SNW_VFI_PARAM Small 5/3 Solution Analysis

This is the example vignette for function: **snw_vfi_main_bisec_vec** from the **PrjOptiSNW Package.** This function solves for policy function with vectorized bisection. Small Solution Analysis, husband 5 shocks, wife 3 shocks.

Test SNW_VFI_MAIN Defaults Small

Call the function with defaults.

```
mp_param = snw_mp_param('default_small53');
[V_VFI,ap_VFI,cons_VFI,mp_valpol_more] = snw_vfi_main_bisec_vec(mp_param);
```

```
SNW_VFI_MAIN: Finished Age Group:18 of 18
SNW_VFI_MAIN: Finished Age Group:17 of 18
SNW_VFI_MAIN: Finished Age Group:16 of 18
SNW_VFI_MAIN: Finished Age Group:15 of 18
SNW_VFI_MAIN: Finished Age Group:14 of 18
SNW_VFI_MAIN: Finished Age Group:13 of 18
SNW_VFI_MAIN: Finished Age Group:12 of 18
SNW_VFI_MAIN: Finished Age Group:11 of 18
SNW_VFI_MAIN: Finished Age Group:10 of 18
SNW_VFI_MAIN: Finished Age Group:9 of 18
SNW_VFI_MAIN: Finished Age Group:8 of 18
SNW_VFI_MAIN: Finished Age Group:7 of 18
SNW_VFI_MAIN: Finished Age Group:6 of 18
SNW_VFI_MAIN: Finished Age Group:5 of 18
SNW_VFI_MAIN: Finished Age Group:4 of 18
SNW_VFI_MAIN: Finished Age Group:3 of 18
SNW_VFI_MAIN: Finished Age Group:2 of 18
SNW_VFI_MAIN: Finished Age Group:1 of 18
Elapsed time is 4.405878 seconds.
Completed SNW_VFI_MAIN;SNW_MP_PARAM=default_small53;SNW_MP_CONTROL=default_base
```

Small Param Results Define Frames

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

```
% Grids:
age_grid = [19, 22:5:97, 100];
agrid = mp_param('agrid')';
eta_H_grid = mp_param('eta_H_grid')';
eta_S_grid = mp_param('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_param('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 Savings and Shocks

First, analyze Savings Levels and Shocks, Aggregate Over All Others, and do various other calculations.

```
% Generate some Data
mp_support_graph = containers.Map('KeyType', 'char', 'ValueType', 'any');
mp_support_graph('cl_st_xtitle') = {'Savings States, a'};
mp_support_graph('st_legend_loc') = 'best';
mp_support_graph('bl_graph_logy') = true; % do not log
mp_support_graph('it_legend_select') = 9; % how many shock legends to show
mp_support_graph('cl_colors') = 'jet';
```

MEAN(VAL(A,Z)), MEAN(AP(A,Z)), MEAN(C(A,Z))

Tabulate value and policies along savings and shocks:

```
% Set
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
ar_permute = [1,4,5,6,3,2];
% Value Function
tb_az_v = ff_summ_nd_array("MEAN(VAL(A,Z))", V_VFI, true, ["mean"], 4, 1, cl_mp_datasetdesc, ar
```

```
xxx  MEAN(VAL(A,Z))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
```

group	savings	mean_eta_1	mean_eta_2	mean_eta_3	mean_eta_4	mean_eta_5	mean_eta_6	mean_e
1	0	-7.882	-5.7348	-4.085	-2.8085	-1.8188	-7.0297	-5.08
2	0.0097656	-7.7212	-5.6181	-3.9885	-2.7215	-1.7365	-6.9116	-4.99
3	0.078125	-6.8428	-4.9741	-3.4642	-2.2559	-1.3014	-6.2511	-4.50
4	0.26367	-5.4385	-3.9243	-2.6322	-1.5472	-0.66003	-5.0899	-3.64
5	0.625	-3.9212	-2.7733	-1.7454	-0.83276	-0.049731	-3.7236	-2.60
6	1.2207	-2.4938	-1.6768	-0.89179	-0.17035	0.48277	-2.3765	-1.57
7	2.1094	-1.2492	-0.69701	-0.12719	0.42663	0.94331	-1.1762	-0.63
8	3.3496	-0.21896	0.14154	0.536	0.94666	1.3467	-0.17291	0.183
9	5	0.60263	0.83385	1.0995	1.3921	1.6958	0.63191	0.861
10	7.1191	1.242	1.3897	1.5663	1.7699	1.9935	1.2607	1.40
11	9.7656	1.7339	1.8287	1.9458	2.086	2.247	1.7458	1.84
12	12.998	2.1109	2.1725	2.2505	2.3468	2.4616	2.1187	2.18
13	16.875	2.4005	2.4411	2.4935	2.5599	2.6414	2.4057	2.44
14	21.455	2.6243	2.6513	2.687	2.733	2.7911	2.6277	2.65
15	26.797	2.7986	2.817	2.8415	2.8737	2.9153	2.8009	2.81
16	32.959	2.9355	2.9482	2.9654	2.9882	3.0181	2.9371	2.94
17	40	3.0441	3.053	3.0651	3.0815	3.1033	3.0452	3.05
18	47.979	3.1309	3.1373	3.146	3.1579	3.1739	3.1317	3.13
19	56.953	3.201	3.2056	3.212	3.2207	3.2326	3.2016	3.20
20	66.982	3.258	3.2614	3.2662	3.2727	3.2816	3.2585	3.26
21	78.125	3.3049	3.3074	3.311	3.3159	3.3226	3.3052	3.30
22	90.439	3.3437	3.3456	3.3483	3.352	3.3572	3.3439	3.34
23	103.98	3.3761	3.3775	3.3796	3.3824	3.3864	3.3762	3.37
24	118.82	3.4032	3.4044	3.4059	3.4082	3.4113	3.4034	3.40
25	135	3.4262	3.4271	3.4283	3.4301	3.4325	3.4263	3.42

```
% Aprime Choice
tb_az_ap = ff_summ_nd_array("MEAN(AP(A,Z))", ap_VFI, true, ["mean"], 4, 1, cl_mp_datasetdesc, a
```

