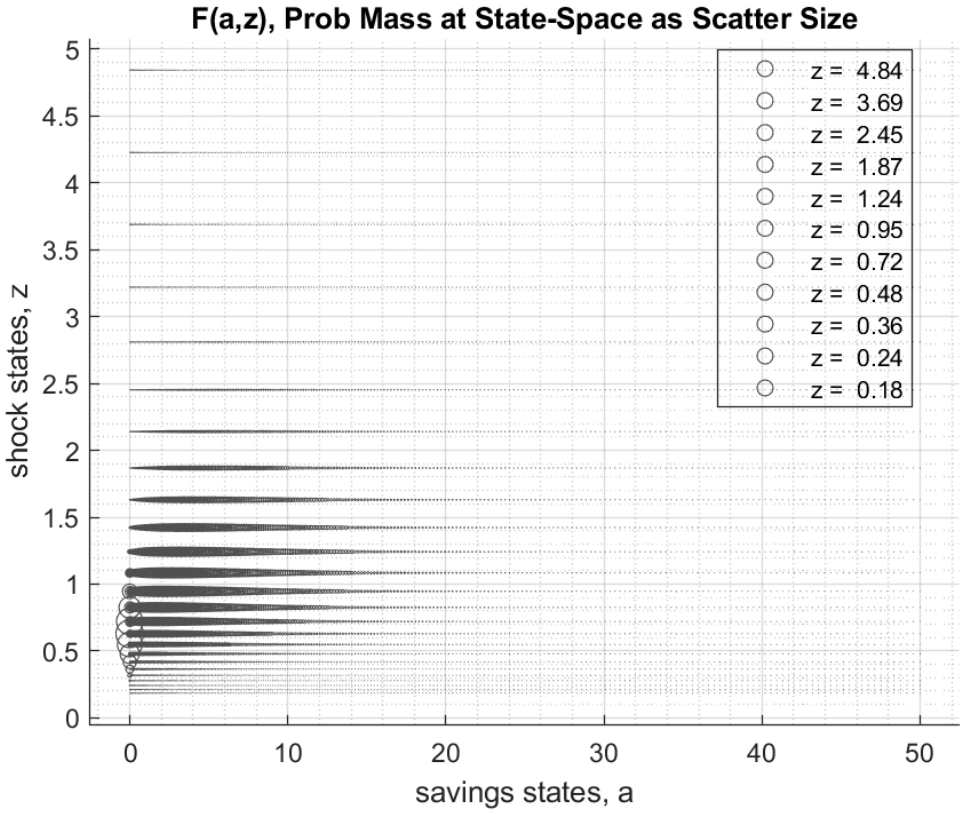
```
Elapsed time is 7.884421 seconds.
FF_DS_AZ_CTS_LOOP finished. Distribution took = 0.34095
```


Marginal Stationary Probability: f(a), savings=x
f(a) marginal mass
savings states, a
shock
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
10
20
30
40
50


Marginal Stationary Probability: f(a), savings=x
f(a) marginal mass
LOG(Y+min(Y))
savings states, a
LOG(X+min(X))
shock
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
-6
-6.5
-7
-8
-6
-4
-2
0
2
4


Joint Stationary Discrete Probability: f(a,z), savings=x, shock=color
f(a,z) joint mass
savings states, a
shock= 4.84
shock= 3.69
shock= 2.45
shock= 1.87
shock= 1.24
shock= 0.95
shock= 0.72
shock= 0.48
shock= 0.36
shock= 0.24
shock= 0.18


