deriv_stepsize_investiation

March 23, 2021

[49]:
```
import numpy as np

import kcap_methods as km
import score_compression as sc
import deriv_stepsize_investigation as dsi

import matplotlib.pyplot as plt
```

[5]:
```
step_sizes = np.array([])
for value in [0.00001, 0.0001, 0.001, 0.01]:
    for i in range(10):
        step_sizes = np.append(step_sizes, value * (i+1))
step_sizes = np.append(step_sizes, 0.1)

print(step_sizes)
```

```
[1.e-05 2.e-05 3.e-05 4.e-05 5.e-05 6.e-05 7.e-05 8.e-05 9.e-05 1.e-04
 1.e-04 2.e-04 3.e-04 4.e-04 5.e-04 6.e-04 7.e-04 8.e-04 9.e-04 1.e-03
 1.e-03 2.e-03 3.e-03 4.e-03 5.e-03 6.e-03 7.e-03 8.e-03 9.e-03 1.e-02
 1.e-02 2.e-02 3.e-02 4.e-02 5.e-02 6.e-02 7.e-02 8.e-02 9.e-02 1.e-01
 1.e-01]
```

1 Calculate the derivatives for varying stepsizes

[6]:
```
dsi.run_varying_stepsize(step_sizes = step_sizes)
```

```
alues wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
```

```
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
```

```
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
```

```
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
```

```
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
```

```
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
```

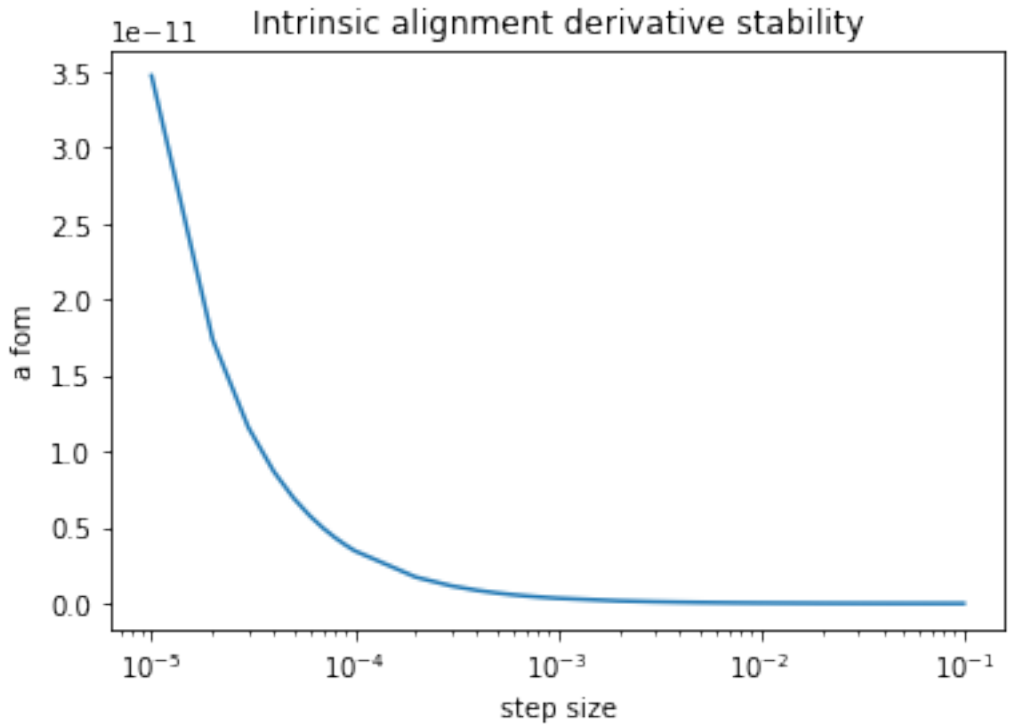
```
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
```

```
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to omch2 found.
Files for shear_xi_plus_binned numerical derivative values wrt to omch2 found.
Files for theory_data_covariance numerical derivative values wrt to omch2 found.
Stepsize file for deriv wrt to omch2 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to sigma_8
found.
Files for shear_xi_plus_binned numerical derivative values wrt to sigma_8 found.
Files for theory_data_covariance numerical derivative values wrt to sigma_8
found.
Stepsize file for deriv wrt to sigma_8 found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
Checking if the corresponding derivatives exist…
Files for shear_xi_minus_binned numerical derivative values wrt to a found.
Files for shear_xi_plus_binned numerical derivative values wrt to a found.
Files for theory_data_covariance numerical derivative values wrt to a found.
Stepsize file for deriv wrt to a found
All wanted numerical derivative values found!
All files found for these parameters, skipping this particular deriv run
```