```
xxx  MEAN(AP(A,Z))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
```

group	savings	mean_eta_1	mean_eta_2	mean_eta_3	mean_eta_4	mean_eta_5	mean_eta_6	mean_e

1	0	0.0019699	0.012569	0.042745	0.11279	0.27641	0.0053954	0.019
2	0.0097656	0.0026822	0.013934	0.045039	0.11613	0.28116	0.0068403	0.022
3	0.078125	0.012725	0.028983	0.063429	0.14286	0.31616	0.026742	0.046
4	0.26367	0.086315	0.10163	0.14743	0.23696	0.42136	0.1257	0.14
5	0.625	0.30688	0.32748	0.37158	0.48022	0.66179	0.36452	0.3
6	1.2207	0.71364	0.74681	0.79866	0.90672	1.1008	0.7942	0.82
7	2.1094	1.38	1.4122	1.473	1.5674	1.7516	1.4621	1.4
8	3.3496	2.3237	2.3547	2.4215	2.5241	2.6817	2.4018	2.4
9	5	3.5866	3.6174	3.6852	3.8049	3.9657	3.665	3.7
10	7.1191	5.2284	5.258	5.3256	5.4521	5.645	5.3076	5.3
11	9.7656	7.2439	7.2717	7.3376	7.4667	7.6795	7.3275	7.3
12	12.998	9.683	9.7074	9.7687	9.8969	10.122	9.757	9.7
13	16.875	12.69	12.713	12.768	12.888	13.118	12.761	12.
14	21.455	16.245	16.267	16.322	16.434	16.656	16.326	16.
15	26.797	20.297	20.314	20.362	20.471	20.681	20.374	20.
16	32.959	24.972	24.994	25.04	25.136	25.339	25.05	25.
17	40	30.336	30.36	30.416	30.523	30.708	30.406	30.
18	47.979	36.418	36.442	36.497	36.607	36.811	36.485	36.
19	56.953	43.405	43.428	43.48	43.586	43.789	43.471	43.
20	66.982	51.176	51.202	51.26	51.37	51.568	51.247	51.
21	78.125	59.419	59.447	59.507	59.624	59.834	59.503	59.
22	90.439	68.737	68.762	68.819	68.932	69.146	68.808	68.
23	103.98	79.211	79.236	79.291	79.402	79.606	79.282	79.
24	118.82	90.517	90.543	90.601	90.715	90.921	90.585	90.
25	135	102.82	102.85	102.9	103.01	103.22	102.9	102

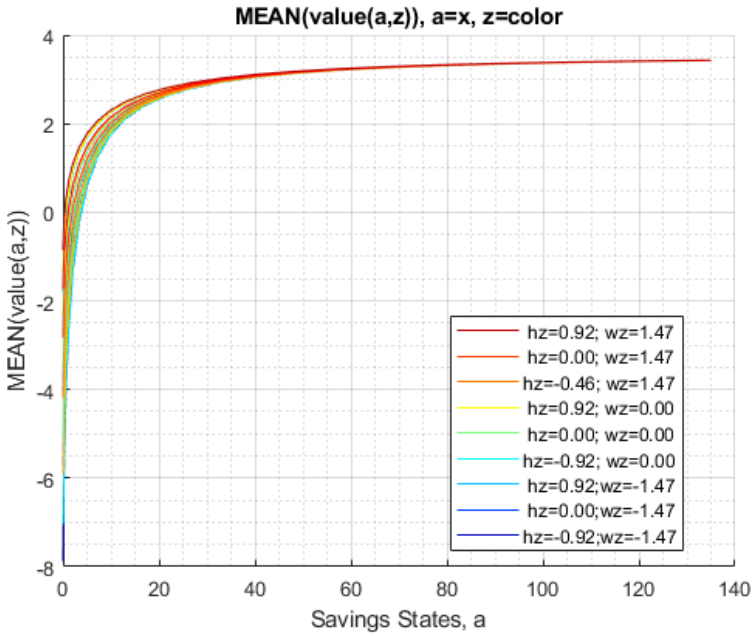
```
% Consumption Choices
tb_az_c = ff_summ_nd_array("MEAN(C(A,Z))", cons_VFI, true, ["mean"], 4, 1, cl_mp_datasetdesc, a
```

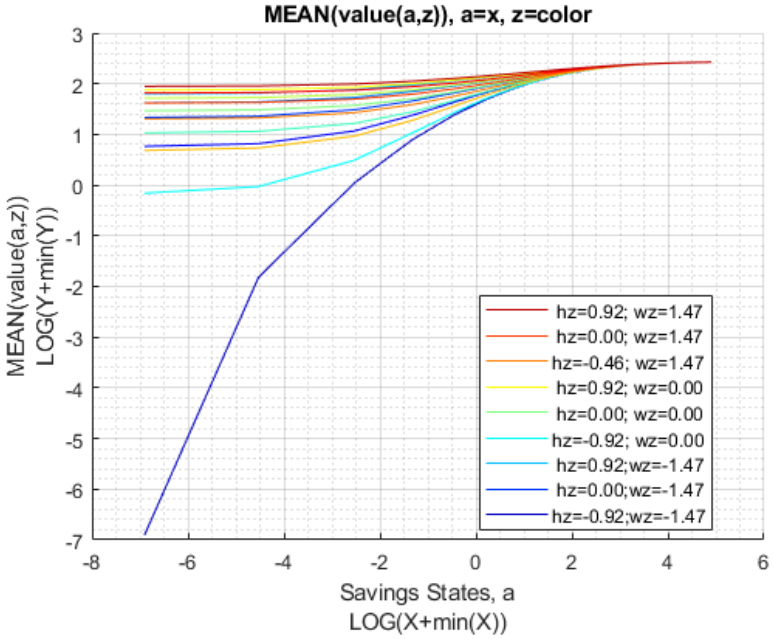
```
xxx  MEAN(C(A,Z))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
```

group	savings	mean_eta_1	mean_eta_2	mean_eta_3	mean_eta_4	mean_eta_5	mean_eta_6	mean_e
1	0	0.36263	0.48831	0.66884	0.92666	1.2761	0.47329	0.598