Joint Stationary Discrete Probability: f(a,z), savings=x, shock=color
f(a,z) joint mass
LOG(Y+min(Y))
savings states, a
LOG(X+min(X))
shock= 4.84
shock= 3.69
shock= 2.45
shock= 1.87
shock= 1.24
shock= 0.95
shock= 0.72
shock= 0.48
shock= 0.36
shock= 0.24
shock= 0.18



xxx tb_outcomes: all stats xxx

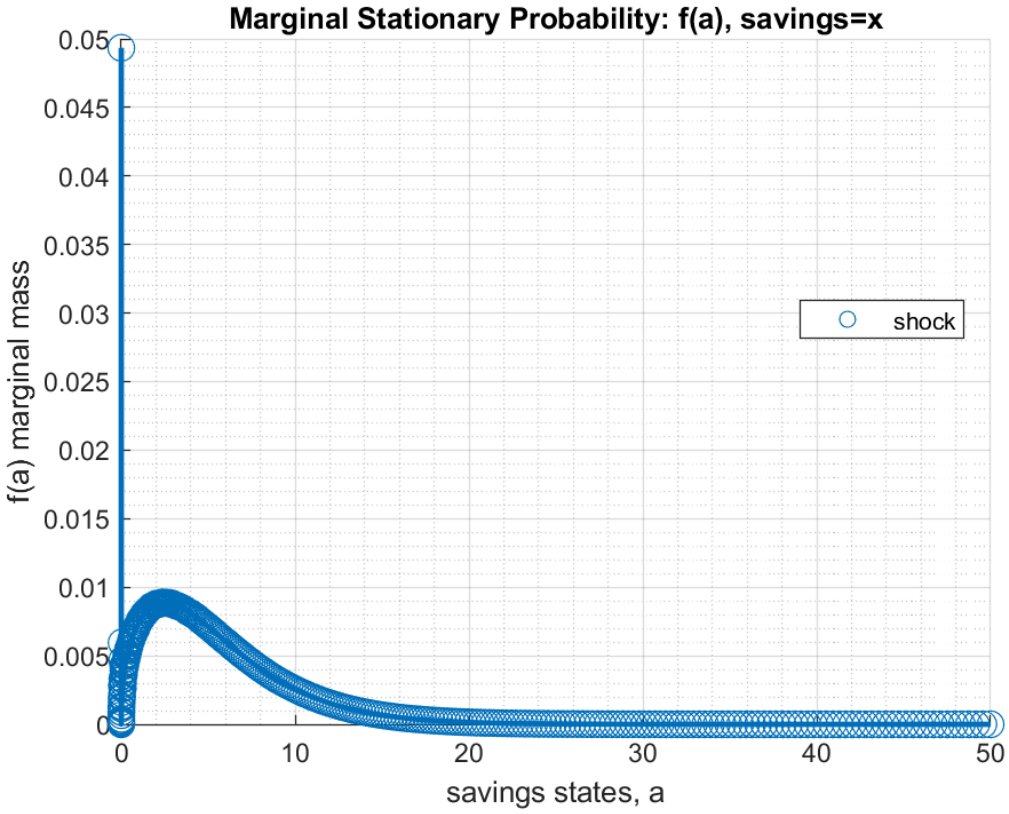
OriginalVariableNames	ap	v	c	y	coh	savefraccoh
{'mean' }	3.2612	6.9497	1.5318	1.5305	4.793	0.52715
{'unweighted_sum' }	1.1043e+05	79555	16733	19751	1.2716e+05	3442.8
{'sd' }	3.3352	2.1663	0.35078	0.5359	3.6495	0.25199
{'coefofvar' }	1.0227	0.31171	0.229	0.35014	0.76143	0.47803
{'gini' }	0.52534	0.17597	0.12824	0.19145	0.39608	0.26748
{'min' }	0	-2.7616	0.25871	0.25871	0.25871	0
{'max' }	54.451	20.418	4.3301	8.7798	58.78	0.92837
{'pYis0' }	0.04941	0	0	0	0	0.04941
{'pYls0' }	0	7.3281e-05	0	0	0	0
{'pYgr0' }	0.95059	0.99993	1	1	1	0.95059
{'pYisMINY' }	0.04941	3.1163e-08	3.1163e-08	3.1163e-08	3.1163e-08	0.04941
{'pYisMAXY' }	2.8477e-13	2.8477e-13	1.121e-13	2.8477e-13	2.8477e-13	3.6157e-25
{'p0_01' }	0	0.33584	0.44588	0.42374	0.44588	0
{'p0_1' }	0	1.0287	0.51088	0.51088	0.51088	0
{'p1' }	0	2.33	0.67226	0.67069	0.67505	0
{'p5' }	0.0027154	3.5353	0.94151	0.8016	1.0088	0.002787
{'p10' }	0.11496	4.1978	1.0921	0.9095	1.2356	0.093483
{'p20' }	0.51133	5.096	1.2504	1.0657	1.779	0.28788
{'p25' }	0.75298	5.4004	1.3077	1.1577	2.0685	0.36173
{'p30' }	1.004	5.7312	1.3565	1.1951	2.3792	0.42532
{'p40' }	1.5834	6.298	1.4458	1.3352	3.0372	0.52408
{'p50' }	2.2686	6.8433	1.5287	1.441	3.7996	0.59884
{'p60' }	3.0898	7.4098	1.6132	1.5764	4.6904	0.65811
{'p70' }	4.0971	8.0297	1.7037	1.7526	5.7899	0.70877
{'p75' }	4.7228	8.3787	1.7552	1.8223	6.462	0.73135
{'p80' }	5.4827	8.7742	1.8144	1.9267	7.2769	0.75357
{'p90' }	7.7718	9.8224	1.9746	2.2406	9.6945	0.79922
{'p95' }	9.9683	10.704	2.1148	2.5163	12.048	0.82675
{'p99' }	14.759	12.325	2.3956	3.157	17.176	0.86245
{'p99_9' }	21.215	14.066	2.7525	3.9803	23.946	0.88686
{'p99_99' }	27.205	15.415	3.0759	4.7968	30.277	0.90047