[7]:
```
# Get omega_m deriv FOMs
```

```
omega_m_step_sizes, omega_m_fom = dsi.get_fom_vals(deriv_param = 'omega_m',␣
↪step_sizes = step_sizes)

# Get omch2 deriv FOMs

omch2_step_sizes, omch2_fom = dsi.get_fom_vals(deriv_param = 'omch2',␣
↪step_sizes = step_sizes)

# Get ia deriv FOMs

a_step_sizes, a_fom = dsi.get_fom_vals(deriv_param = 'a', step_sizes =␣
↪step_sizes)

# Get sigma_8 deriv FOMs

sigma_8_step_sizes, sigma_8_fom = dsi.get_fom_vals(deriv_param = 'sigma_8',␣
↪step_sizes = step_sizes)
```

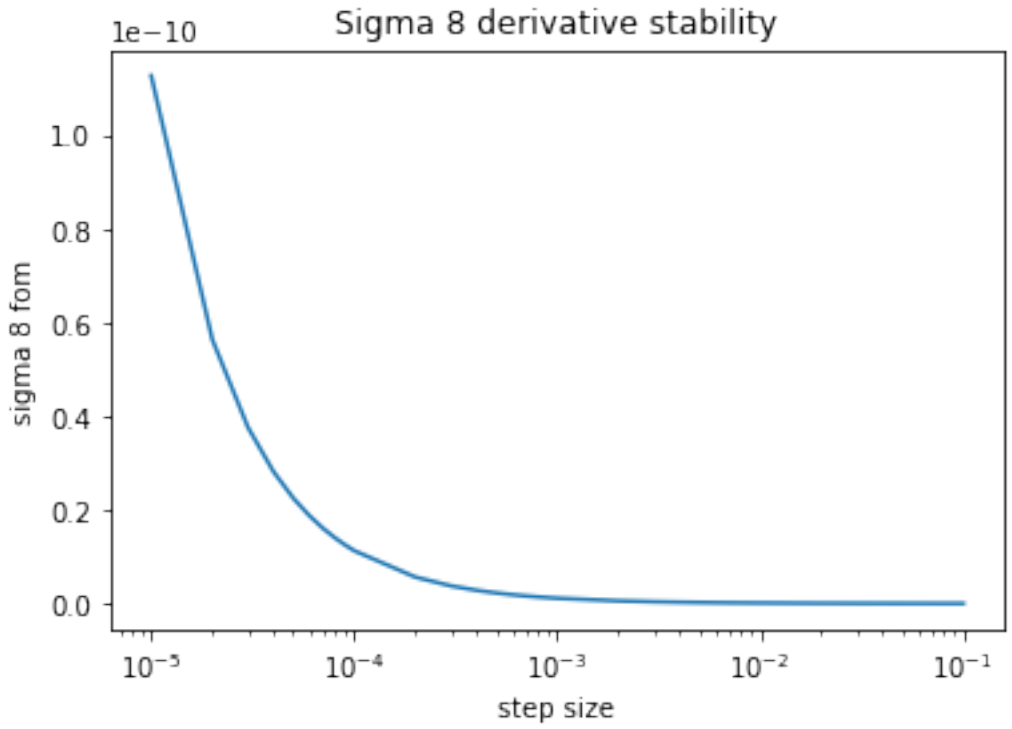
[8]:
```
plt.plot(a_step_sizes, a_fom)
plt.xscale('log')
plt.xlabel('step size')
plt.ylabel('a fom')
plt.title('Intrinsic alignment derivative stability')
plt.show()
```



