

Small Test Exact Solution Vectorized Bisection

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. Small Solution Analysis, husband 5 shocks, wife 1 shocks.

Test SNW_VFI_MAIN Defaults Small

Call the function with defaults parameters.

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

SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:18 of 17, time-this-age:0.019266
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:17 of 17, time-this-age:0.020088
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:16 of 17, time-this-age:0.019484
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:15 of 17, time-this-age:0.020422
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:14 of 17, time-this-age:0.018799
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:13 of 17, time-this-age:0.019274
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:12 of 17, time-this-age:0.019728
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:11 of 17, time-this-age:0.020101
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:10 of 17, time-this-age:0.019674
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:9 of 17, time-this-age:0.019648
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:8 of 17, time-this-age:0.019126
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:7 of 17, time-this-age:0.018838
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:6 of 17, time-this-age:0.01893
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:5 of 17, time-this-age:0.018729
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:4 of 17, time-this-age:0.018653
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:3 of 17, time-this-age:0.018577
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:2 of 17, time-this-age:0.018797
SNW_VFI_MAIN_BISEC_VEC: Finished Age Group:1 of 17, time-this-age:0.019341
Completed SNW_VFI_MAIN_BISEC_VEC;SNW_MP_PARAM=default_small;SNW_MP_CONTROL=default_base;time=0.35835
```

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=%3.2f;')], 'wz=%3.2f;'));
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'}, {'Hshock', 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
```