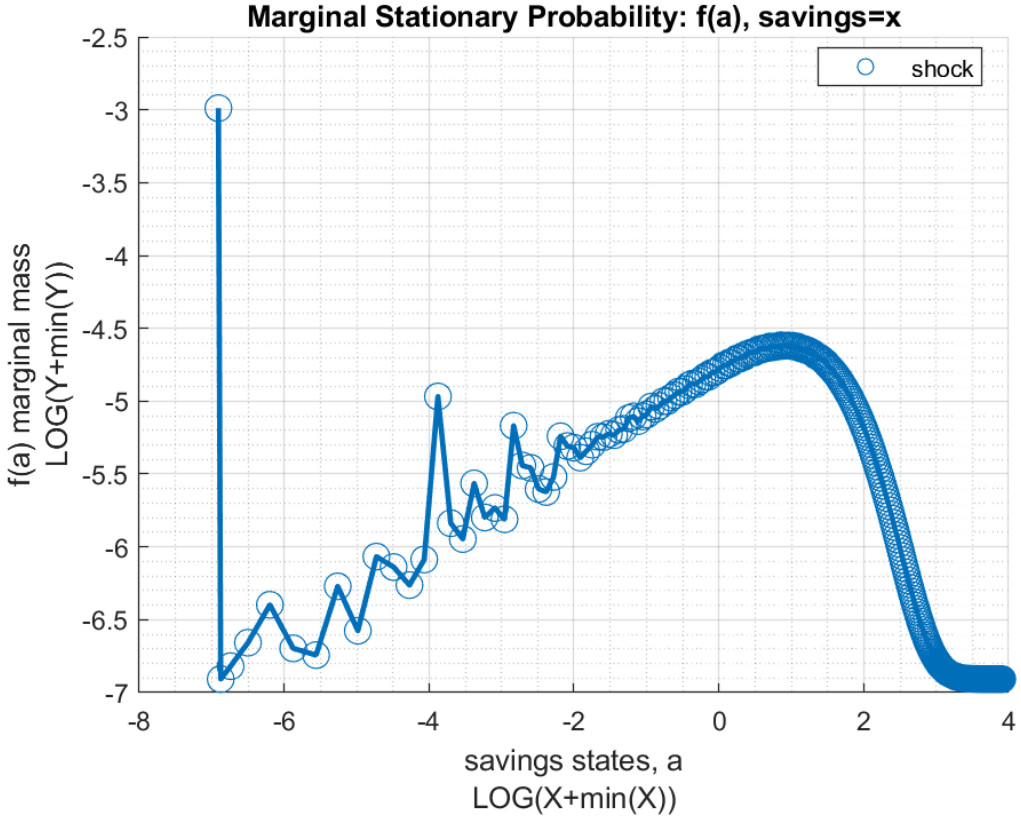
{'fl_cov_ap'}	11.123	6.4528	1.0361	1.0808	12.16	0.65691
{'fl_cor_ap'}	1	0.89313	0.88563	0.60472	0.999	0.78162
{'fl_cov_v'}	6.4528	4.6928	0.75717	0.98035	7.21	0.46786
{'fl_cor_v'}	0.89313	1	0.99643	0.84447	0.91198	0.85705
{'fl_cov_c'}	1.0361	0.75717	0.12304	0.15594	1.1592	0.07767
{'fl_cor_c'}	0.88563	0.99643	1	0.82954	0.90548	0.87868
{'fl_cov_y'}	1.0808	0.98035	0.15594	0.28718	1.2368	0.077234
{'fl_cor_y'}	0.60472	0.84447	0.82954	1	0.63237	0.57192
{'fl_cov_coh'}	12.16	7.21	1.1592	1.2368	13.319	0.73458
{'fl_cor_coh'}	0.999	0.91198	0.90548	0.63237	1	0.79876
{'fl_cov_savefraccoh'}	0.65691	0.46786	0.07767	0.077234	0.73458	0.063501
{'fl_cor_savefraccoh'}	0.78162	0.85705	0.87868	0.57192	0.79876	1
{'fracByP0_01'}	0	7.2341e-06	8.9677e-05	2.5415e-05	2.8657e-05	0
{'fracByP0_1'}	0	0.00014925	0.00040034	0.00047536	0.00012777	0
{'fracByP1'}	0	0.0031002	0.004056	0.0057421	0.0012982	0
{'fracByP5'}	4.4271e-07	0.020663	0.026101	0.023318	0.010275	3.7554e-06
{'fracByP10'}	0.00081444	0.049128	0.059669	0.051817	0.020124	0.0043579
{'fracByP20'}	0.010142	0.11647	0.13733	0.1174	0.051401	0.041452
{'fracByP25'}	0.0197	0.15487	0.17845	0.15395	0.07176	0.07241
{'fracByP30'}	0.033115	0.19474	0.22243	0.19298	0.095014	0.11033
{'fracByP40'}	0.07268	0.28138	0.31442	0.27544	0.15079	0.20152
{'fracByP50'}	0.13241	0.3756	0.41097	0.36527	0.22198	0.30736
{'fracByP60'}	0.21444	0.47892	0.51282	0.46572	0.31091	0.42746
{'fracByP70'}	0.323	0.58868	0.62139	0.57261	0.41949	0.55675
{'fracByP75'}	0.39061	0.6478	0.67743	0.63129	0.48319	0.62572
{'fracByP80'}	0.46952	0.70943	0.73587	0.6919	0.55532	0.69697
{'fracByP90'}	0.66831	0.84297	0.85906	0.82754	0.72955	0.84259
{'fracByP95'}	0.80219	0.91616	0.92541	0.90507	0.84194	0.91979
{'fracByP99'}	0.94613	0.98125	0.98339	0.97711	0.95822	0.98365
{'fracByP99_9'}	0.9927	0.9979	0.99812	0.99719	0.99443	0.99831
{'fracByP99_99'}	0.99909	0.99977	0.99979	0.99967	0.99932	0.99983