2	0.0097656	0.37339	0.4984	0.67798	0.93473	1.2828	0.4833	0.607
3	0.078125	0.44367	0.56349	0.73958	0.98789	1.3276	0.54356	0.662
4	0.26367	0.58796	0.70825	0.87262	1.1106	1.439	0.66208	0.782
5	0.625	0.7912	0.90541	1.0708	1.2892	1.6202	0.84639	0.959
6	1.2207	1.082	1.1826	1.3394	1.5577	1.8756	1.1134	1.21
7	2.1094	1.4544	1.5549	1.7017	1.9328	2.26	1.4833	1.58
8	3.3496	1.958	2.0586	2.1984	2.4204	2.7735	1.99	2.09
9	5	2.6182	2.7182	2.8561	3.0601	3.4093	2.6493	2.74
10	7.1191	3.4432	3.5437	3.6809	3.8773	4.1937	3.4728	3.57
11	9.7656	4.5057	4.6075	4.7459	4.939	5.2349	4.5305	4.62
12	12.998	5.824	5.9289	6.0713	6.2649	6.5482	5.8581	5.96
13	16.875	7.322	7.4281	7.5761	7.7778	8.0549	7.359	7.46
14	21.455	9.0868	9.1934	9.342	9.5513	9.8361	9.1139	9.
15	26.797	11.239	11.351	11.506	11.717	12.014	11.27	11.
16	32.959	13.72	13.826	13.983	14.207	14.511	13.749	13.8
17	40	16.53	16.635	16.782	16.996	17.316	16.568	16.6
18	47.979	19.712	19.817	19.964	20.174	20.477	19.752	19.8
19	56.953	23.144	23.25	23.4	23.614	23.917	23.185	23.
20	66.982	27.016	27.118	27.263	27.473	27.781	27.053	27.1
21	78.125	31.708	31.809	31.951	32.154	32.451	31.731	31.8
22	90.439	36.685	36.789	36.934	37.141	37.433	36.721	36.8
23	103.98	41.935	42.038	42.186	42.395	42.696	41.971	42.0
24	118.82	47.848	47.951	48.095	48.301	48.601	47.887	47.
25	135	54.325	54.429	54.577	54.788	55.087	54.36	54.4

Graph Mean Values:

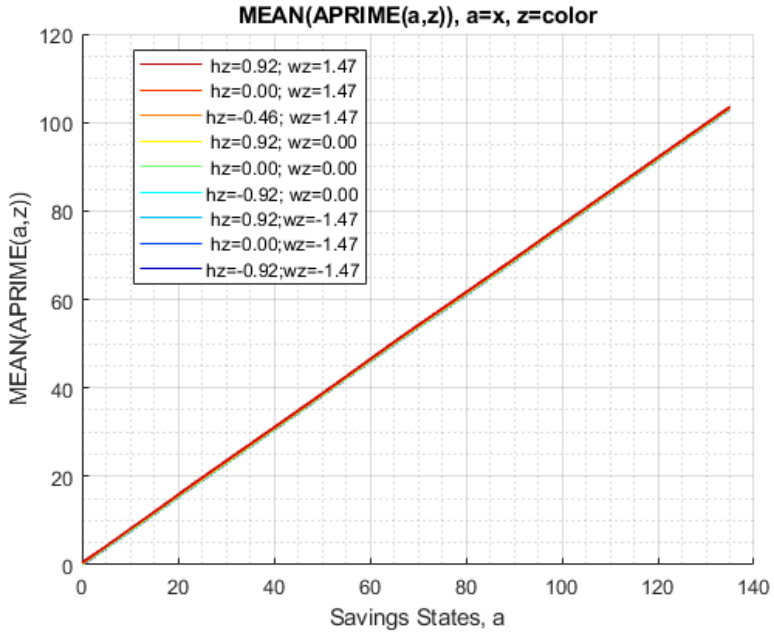
```
mp_support_graph('cl_st_graph_title') = {'MEAN(value(a,z)), a=x, z=color'};
mp_support_graph('cl_st_ytitle') = {'MEAN(value(a,z))'};
ff_graph_grid((tb_az_v{1:end, 3:end})', ar_st_eta_HS_grid, agrid, mp_support_graph);
```

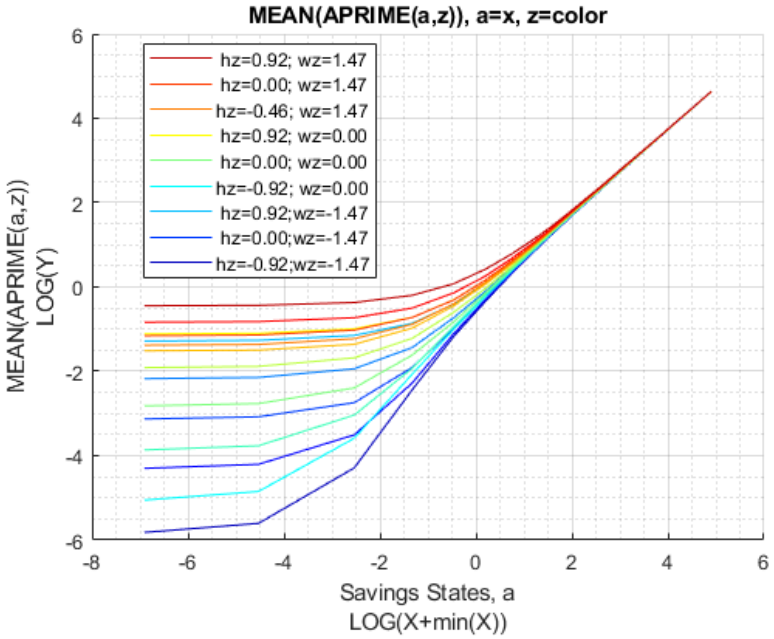




Graph Mean Savings Choices:

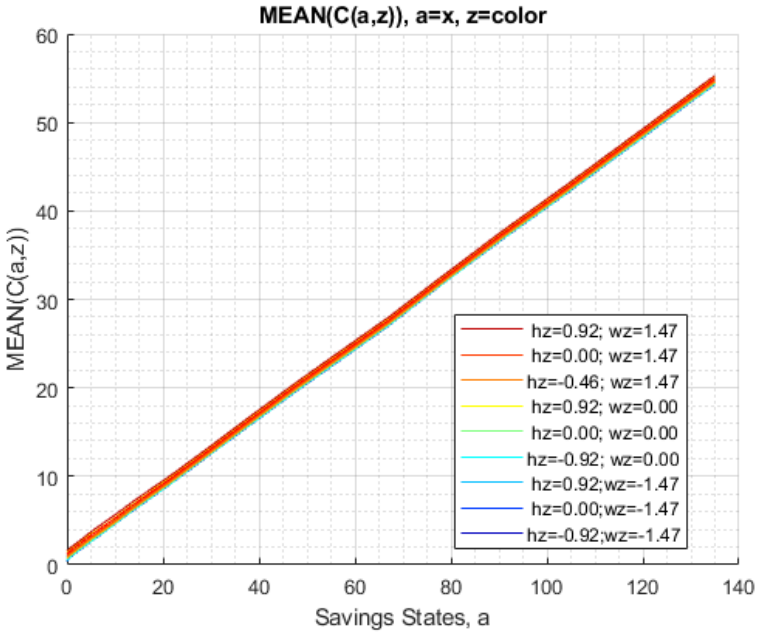
```
mp_support_graph('cl_st_graph_title') = {'MEAN(APRIME(a,z)), a=x, z=color'};
mp_support_graph('cl_st_ytitle') = {'MEAN(APRIME(a,z))'};
ff_graph_grid((tb_az_ap{1:end, 3:end})', ar_st_eta_HS_grid, agrid, mp_support_graph);
```

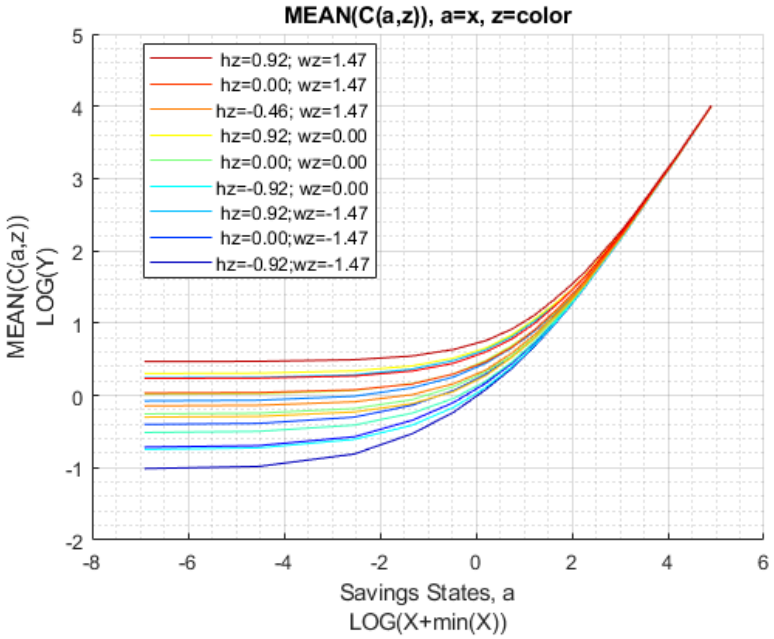




Graph Mean Consumption:

```
mp_support_graph('cl_st_graph_title') = {'MEAN(C(a,z)), a=x, z=color'};
mp_support_graph('cl_st_ytitle') = {'MEAN(C(a,z))'};
ff_graph_grid((tb_az_c{1:end, 3:end})', ar_st_eta_HS_grid, agrid, mp_support_graph);
```





Analyze Kids and Marriage and Age

Aggregating over education, savings, and shocks, what are the differential effects of Marriage and Age.

```
% Generate some Data
mp_support_graph = containers.Map('KeyType', 'char', 'ValueType', 'any');
ar_row_grid = ["k0M0", "K1M0", "K2M0", "k0M1", "K1M1", "K2M1"];
mp_support_graph('cl_st_xtitle') = {'Age'};
mp_support_graph('st_legend_loc') = 'best';
mp_support_graph('bl_graph_logy') = true; % do not log
mp_support_graph('st_rounding') = '6.2f'; % format shock legend
mp_support_graph('cl_scatter_shapes') = { 'o', 'd' ,'s', 'o', 'd', 's'};
mp_support_graph('cl_colors') = {'red', 'red', 'red', 'blue', 'blue', 'blue'};
```

MEAN(VAL(KM,J)), MEAN(AP(KM,J)), MEAN(C(KM,J))

Tabulate value and policies:

```
% Set
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
ar_permute = [2,3,4,1,6,5];
% Value Function
tb_az_v = ff_summ_nd_array("MEAN(VAL(KM,J))", V_VFI, true, ["mean"], 3, 1, cl_mp_datasetdesc, a
```

```
xxx  MEAN(VAL(KM,J))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
    group    kids    marry    mean_age_19    mean_age_22    mean_age_27    mean_age_32    mean_age_37    mean_age_42
    _____    ____    _____    ___________    ___________    ___________    ___________    ___________    ___________

      1       1        0         2.6201         2.7665         2.8454         2.8242         2.7343         2.5925
      2       2        0         1.5887         1.8727         2.0791         2.1577         2.1527         2.0791
      3       3        0         1.0708         1.3439         1.5546         1.6415         1.6452         1.5844
      4       1        1         2.6802         2.8229         2.9077         2.9056         2.8417         2.7296
      5       2        1         1.9461          2.164         2.3286         2.3959         2.3955         2.3375
      6       3        1          1.615         1.8161         1.9731         2.0371         2.0352         1.9819
```

```
% Aprime Choice
tb_az_ap = ff_summ_nd_array("MEAN(AP(KM,J))", ap_VFI, true, ["mean"], 3, 1, cl_mp_datasetdesc,
```

```
xxx  MEAN(AP(KM,J))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
    group    kids    marry    mean_age_19    mean_age_22    mean_age_27    mean_age_32    mean_age_37    mean_age_42
    _____    ____    _____    ___________    ___________    ___________    ___________    ___________    ___________