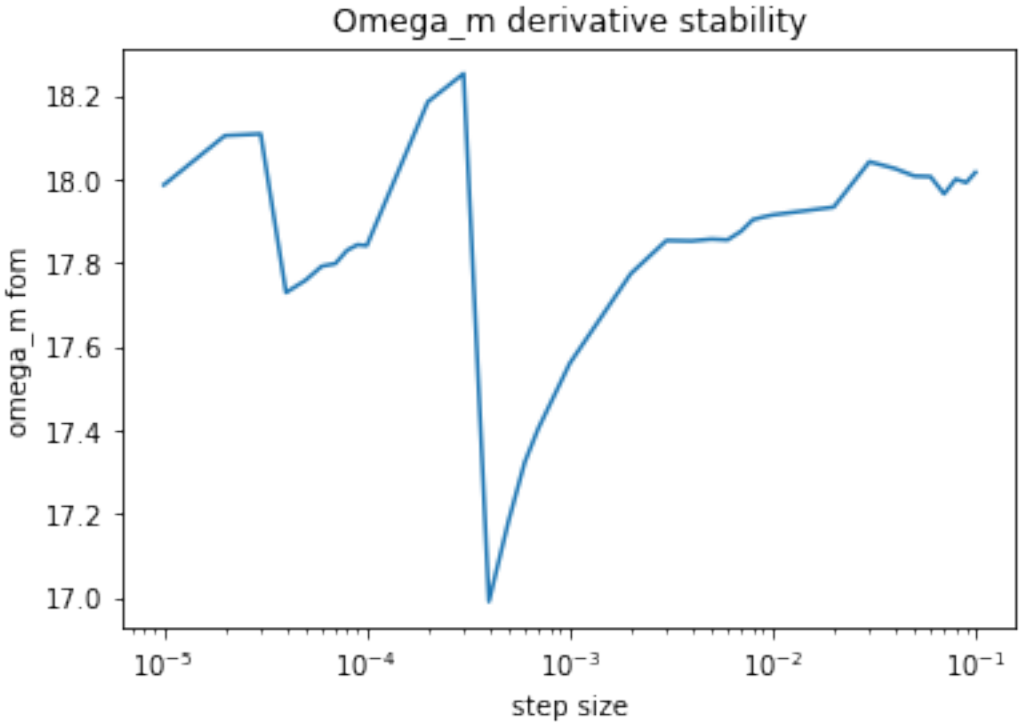
[9]:
```
print(a_fom)
```

```
[3.47504387e-11 1.73752194e-11 1.15834796e-11 8.68760968e-12
 6.95008775e-12 5.79173979e-12 4.96434839e-12 4.34380484e-12
 3.86115986e-12 3.47504387e-12 3.47504387e-12 1.73752194e-12
 1.15834796e-12 8.68760968e-13 6.95008775e-13 5.79173979e-13
 4.96434839e-13 4.34380484e-13 3.86115986e-13 3.47504387e-13
 3.47504387e-13 1.73752194e-13 1.15834796e-13 8.68760968e-14
 6.95008775e-14 5.79173979e-14 4.96434839e-14 4.34380484e-14
 3.86115986e-14 3.47504387e-14 3.47504387e-14 1.73752194e-14
 1.15834796e-14 8.68760968e-15 6.95008775e-15 5.79173979e-15
 4.96434839e-15 4.34380484e-15 3.86115986e-15 3.47504387e-15
 3.47504387e-15]
```