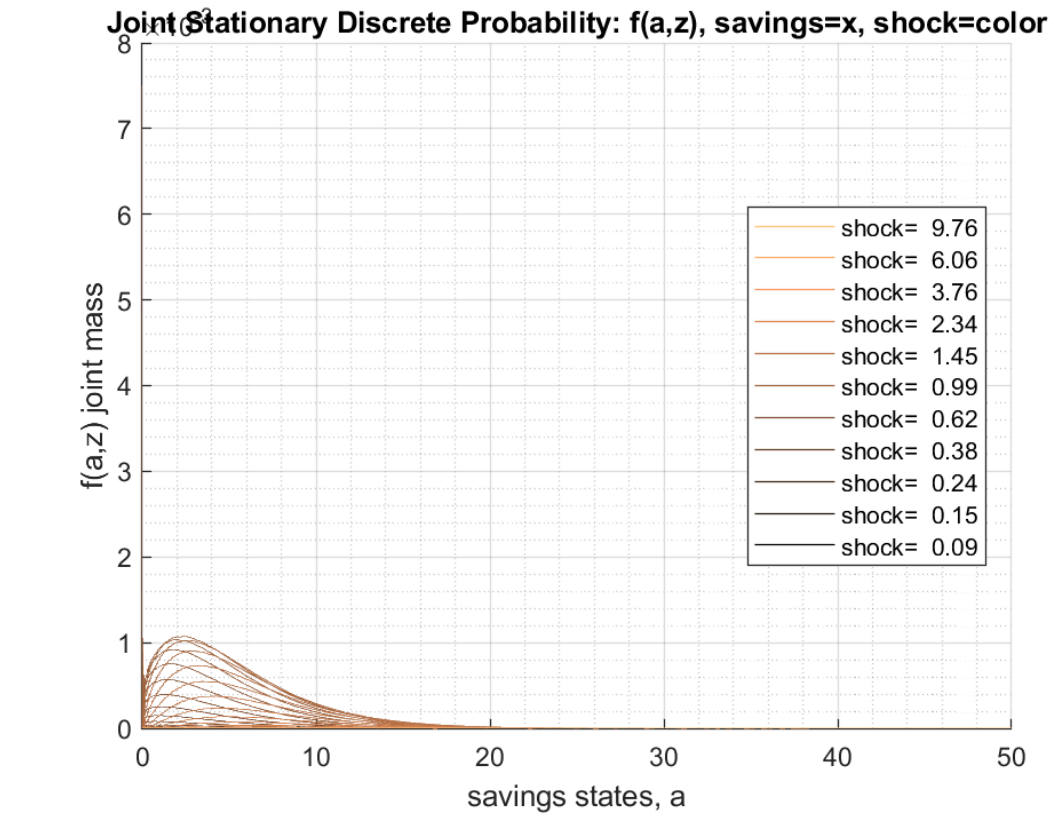
Test FF_DS_AZ_CTS_VEC A grid 300 Shock grid 50