      1       1        0          34.74         34.523         34.415         34.265         34.042         33.736
      2       2        0         34.413         34.138         33.952         33.709         33.376         32.947
      3       3        0         34.001         33.777         33.635         33.423         33.115         32.697
      4       1        1         34.626         34.419         34.323         34.185         33.976         33.682
      5       2        1         34.477         34.253         34.116         33.923         33.642         33.267
      6       3        1         34.101         33.913         33.809         33.641         33.384         33.024
```

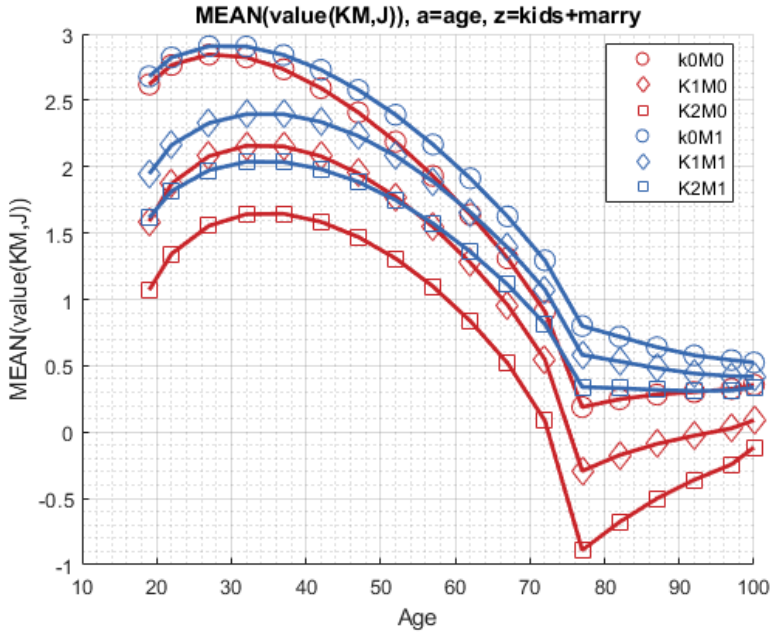
```
% Consumption Choices
tb_az_c = ff_summ_nd_array("MEAN(C(KM,J))", cons_VFI, true, ["mean"], 3, 1, cl_mp_datasetdesc,
```

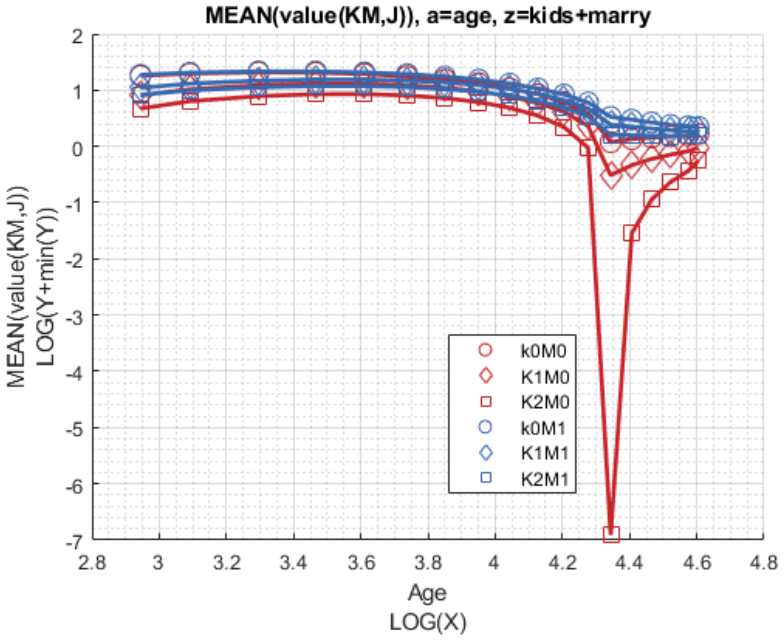
```
xxx  MEAN(C(KM,J))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
    group    kids    marry    mean_age_19    mean_age_22    mean_age_27    mean_age_32    mean_age_37    mean_age_42
    _____    ____    _____    ___________    ___________    ___________    ___________    ___________    ___________