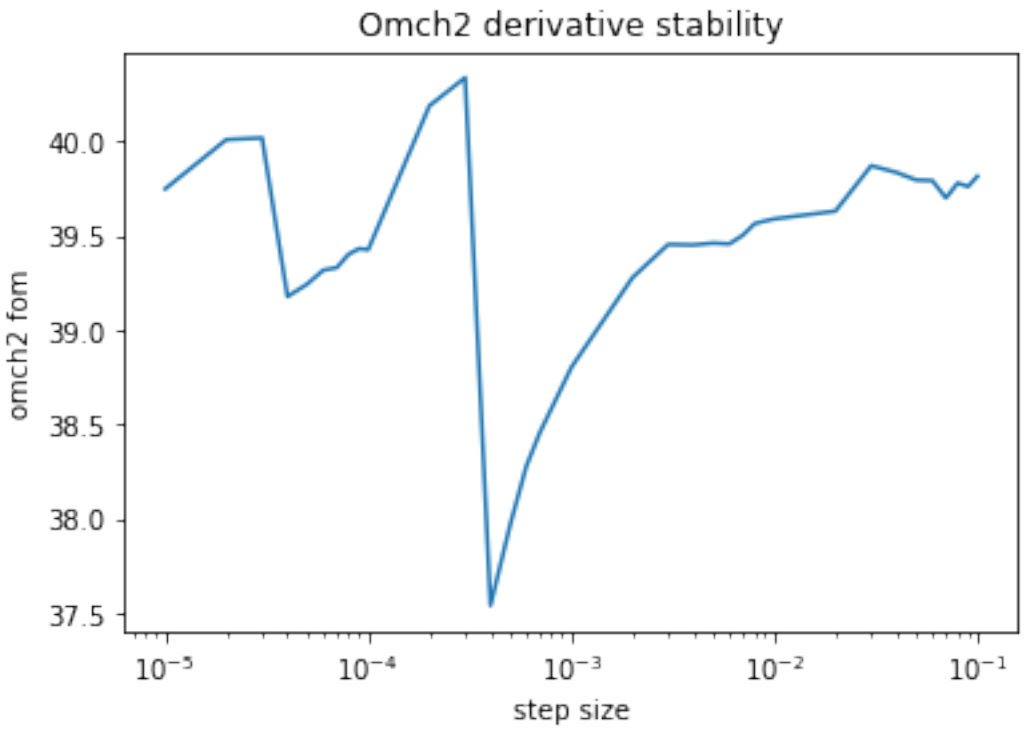
[10]:
```
plt.plot(sigma_8_step_sizes, sigma_8_fom)
plt.xscale('log')
plt.xlabel('step size')
plt.ylabel('sigma 8 fom')
plt.title('Sigma 8 derivative stability')
plt.show()
```



[11]:
```
plt.plot(omega_m_step_sizes, omega_m_fom)
plt.xscale('log')
plt.xlabel('step size')
plt.ylabel('omega_m fom')
plt.title('Omega_m derivative stability')
plt.show()
```



[12]:
```
plt.plot(omch2_step_sizes, omch2_fom)
plt.xscale('log')
plt.xlabel('step size')
plt.ylabel('omch2 fom')
plt.title('Omch2 derivative stability')
plt.show()
```



Trial run 30 is the 0.01 stepsize run, so going to plot the actual derivative values that run. Should expect to see smooth IA/sigma_8, but non smooth omega_m

[85]:
```
theta_dict = km.get_theta(mock_run = 30, vals_to_read =␣
 ↪['shear_xi_plus_binned', 'shear_xi_minus_binned'])
omega_m_deriv_dict = km.get_values(mock_run = 30, vals_to_read =␣
 ↪['shear_xi_plus_binned_omega_m_deriv',␣
 ↪'shear_xi_minus_binned_omega_m_deriv'])
sigma_deriv_dict = km.get_values(mock_run = 30, vals_to_read =␣
 ↪['shear_xi_plus_binned_sigma_8_deriv',␣
 ↪'shear_xi_minus_binned_sigma_8_deriv'])
a_deriv_dict = km.get_values(mock_run = 30, vals_to_read =␣
 ↪['shear_xi_plus_binned_a_deriv', 'shear_xi_minus_binned_a_deriv'])

bin_ordering = ['bin_1_1',
                'bin_2_1', 'bin_2_2',
                'bin_3_1', 'bin_3_2', 'bin_3_3',
                'bin_4_1', 'bin_4_2', 'bin_4_3', 'bin_4_4',
                'bin_5_1', 'bin_5_2', 'bin_5_3', 'bin_5_4', 'bin_5_5']
```