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_permute);
```

xxx	MEAN(VAL(A,Z))	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx					
group	savings	mean_Hshock__1_8395	mean_Hshock__0_91976	mean_Hshock__0	mean_Hshock__0_91976	mean_Hshock__0	mean_Hshock__0_91976
1	0	-17.393	-9.1596	-4.4164	-1.5921		
2	0.0097656	-16.967	-9.023	-4.3405	-1.5316		
3	0.078125	-14.925	-8.2554	-3.9177	-1.2071		
4	0.26367	-11.699	-6.8681	-3.1808	-0.6913		
5	0.625	-8.2751	-5.1669	-2.2785	-0.13883		
6	1.2207	-5.3024	-3.4437	-1.3431	0.38362		
7	2.1094	-2.9816	-1.9066	-0.47797	0.86412		
8	3.3496	-1.2609	-0.64407	0.28612	1.3001		
9	5	-0.012543	0.34403	0.9369	1.6782		
10	7.1191	0.88751	1.097	1.4725	1.9981		
11	9.7656	1.5392	1.665	1.9037	2.2701		
12	12.998	2.0158	2.0932	2.2465	2.5004		
13	16.875	2.3684	2.4172	2.5172	2.6933		
14	21.455	2.6328	2.6644	2.7307	2.8535		
15	26.797	2.8339	2.8549	2.8997	2.986		
16	32.959	2.989	3.0032	3.034	3.0954		
17	40	3.1102	3.12	3.1416	3.1857		
18	47.979	3.2059	3.2128	3.2282	3.2603		
19	56.953	3.2825	3.2875	3.2986	3.3222		
20	66.982	3.3443	3.348	3.3562	3.3738		
21	78.125	3.3948	3.3975	3.4036	3.4169		
22	90.439	3.4364	3.4384	3.443	3.4532		
23	103.98	3.4709	3.4724	3.476	3.4838		
24	118.82	3.4998	3.501	3.5037	3.5098		
25	135	3.5241	3.5251	3.5272	3.5319		

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

xxx	MEAN(AP(A,Z))	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx					
group	savings	mean_Hshock__1_8395	mean_Hshock__0_91976	mean_Hshock__0	mean_Hshock__0_91976	mean_Hshock__0	mean_Hshock__0_91976
1	0	2.7511e-05	0.0021997	0.046353	0.23828		
2	0.0097656	0.00054711	0.0036547	0.049525	0.24213		

3	0.078125	0.021674	0.027305	0.079481	0.27462
4	0.26367	0.13129	0.14249	0.19451	0.38201
5	0.625	0.38703	0.404	0.44756	0.63879
6	1.2207	0.83381	0.85545	0.90672	1.0839
7	2.1094	1.5206	1.5442	1.6064	1.7452
8	3.3496	2.477	2.5013	2.5629	2.6788
9	5	3.7541	3.7788	3.8405	3.9859
10	7.1191	5.416	5.4412	5.5038	5.6835
11	9.7656	7.4668	7.4912	7.5553	7.7413
12	12.998	9.9008	9.9211	9.9832	10.174