      1       1        0          6.778         7.0757         7.3697         7.6652         7.9826         8.3391
      2       2        0         7.1055         7.4611         7.8334         8.2212         8.6487         9.1272
      3       3        0         7.5174         7.8216         8.1497         8.5069           8.91         9.3774
      4       1        1         7.3063         7.6329         7.9639         8.2916          8.638         9.0211
      5       2        1         7.3917         7.7297         8.0937         8.4696         8.8812          9.339
      6       3        1         7.7233         8.0217         8.3477         8.6932         9.0766         9.5155
```

Graph Mean Values:

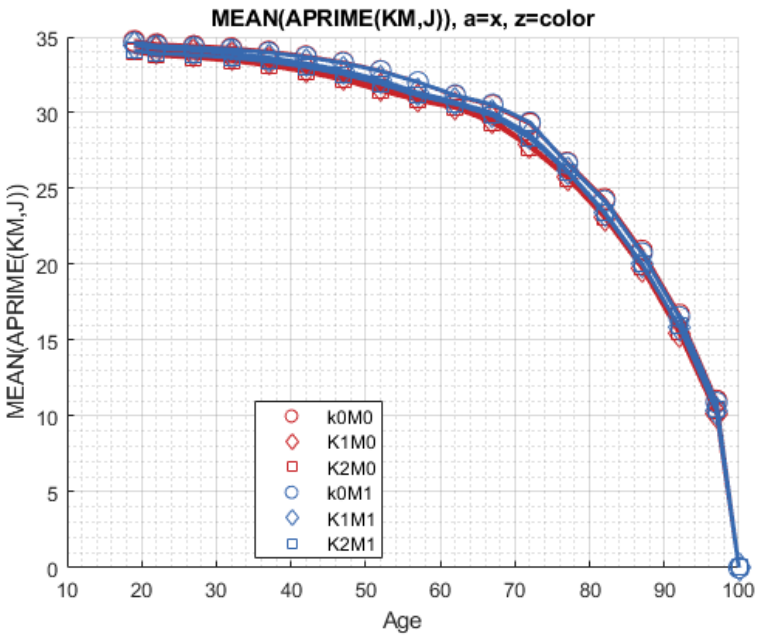
```
mp_support_graph('cl_st_graph_title') = {'MEAN(value(KM,J)), a=age, z=kids+marry'};
mp_support_graph('cl_st_ytitle') = {'MEAN(value(KM,J))'};
ff_graph_grid((tb_az_v{1:end, 4:end}), ar_row_grid, age_grid, mp_support_graph);
```

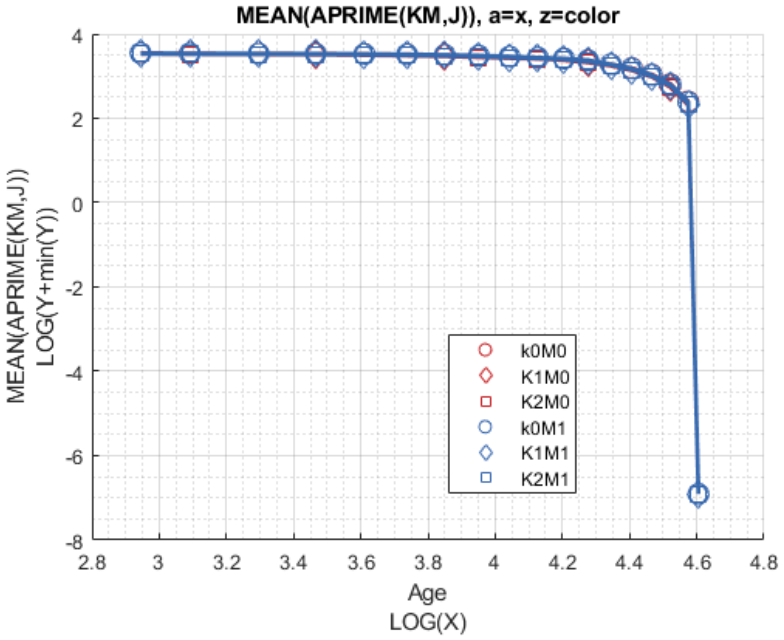




Graph Mean Savings Choices:

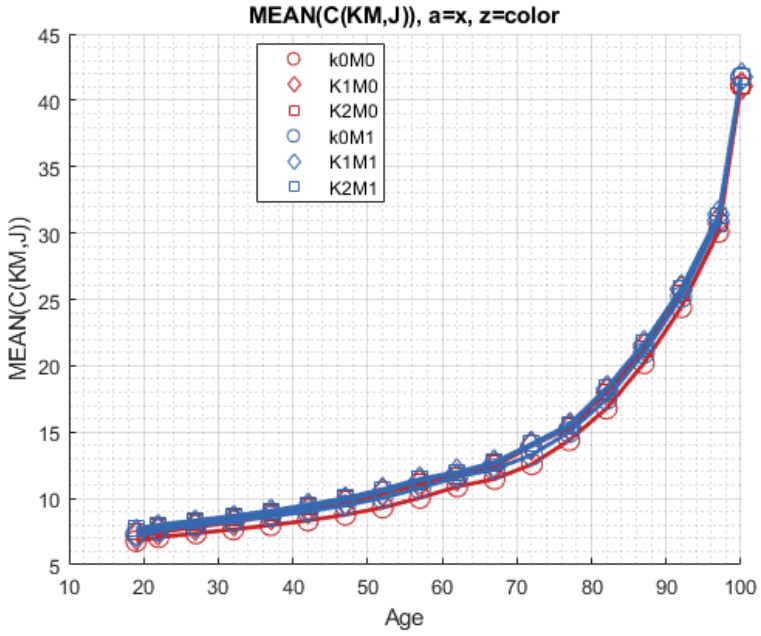
```
mp_support_graph('cl_st_graph_title') = {'MEAN(APRIME(KM,J)), a=x, z=color'};
mp_support_graph('cl_st_ytitle') = {'MEAN(APRIME(KM,J))'};
ff_graph_grid((tb_az_ap{1:end, 4:end}), ar_row_grid, age_grid, mp_support_graph);
```

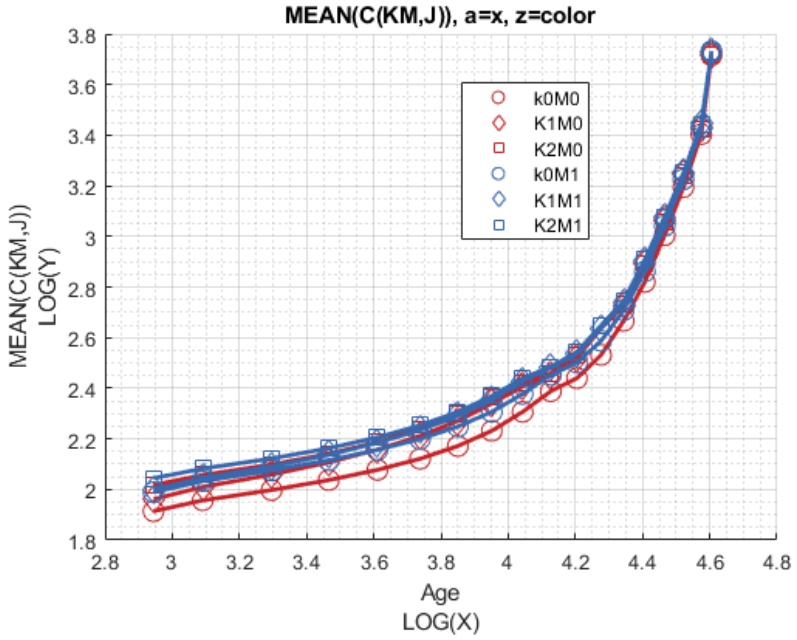




Graph Mean Consumption:

```
mp_support_graph('cl_st_graph_title') = {'MEAN(C(KM,J)), a=x, z=color'};
mp_support_graph('cl_st_ytitle') = {'MEAN(C(KM,J))'};
ff_graph_grid((tb_az_c{1:end, 4:end}), ar_row_grid, age_grid, mp_support_graph);
```





Analyze Education and Marriage and Age

Aggregating over education, savings, and shocks, what are the differential effects of Marriage and Age.

```
% Generate some Data
mp_support_graph = containers.Map('KeyType', 'char', 'ValueType', 'any');
ar_row_grid = ["E0M0", "E1M0", "E0M1", "E1M1"];
mp_support_graph('cl_st_xtitle') = {'Age'};
mp_support_graph('st_legend_loc') = 'best';
mp_support_graph('bl_graph_logy') = true; % do not log
mp_support_graph('st_rounding') = '6.2f'; % format shock legend
mp_support_graph('cl_scatter_shapes') = {'*', 'p', '*','p' };
mp_support_graph('cl_colors') = {'red', 'red', 'blue', 'blue'};
```

MEAN(VAL(EKM,J)), MEAN(AP(EKM,J)), MEAN(C(EKM,J))

Tabulate value and policies:

```
% Set
% NaN(n_jgrid,n_agrid,n_etagrid,n_educgrid,n_marriedgrid,n_kidsgrid);
ar_permute = [2,3,6,1,4,5];
% Value Function
tb_az_v = ff_summ_nd_array("MEAN(VAL(EKM,J))", V_VFI, true, ["mean"], 3, 1, cl_mp_datasetdesc,
```

```
xxx  MEAN(VAL(EKM,J))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
    group    edu    marry    mean_age_19    mean_age_22    mean_age_27    mean_age_32    mean_age_37    mean_age_42
    _____    ___    _____    ___________    ___________    ___________    ___________    ___________    ___________

      1       0       0         1.4646         1.6636         1.8129         1.8698         1.8591         1.7896
      2       1       0         2.0551         2.3251         2.5065         2.5458         2.4958         2.3811
      3       0       1          1.795         1.9657         2.0955         2.1504         2.1481         2.0956
      4       1       1         2.3659         2.5697         2.7107         2.7421         2.7001         2.6037
```