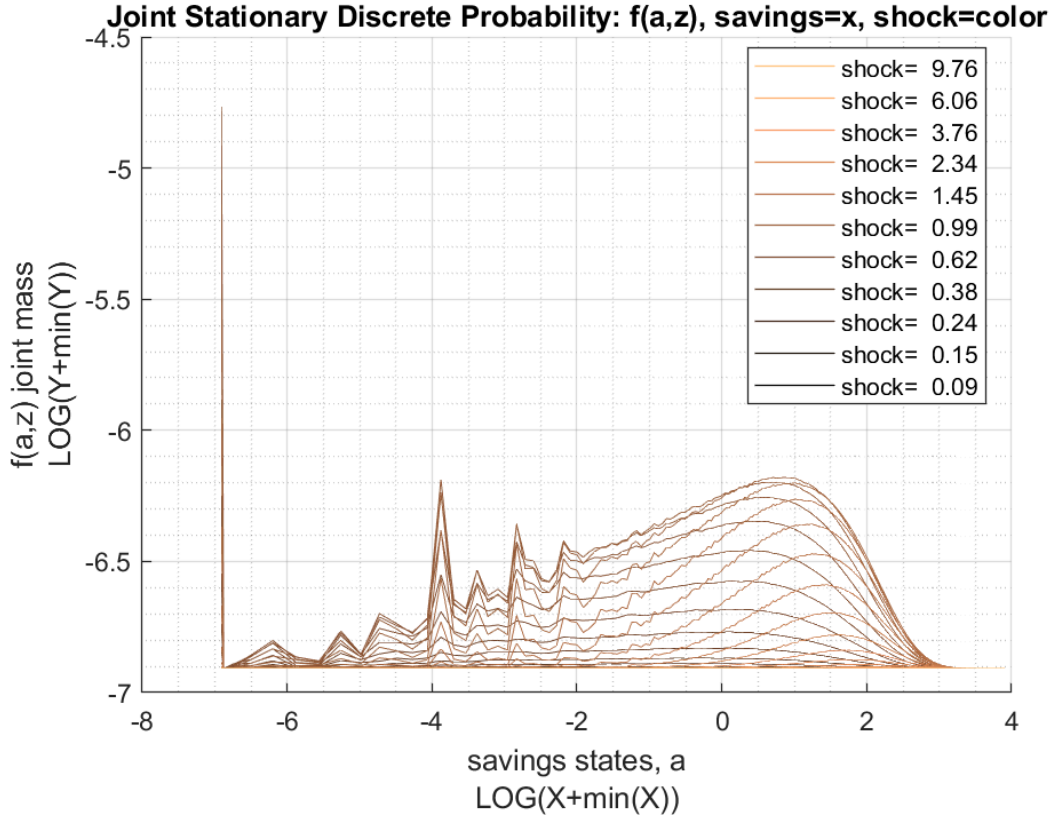
```
mp_support = containers.Map('KeyType','char', 'ValueType','any');
mp_support('bl_timer') = true;
mp_support('ls_ffcmd') = {};
mp_support('ls_ddcmd') = {};
mp_support('ls_ddgrh') = {'faz','fa'};
mp_support('bl_show_stats_table') = true;
mp_params = containers.Map('KeyType','char', 'ValueType','any');
mp_params('it_a_n') = 300;
mp_params('it_z_n') = 50;
ff_ds_az_cts_vec(mp_params, mp_support);
```