13	16.875	12.918	12.94	12.995	13.186
14	21.455	16.519	16.538	16.594	16.772
15	26.797	20.59	20.608	20.657	20.825
16	32.959	25.295	25.313	25.358	25.513
17	40	30.657	30.68	30.732	30.877
18	47.979	36.751	36.772	36.831	36.99
19	56.953	43.764	43.786	43.839	44.003
20	66.982	51.594	51.617	51.677	51.84
21	78.125	59.942	59.965	60.024	60.197
22	90.439	69.254	69.278	69.34	69.515
23	103.98	79.741	79.762	79.821	79.995
24	118.82	91.103	91.126	91.188	91.354
25	135	103.46	103.48	103.53	103.71

% Consumption Choices

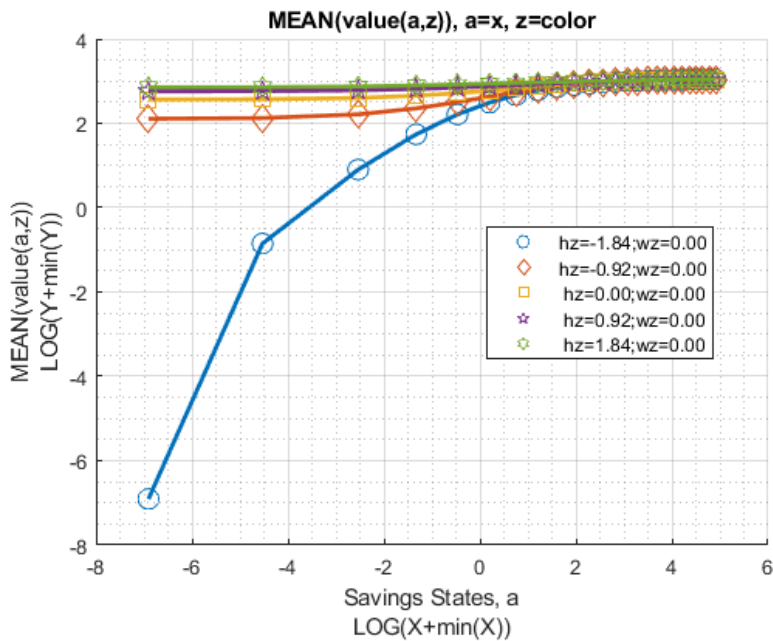
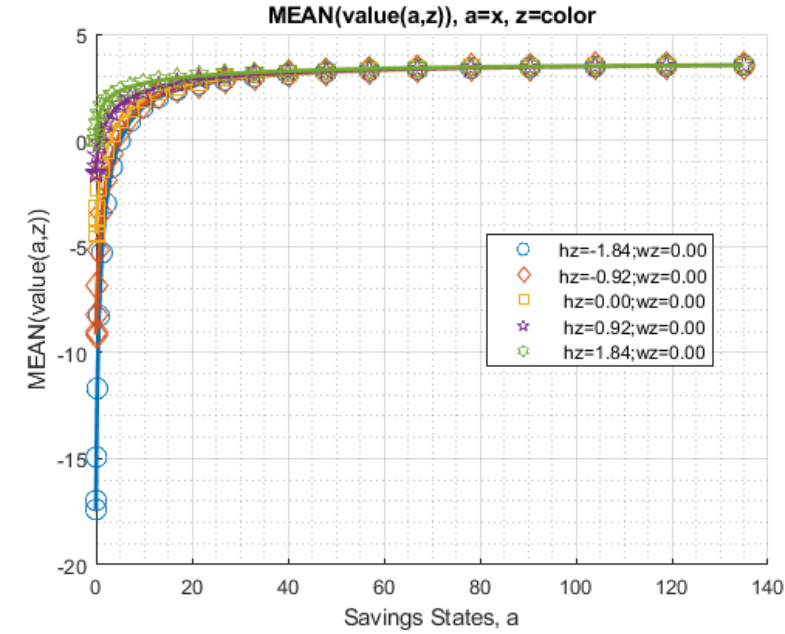
```
tb_az_c = ff_summ_nd_array("MEAN(C(A,Z))", cons_VFI, true, ["mean"], 4, 1, cl_mp_datasetdesc, a
```

xxx	MEAN(C(A,Z))	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx				
group	savings	mean_Hshock__1_8395	mean_Hshock__0_91976	mean_Hshock__0	mean_Hshock__0_91976	mean_Hshock__0
1	0	0.3104	0.44	0.69897	1.2297	
2	0.0097656	0.3214	0.45001	0.70723	1.2373	
3	0.078125	0.3809	0.50664	0.75724	1.2846	
4	0.26367	0.48992	0.60921	0.8592	1.3937	
5	0.625	0.65917	0.77131	1.0284	1.5584	
6	1.2207	0.91141	1.0172	1.2649	1.8076	
7	2.1094	1.2649	1.3671	1.6019	2.1815	
8	3.3496	1.7572	1.8573	2.0907	2.6915	
9	5	2.4045	2.503	2.7347	3.3043	
10	7.1191	3.2104	3.3074	3.537	4.0708	
11	9.7656	4.2385	4.3358	4.5627	5.0889	
12	12.998	5.5627	5.6635	5.8917	6.4121	
13	16.875	7.0504	7.1499	7.3847	7.9039	
14	21.455	8.7708	8.8721	9.1059	9.6366	
15	26.797	10.904	11.007	11.247	11.787	
16	32.959	13.355	13.457	13.7	14.254	
17	40	16.168	16.266	16.502	17.066	
18	47.979	19.337	19.437	19.666	20.215	
19	56.953	22.744	22.843	23.078	23.621	
20	66.982	26.557	26.654	26.883	27.428	
21	78.125	31.145	31.242	31.47	32.006	
22	90.439	36.128	36.224	36.451	36.982	
23	103.98	41.364	41.464	41.692	42.226	
24	118.82	47.222	47.319	47.545	48.086	
25	135	53.652	53.751	53.983	54.518	

Graph Mean Values:

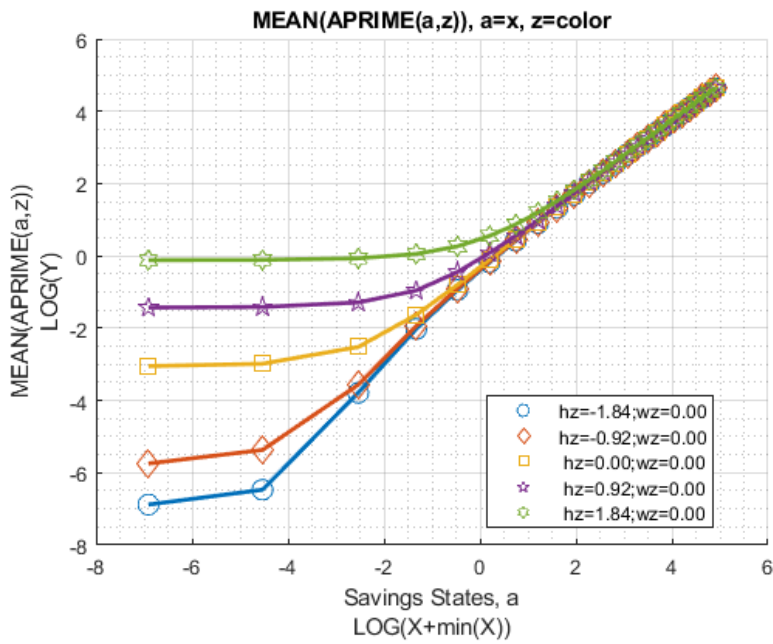
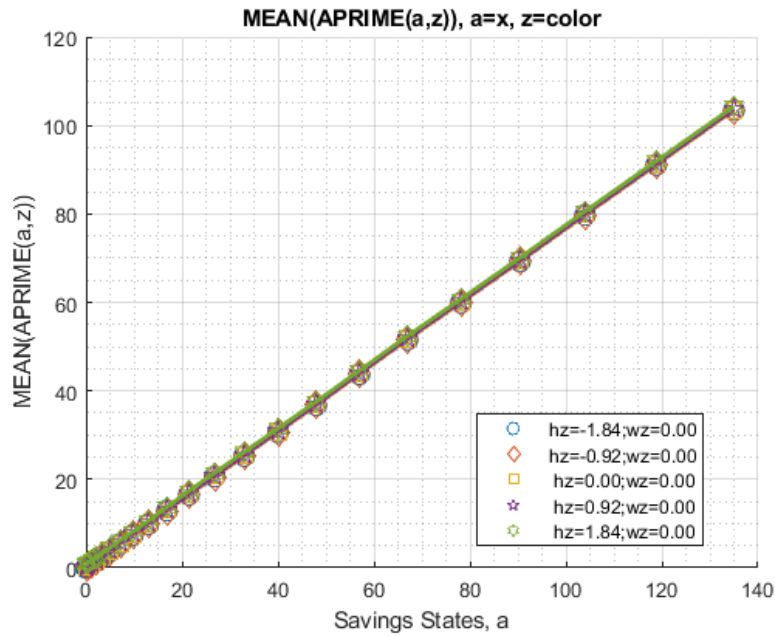
```
mp_support_graph('cl_st_graph_title') = {'MEAN(value(a,z)), a=x, z=color'};
```