```
% Aprime Choice
tb_az_ap = ff_summ_nd_array("MEAN(AP(EKM,J))", ap_VFI, true, ["mean"], 3, 1, cl_mp_datasetdesc,
```

```
xxx  MEAN(AP(EKM,J))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
    group    edu    marry    mean_age_19    mean_age_22    mean_age_27    mean_age_32    mean_age_37    mean_age_42
    _____    ___    _____    ___________    ___________    ___________    ___________    ___________    ___________

      1       0       0          34.471         34.227         34.028         33.781         33.465         33.068
      2       1       0          34.298         34.065         33.974         33.817         33.557         33.186
      3       0       1          34.499         34.288         34.123          33.91         33.632         33.274
      4       1       1          34.304         34.102         34.042         33.923         33.703         33.375
```

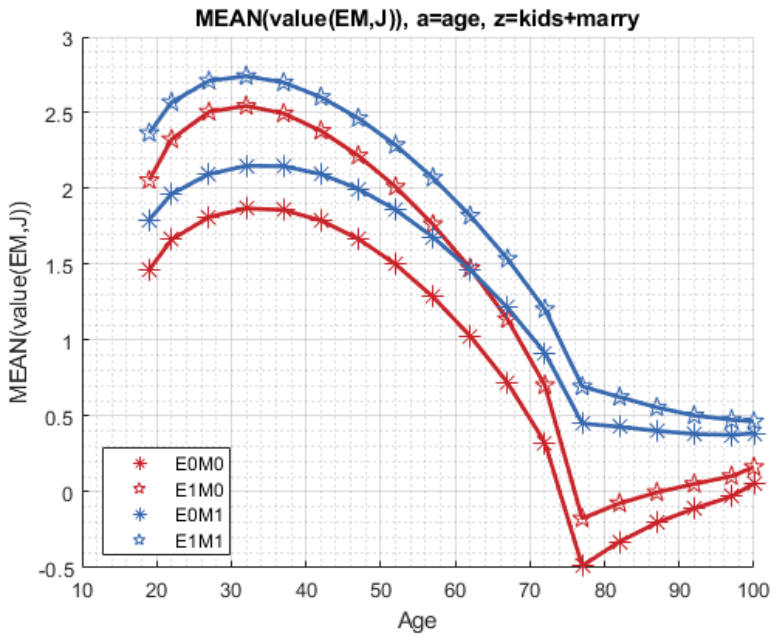
```
% Consumption Choices
tb_az_c = ff_summ_nd_array("MEAN(C(EKM,J))", cons_VFI, true, ["mean"], 3, 1, cl_mp_datasetdesc,
```

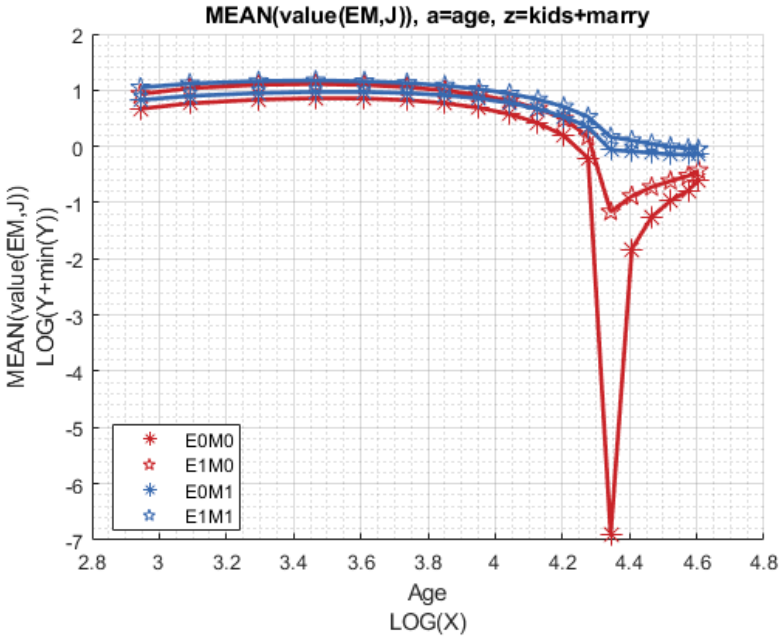
```
xxx  MEAN(C(EKM,J))  xxxxxxxxxxxxxxxxxxxxxxxxxxx
    group    edu    marry    mean_age_19    mean_age_22    mean_age_27    mean_age_32    mean_age_37    mean_age_42
    _____    ___    _____    ___________    ___________    ___________    ___________    ___________    ___________