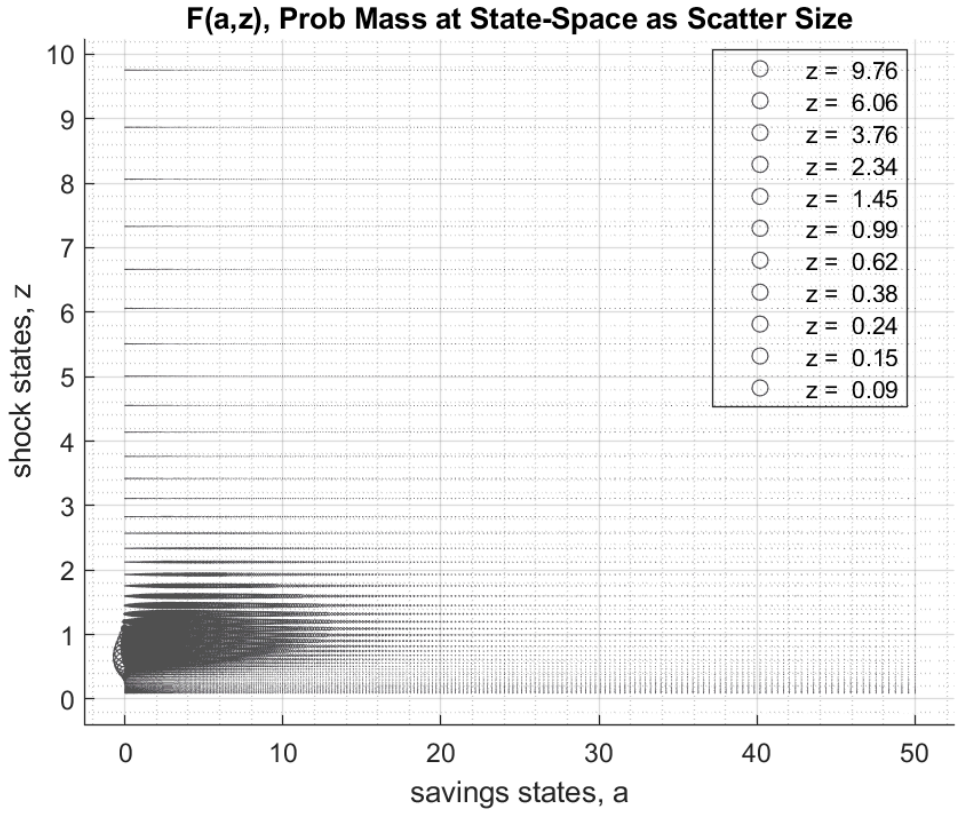
```
Elapsed time is 14.233149 seconds.
FF_DS_AZ_CTS_LOOP finished. Distribution took = 1.2257
```