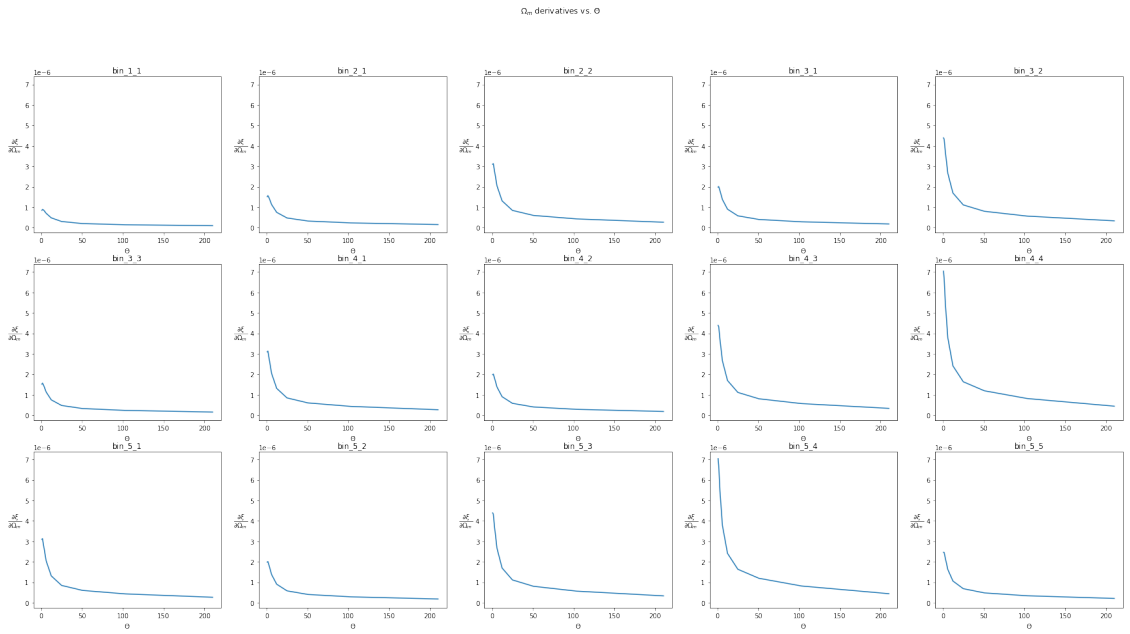
The theta values seem to jump drastically in size, maybe this is part of the problem?

[88]:
```
print(theta_dict['shear_xi_minus_binned'][0:9])
```

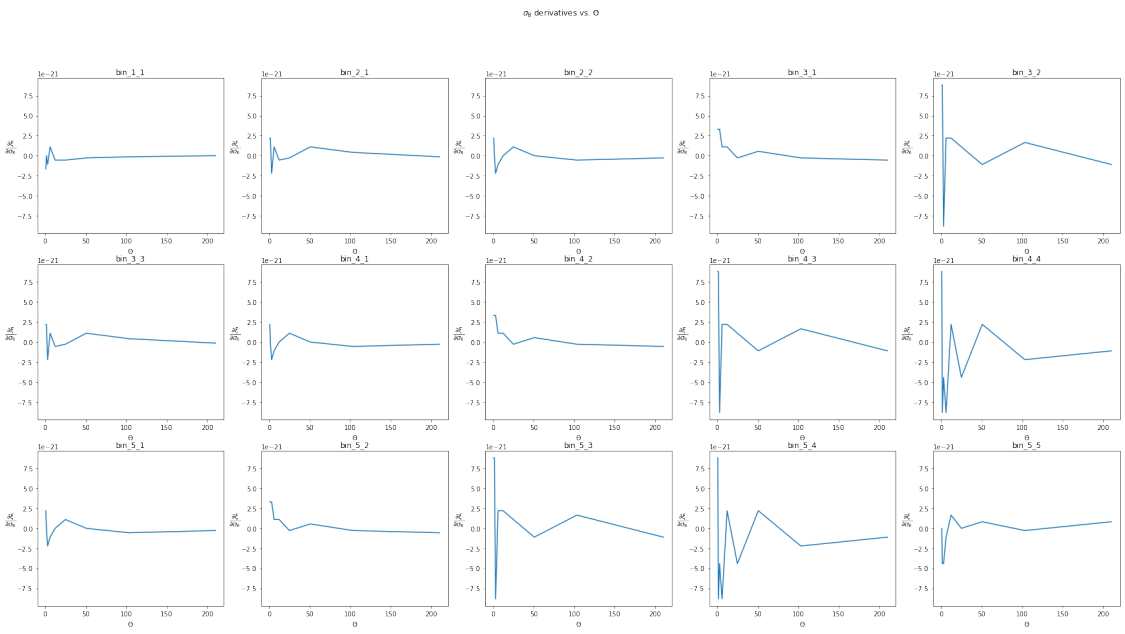
```
[  0.71336491   1.45209561   2.95582478   6.01675264  12.24744871
  24.93039168  50.74725716 103.29898312 210.27106705]
```

Time to plot the derivative values vs. theta for the various parameters...