```
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);
```



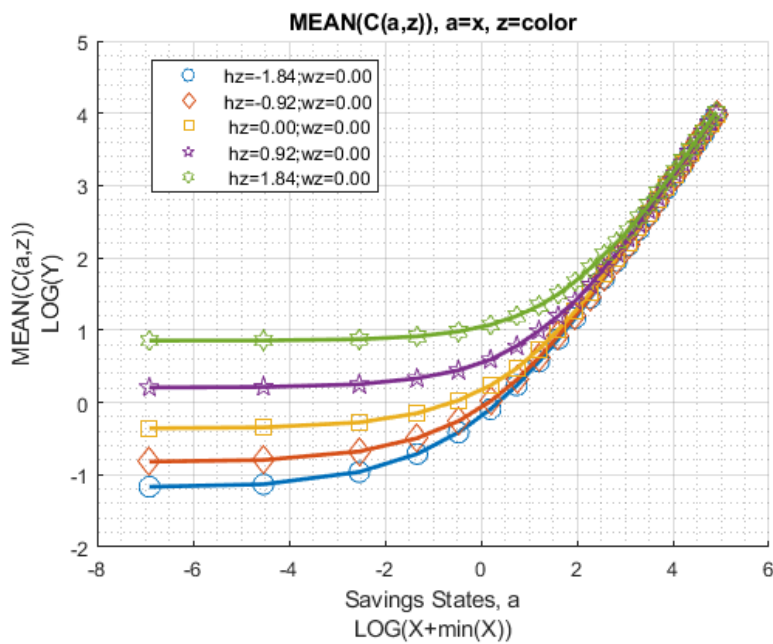
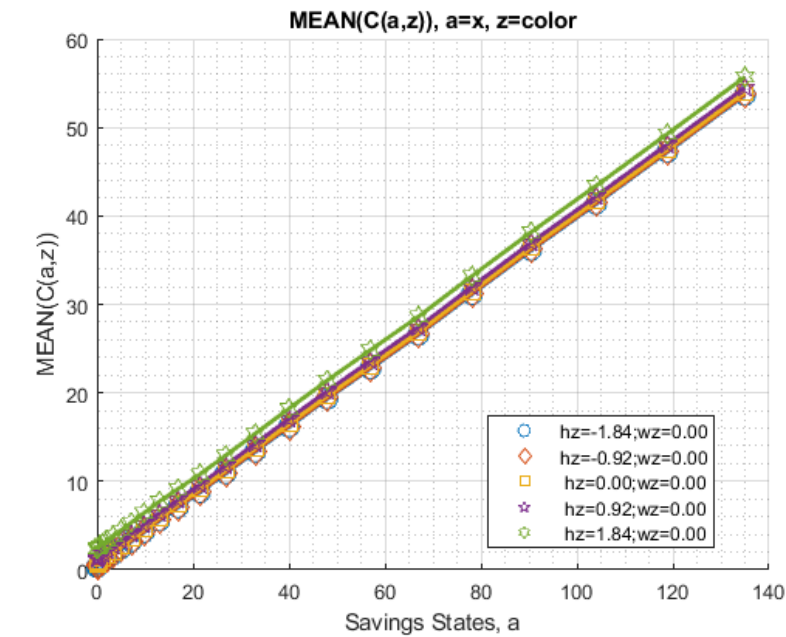
Graph Mean Savings Choices:

```
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))	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx							
	group	kids	marry	mean_age_19	mean_age_22	mean_age_27	mean_age_32	mean_age_37	mean_age_42
	1	1	0	1.4699	1.7485	1.9344	1.9907	1.9652	1.8837
	2	2	0	-0.020723	0.46111	0.83504	1.0389	1.1397	1.1609
	3	3	0	-0.77111	-0.30145	0.081934	0.30157	0.41928	0.46457
	4	1	1	2.0205	2.2326	2.3705	2.4138	2.3913	2.3187
	5	2	1	1.0463	1.3598	1.6057	1.745	1.8111	1.8148
	6	3	1	0.61068	0.90045	1.1354	1.2721	1.3395	1.3538

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

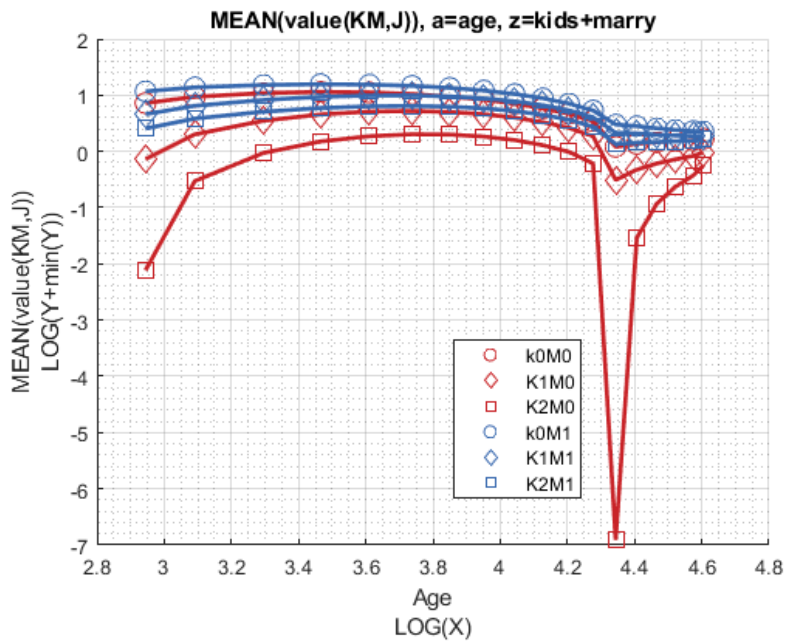
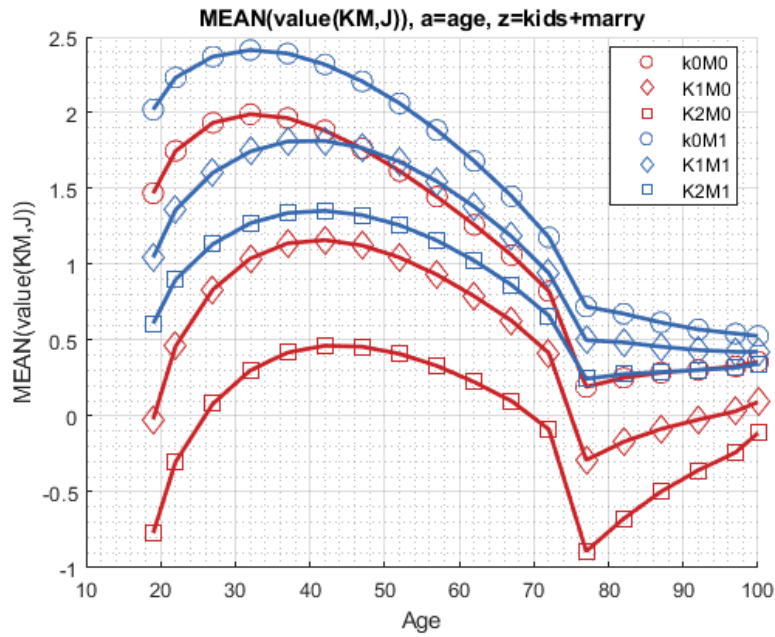
xxx	MEAN(AP(KM,J))	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx							
	group	kids	marry	mean_age_19	mean_age_22	mean_age_27	mean_age_32	mean_age_37	mean_age_42
	1	1	0	34.929	34.724	34.662	34.55	34.357	34.071
	2	2	0	34.6	34.331	34.195	33.99	33.687	33.279
	3	3	0	34.185	33.965	33.873	33.7	33.421	33.026
	4	1	1	34.819	34.614	34.562	34.453	34.262	33.978
	5	2	1	34.667	34.448	34.36	34.201	33.945	33.586
	6	3	1	34.3	34.115	34.061	33.932	33.7	33.356

```
% 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))	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx							
	group	kids	marry	mean_age_19	mean_age_22	mean_age_27	mean_age_32	mean_age_37	mean_age_42
	1	1	0	6.8551	7.1756	7.502	7.8205	8.1483	8.5053
	2	2	0	7.1843	7.5683	7.9695	8.3802	8.8184	9.2974
	3	3	0	7.5997	7.934	8.2911	8.6703	9.0841	9.5509
	4	1	1	7.1871	7.5271	7.8696	8.209	8.5573	8.9343
	5	2	1	7.3044	7.6564	8.0306	8.4165	8.826	9.2748
	6	3	1	7.6479	7.9629	8.3009	8.6543	9.0382	9.4691

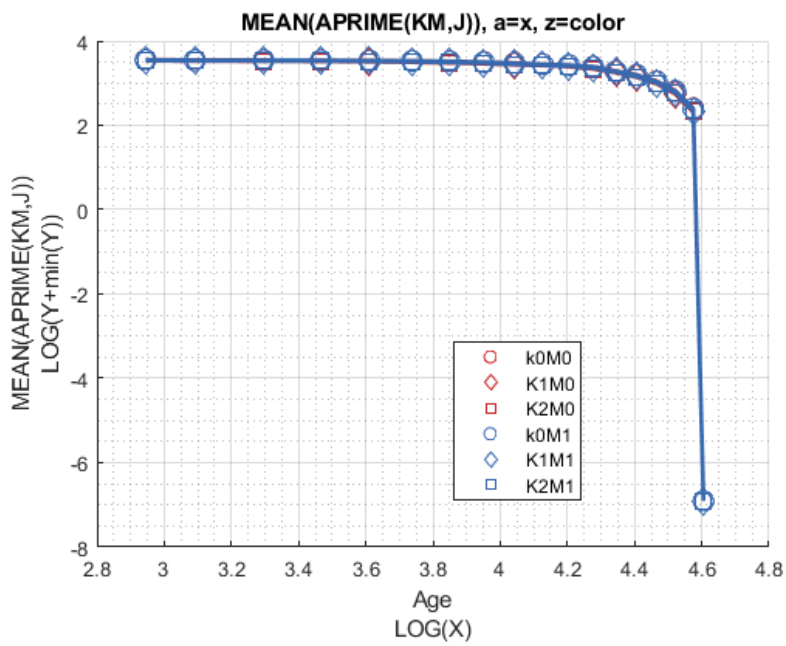
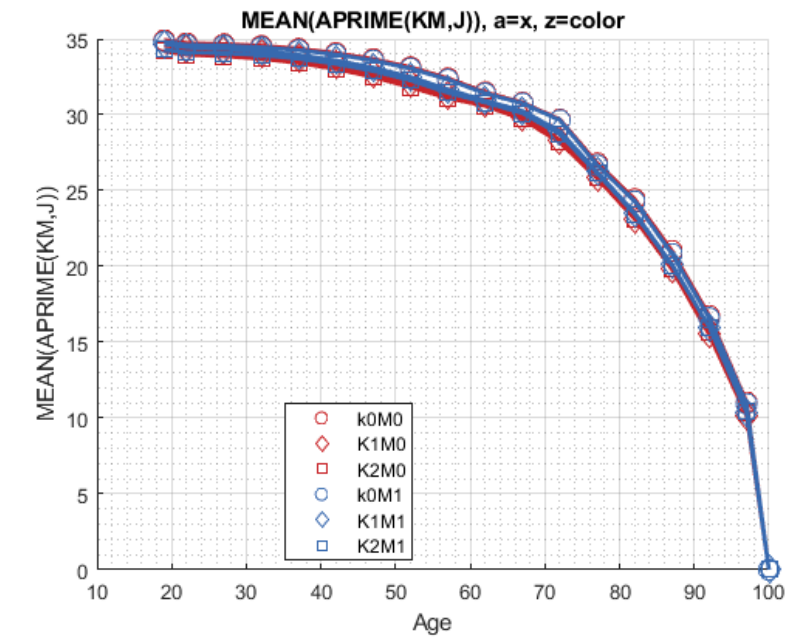
Graph Mean Values:

```
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);
```



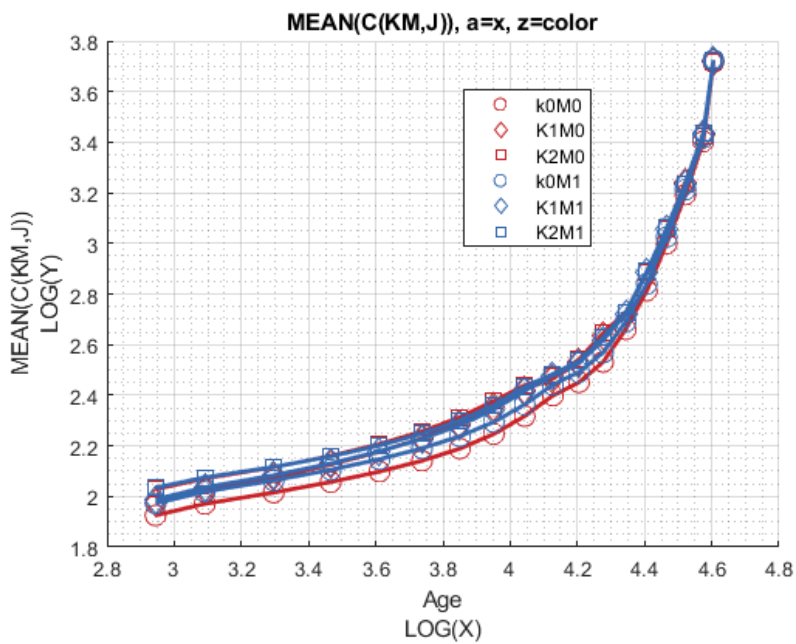
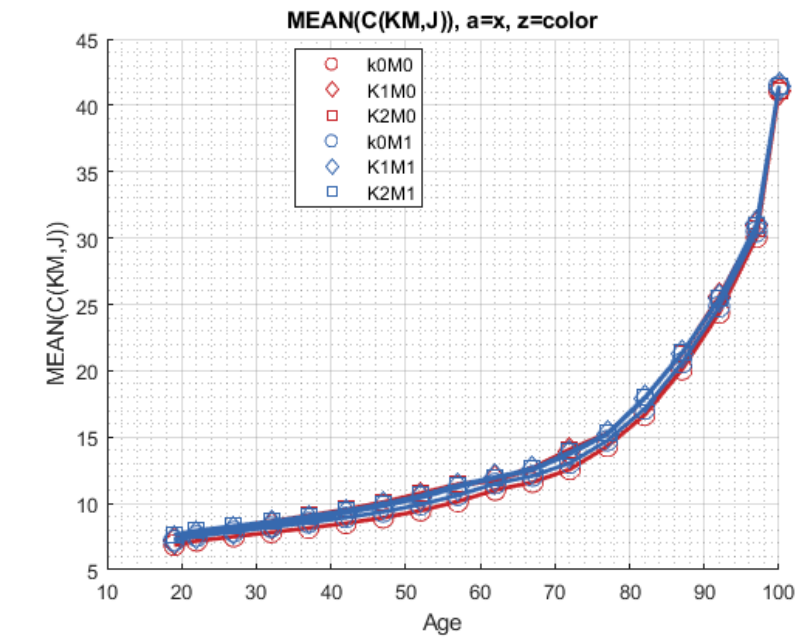
Graph Mean Savings Choices:

```
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))  xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
  group    edu    marry    mean_age_19    mean_age_22    mean_age_27    mean_age_32    mean_age_37    mean_age_42
  -----
    1      0      0      -0.19018      0.16944      0.46325      0.63924      0.73534      0.76637
    2      1      0      0.64221      1.1027      1.4377      1.5815      1.6141      1.5731
    3      0      1      0.85396      1.1146      1.3219      1.4469      1.5109      1.5218
    4      1      1      1.5977      1.8806      2.0859      2.1737      2.1837      2.1364
```

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

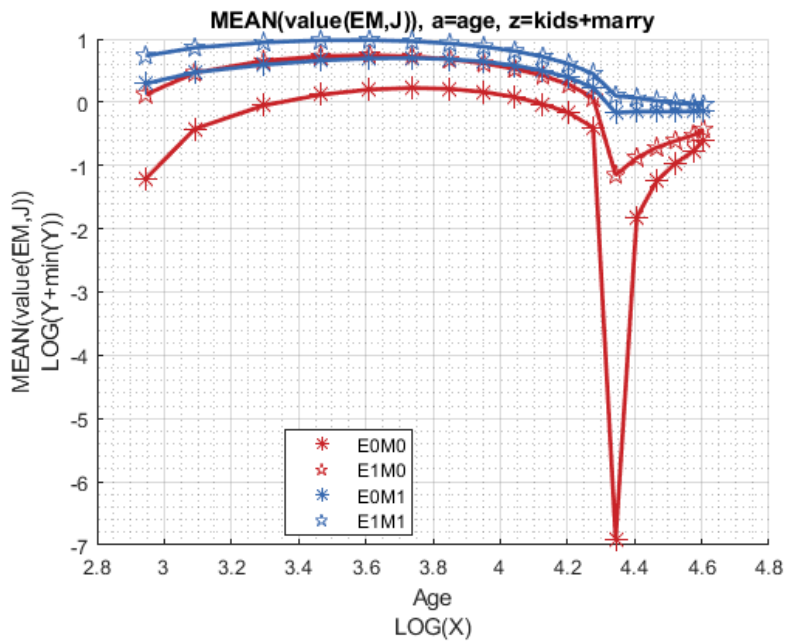
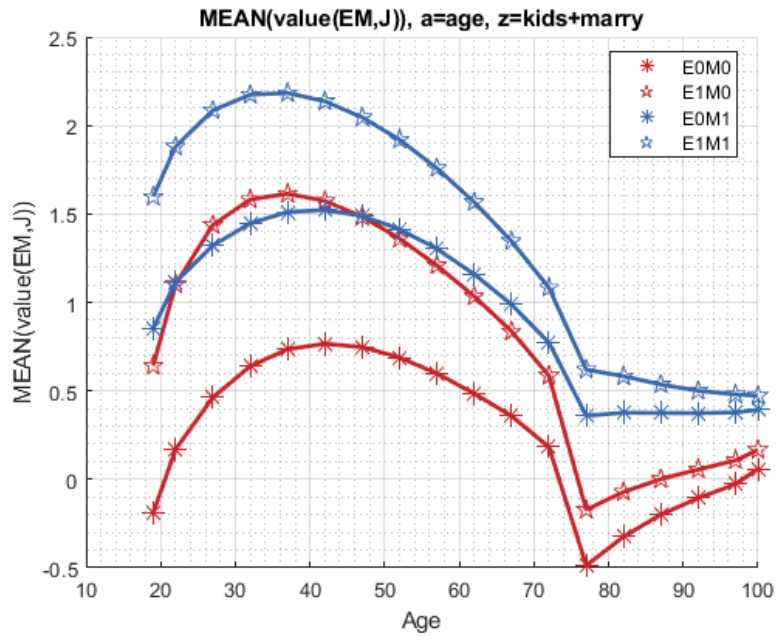
```
xxx  MEAN(AP(EKM,J))  xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
  group    edu    marry    mean_age_19    mean_age_22    mean_age_27    mean_age_32    mean_age_37    mean_age_42
  -----
    1      0      0      34.68      34.441      34.268      34.044      33.748      33.368
    2      1      0      34.463      34.238      34.218      34.116      33.895      33.549
    3      0      1      34.723      34.511      34.368      34.173      33.909      33.563
    4      1      1      34.468      34.274      34.287      34.218      34.029      33.717
```