Marginal Stationary Probability: f(a), savings=x
f(a) marginal mass
savings states, a
shock
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
10
20
30
40
50


Marginal Stationary Probability: f(a), savings=x
f(a) marginal mass
LOG(Y+min(Y))
savings states, a
LOG(X+min(X))
shock
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
-6
-6.5
-7
-8
-6
-4
-2
0
2
4


Joint Stationary Discrete Probability: f(a,z), savings=x, shock=color
x 10^-3
f(a,z) joint mass
savings states, a
shock= 9.76
shock= 6.06
shock= 3.76
shock= 2.34
shock= 1.45
shock= 0.99
shock= 0.62
shock= 0.38
shock= 0.24
shock= 0.15
shock= 0.09


Joint Stationary Discrete Probability: f(a,z), savings=x, shock=color
f(a,z) joint mass
LOG(Y+min(Y))
savings states, a
LOG(X+min(X))
shock= 9.76
shock= 6.06
shock= 3.76
shock= 2.34
shock= 1.45
shock= 0.99
shock= 0.62
shock= 0.38
shock= 0.24
shock= 0.15
shock= 0.09



xxx tb_outcomes: all stats xxx

OriginalVariableNames	ap	v	c	y	coh	savefraccoh
{'mean' }	3.2794	6.957	1.5328	1.5312	4.8122	0.52801
{'unweighted_sum' }	2.3346e+05	1.6237e+05	34668	53309	2.6813e+05	5324.8
{'sd' }	3.3623	2.1722	0.35142	0.53693	3.6772	0.25195
{'coefofvar' }	1.0253	0.31224	0.22927	0.35065	0.76415	0.47717
{'gini' }	0.52595	0.17618	0.12829	0.19144	0.3969	0.26705
{'min' }	0	-7.6866	0.12843	0.12843	0.12843	0
{'max' }	61.275	22.164	4.3849	15.657	65.657	0.93325
{'pYis0' }	0.049376	0	0	0	0	0.049376
{'pYls0' }	0	0.00011917	0	0	0	0
{'pYgr0' }	0.95062	0.99988	1	1	1	0.95062
{'pYisMINY' }	0.049376	1.1048e-15	1.1048e-15	1.1048e-15	1.1048e-15	0.049376
{'pYisMAXY' }	1.584e-18	1.584e-18	5.0847e-19	1.584e-18	1.584e-18	1.584e-18
{'p0_01' }	0	-0.20427	0.40271	0.40271	0.40271	0
{'p0_1' }	0	1.2141	0.53589	0.48816	0.53589	0
{'p1' }	0	2.3693	0.71312	0.64833	0.71312	0
{'p5' }	0.001023	3.5435	0.94895	0.80724	0.96945	0.0010781
{'p10' }	0.11645	4.2417	1.0917	0.93681	1.2501	0.095192
{'p20' }	0.50875	5.08	1.2515	1.072	1.7735	0.2902
{'p25' }	0.75899	5.4247	1.3061	1.1504	2.0649	0.36356
{'p30' }	1.0156	5.7325	1.3564	1.2011	2.3741	0.42667
{'p40' }	1.6036	6.2932	1.4459	1.3198	3.0387	0.52518
{'p50' }	2.2768	6.8406	1.5297	1.4423	3.8053	0.59933
{'p60' }	3.0945	7.4051	1.6122	1.5771	4.7002	0.6586
{'p70' }	4.113	8.0338	1.7042	1.7334	5.8225	0.70999
{'p75' }	4.7604	8.3794	1.7554	1.8278	6.4985	0.73226
{'p80' }	5.5142	8.7771	1.8143	1.9295	7.3239	0.75424
{'p90' }	7.8048	9.8378	1.9756	2.2476	9.7629	0.80013
{'p95' }	10.007	10.714	2.1161	2.5336	12.107	0.82766
{'p99' }	14.9	12.348	2.407	3.1578	17.285	0.86312
{'p99_9' }	21.501	14.13	2.7694	4.0322	24.216	0.88766
{'p99_99' }	27.735	15.514	3.1037	4.8946	30.851	0.90127