[86]:
```
fig1, ax1 = plt.subplots(3, 5, sharey=True, sharex=True, figsize=(30,15))
fig1.suptitle("$\Omega_m$ derivatives vs. $\Theta$")
for i in range(3):
    ax1[i, 0].plot(theta_dict['shear_xi_minus_binned'][i*9:i*9+9],␣
 ↪omega_m_deriv_dict['shear_xi_minus_binned_omega_m_deriv'][i*9:i*9+9])
    ax1[i, 1].plot(theta_dict['shear_xi_minus_binned'][i*9+9:i*9+18],␣
 ↪omega_m_deriv_dict['shear_xi_minus_binned_omega_m_deriv'][i*9+9:i*9+18])
    ax1[i, 2].plot(theta_dict['shear_xi_minus_binned'][i*9+18:i*9+27],␣
 ↪omega_m_deriv_dict['shear_xi_minus_binned_omega_m_deriv'][i*9+18:i*9+27])
    ax1[i, 3].plot(theta_dict['shear_xi_minus_binned'][i*9+27:i*9+36],␣
 ↪omega_m_deriv_dict['shear_xi_minus_binned_omega_m_deriv'][i*9+27:i*9+36])
    ax1[i, 4].plot(theta_dict['shear_xi_minus_binned'][i*9+36:i*9+45],␣
 ↪omega_m_deriv_dict['shear_xi_minus_binned_omega_m_deriv'][i*9+36:i*9+45])

for i, ax in enumerate(ax1.flatten()):
    ax.xaxis.set_tick_params(labelbottom=True)
    ax.yaxis.set_tick_params(labelleft=True)
    ax.set_title(bin_ordering[i])
    ax.set_xlabel('$\Theta$')
    ax.set_ylabel(r'$\dfrac{\partial \xi}{\partial \Omega_m}$', rotation = 0,␣
 ↪labelpad = 15)
```