```
% 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))  xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
  group    edu    marry    mean_age_19    mean_age_22    mean_age_27    mean_age_32    mean_age_37    mean_age_42
  -----
    1      0      0      7.1043      7.4114      7.7391      8.0887      8.4765      8.9169
    2      1      0      7.3218      7.7071      8.1025      8.492      8.8907      9.3189
    3      0      1      7.2329      7.5281      7.8428      8.1801      8.5525      8.9751
    4      1      1      7.5267      7.9028      8.2913      8.6732      9.0619      9.4769
```

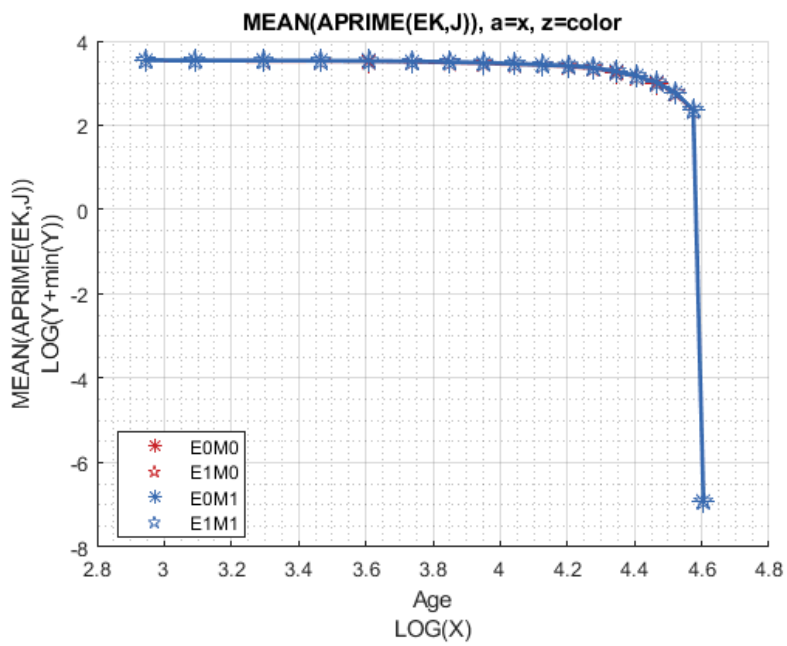
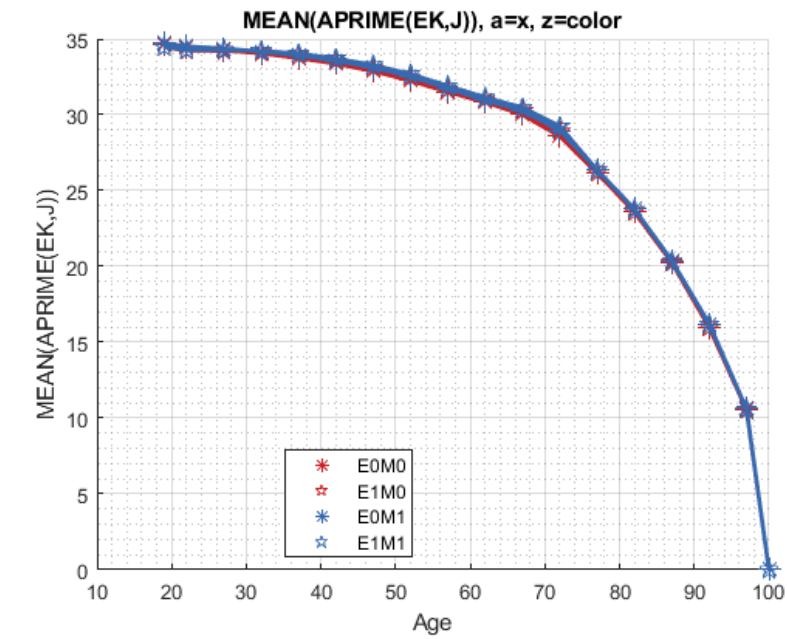
Graph Mean Values:

```
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);
```