{'fl_cov_ap' }	11.305	6.5234	1.0466	1.0907	12.352	0.66084
{'fl_cor_ap' }	1	0.89316	0.88579	0.60415	0.99902	0.78009
{'fl_cov_v' }	6.5234	4.7186	0.76066	0.98362	7.2841	0.46879
{'fl_cor_v' }	0.89316	1	0.99645	0.84334	0.9119	0.85658
{'fl_cov_c' }	1.0466	0.76066	0.1235	0.15645	1.1701	0.077707
{'fl_cor_c' }	0.88579	0.99645	1	0.82914	0.9055	0.87766
{'fl_cov_y' }	1.0907	0.98362	0.15645	0.2883	1.2471	0.0772
{'fl_cor_y' }	0.60415	0.84334	0.82914	1	0.63165	0.57067
{'fl_cov_coh' }	12.352	7.2841	1.1701	1.2471	13.522	0.73855
{'fl_cor_coh' }	0.99902	0.9119	0.9055	0.63165	1	0.79716
{'fl_cov_savefraccoh'}	0.66084	0.46879	0.077707	0.0772	0.73855	0.063478
{'fl_cor_savefraccoh'}	0.78009	0.85658	0.87766	0.57067	0.79716	1
{'fracByP0_01' }	0	-7.0657e-06	2.6272e-05	3.0716e-05	8.3673e-06	0
{'fracByP0_1' }	0	8.1733e-05	0.00058172	0.0003	0.00018482	0
{'fracByP1' }	0	0.0025825	0.0055755	0.0043105	0.0017358	0
{'fracByP5' }	1.3446e-07	0.020553	0.028388	0.023343	0.0084443	1.165e-06
{'fracByP10' }	0.00082822	0.048923	0.059616	0.051792	0.020041	0.0045383
{'fracByP20' }	0.010119	0.11678	0.1368	0.1176	0.051426	0.041679
{'fracByP25' }	0.019764	0.15445	0.17846	0.15402	0.071298	0.07291
{'fracByP30' }	0.033198	0.19437	0.22195	0.19279	0.094487	0.11072
{'fracByP40' }	0.072799	0.28088	0.31405	0.27516	0.15079	0.20093
{'fracByP50' }	0.13186	0.37535	0.41129	0.36559	0.22202	0.30846
{'fracByP60' }	0.21318	0.47748	0.51316	0.46495	0.30966	0.42828
{'fracByP70' }	0.32222	0.58845	0.62103	0.57307	0.41837	0.55682
{'fracByP75' }	0.39045	0.64744	0.67785	0.63075	0.48233	0.62537
{'fracByP80' }	0.46786	0.7092	0.73555	0.69205	0.55399	0.69588
{'fracByP90' }	0.66756	0.84275	0.8587	0.82726	0.72947	0.84385
{'fracByP95' }	0.80166	0.91607	0.92521	0.90478	0.84112	0.91991
{'fracByP99' }	0.94602	0.98111	0.98335	0.97699	0.95791	0.98349
{'fracByP99_9' }	0.99264	0.99789	0.9981	0.99714	0.99438	0.99831
{'fracByP99_99' }	0.99908	0.99977	0.99979	0.99966	0.9993	0.99983