      1       0       0           7.047         7.3391          7.647          7.982         8.3628         8.8022
      2       1       0          7.2203         7.5665         7.9215         8.2802         8.6647         9.0936
      3       0       1          7.3401         7.6271         7.9338         8.2659         8.6401         9.0694
      4       1       1          7.6075         7.9624         8.3364         8.7038         9.0904         9.5144
```

Graph Mean Values:

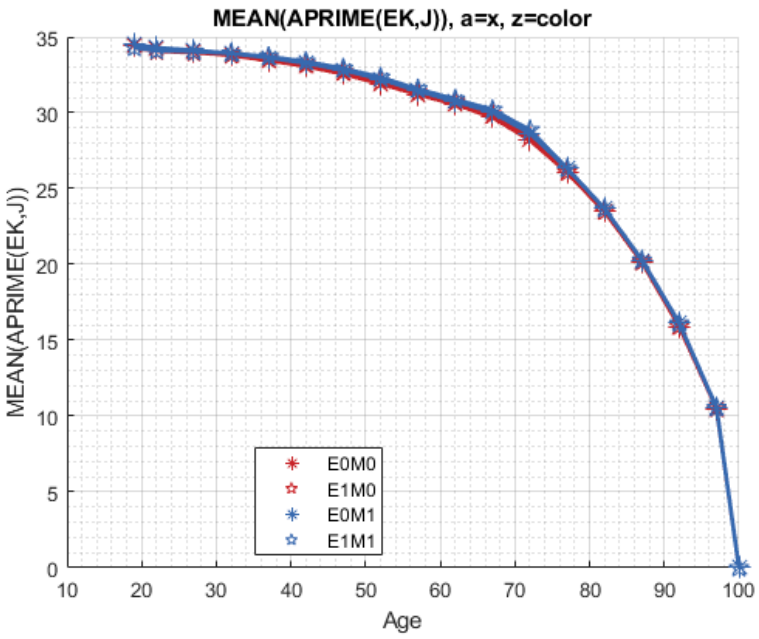
```
mp_support_graph('cl_st_graph_title') = {'MEAN(value(EM,J)), a=age, z=kids+marry'};
mp_support_graph('cl_st_ytitle') = {'MEAN(value(EM,J))'};
ff_graph_grid((tb_az_v{1:end, 4:end}), ar_row_grid, age_grid, mp_support_graph);
```

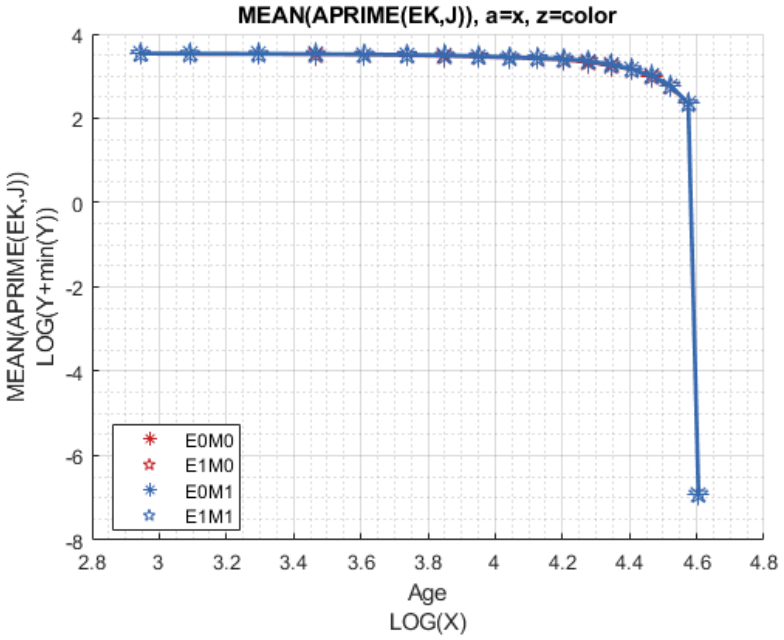




Graph Mean Savings Choices:

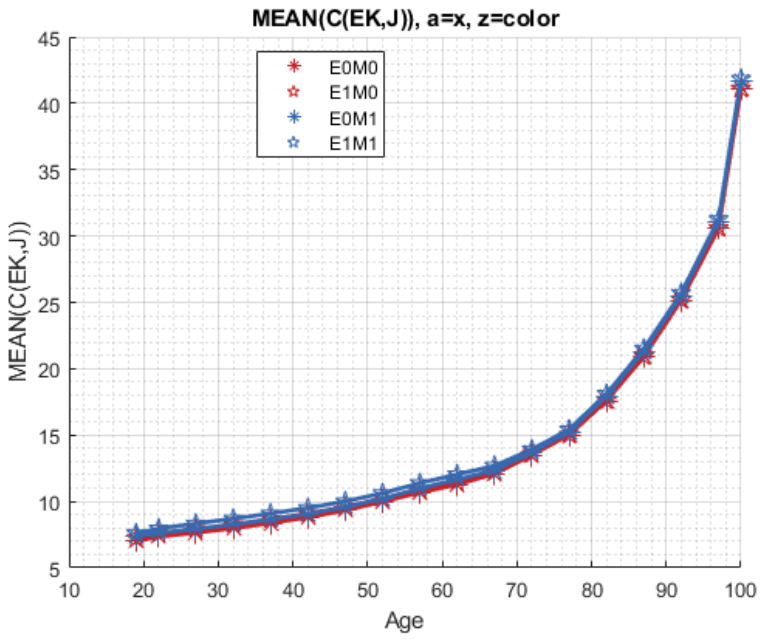
```
mp_support_graph('cl_st_graph_title') = {'MEAN(APRIME(EK,J)), a=x, z=color'};
mp_support_graph('cl_st_ytitle') = {'MEAN(APRIME(EK,J))'};
ff_graph_grid((tb_az_ap{1:end, 4:end}), ar_row_grid, age_grid, mp_support_graph);
```

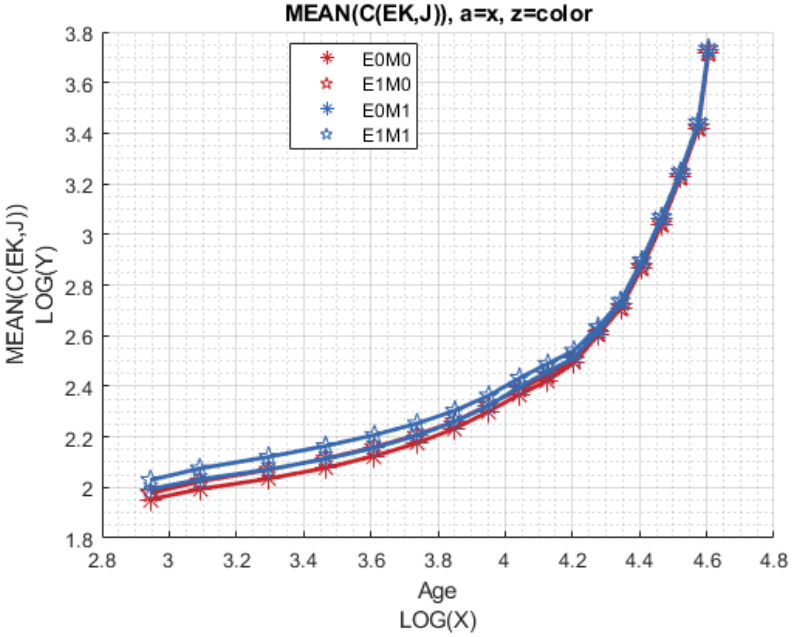




Graph Mean Consumption:

```
mp_support_graph('cl_st_graph_title') = {'MEAN(C(EK,J)), a=x, z=color'};
mp_support_graph('cl_st_ytitle') = {'MEAN(C(EK,J))'};
ff_graph_grid((tb_az_c{1:end, 4:end}), ar_row_grid, age_grid, mp_support_graph);
```


MEAN(C(EK,J)), a=x, z=color
E0M0
E1M0
E0M1
E1M1
MEAN(C(EK,J))
Age


MEAN(C(EK,J)), a=x, z=color
E0M0
E1M0
E0M1
E1M1
MEAN(C(EK,J))
LOG(Y)
Age
LOG(X)