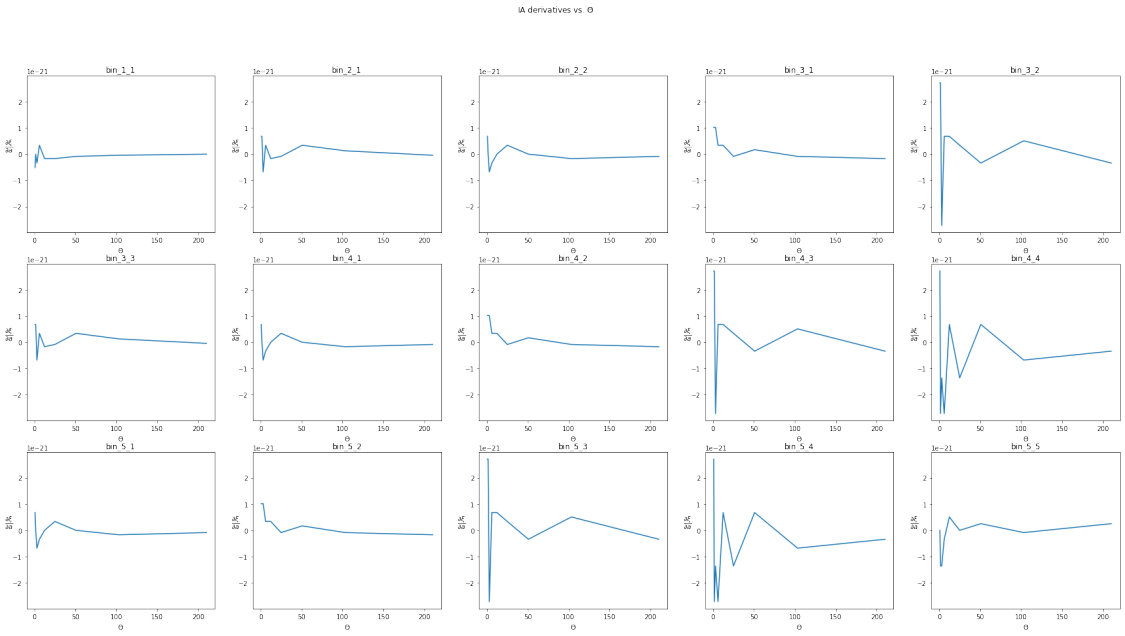


[89]:
```
fig2, ax2 = plt.subplots(3, 5, sharex='all', sharey='all', figsize=(30,15))
fig2.suptitle("$\sigma_8$ derivatives vs. $\Theta$")
for i in range(3):
    ax2[i, 0].plot(theta_dict['shear_xi_minus_binned'][i*9:i*9+9],␣
 ↪sigma_deriv_dict['shear_xi_minus_binned_sigma_8_deriv'][i*9:i*9+9])
    ax2[i, 1].plot(theta_dict['shear_xi_minus_binned'][i*9+9:i*9+18],␣
 ↪sigma_deriv_dict['shear_xi_minus_binned_sigma_8_deriv'][i*9+9:i*9+18])
    ax2[i, 2].plot(theta_dict['shear_xi_minus_binned'][i*9+18:i*9+27],␣
 ↪sigma_deriv_dict['shear_xi_minus_binned_sigma_8_deriv'][i*9+18:i*9+27])
    ax2[i, 3].plot(theta_dict['shear_xi_minus_binned'][i*9+27:i*9+36],␣
 ↪sigma_deriv_dict['shear_xi_minus_binned_sigma_8_deriv'][i*9+27:i*9+36])
    ax2[i, 4].plot(theta_dict['shear_xi_minus_binned'][i*9+36:i*9+45],␣
 ↪sigma_deriv_dict['shear_xi_minus_binned_sigma_8_deriv'][i*9+36:i*9+45])

for i, ax in enumerate(ax2.flatten()):
    ax.xaxis.set_tick_params(labelbottom=True)
    ax.yaxis.set_tick_params(labelleft=True)
    ax.set_title(bin_ordering[i])
    ax.set_xlabel('$\Theta$')
    ax.set_ylabel(r'$\dfrac{\partial \xi}{\partial \sigma_8}$', rotation = 0,␣
 ↪labelpad = 10)
```



[90]:
```
fig3, ax3 = plt.subplots(3, 5, sharex='all', sharey='all', figsize=(30,15))
fig3.suptitle("IA derivatives vs. $\Theta$")
for i in range(3):
```

```
    ax3[i, 0].plot(theta_dict['shear_xi_minus_binned'][i*9:i*9+9],␣
↪a_deriv_dict['shear_xi_minus_binned_a_deriv'][i*9:i*9+9])
    ax3[i, 1].plot(theta_dict['shear_xi_minus_binned'][i*9+9:i*9+18],␣
↪a_deriv_dict['shear_xi_minus_binned_a_deriv'][i*9+9:i*9+18])
    ax3[i, 2].plot(theta_dict['shear_xi_minus_binned'][i*9+18:i*9+27],␣
↪a_deriv_dict['shear_xi_minus_binned_a_deriv'][i*9+18:i*9+27])
    ax3[i, 3].plot(theta_dict['shear_xi_minus_binned'][i*9+27:i*9+36],␣
↪a_deriv_dict['shear_xi_minus_binned_a_deriv'][i*9+27:i*9+36])
    ax3[i, 4].plot(theta_dict['shear_xi_minus_binned'][i*9+36:i*9+45],␣
↪a_deriv_dict['shear_xi_minus_binned_a_deriv'][i*9+36:i*9+45])

for i, ax in enumerate(ax3.flatten()):
    ax.xaxis.set_tick_params(labelbottom=True)
    ax.yaxis.set_tick_params(labelleft=True)
    ax.set_title(bin_ordering[i])
    ax.set_xlabel('$\Theta$')
    ax.set_ylabel(r'$\dfrac{\partial \xi}{\partial a}$', rotation = 0, labelpad␣
↪= 5)
```



Going to manually do a 5 pt stencil on a particular run to see if I get the right numerical value... Checks out

stepsize = 0.001188

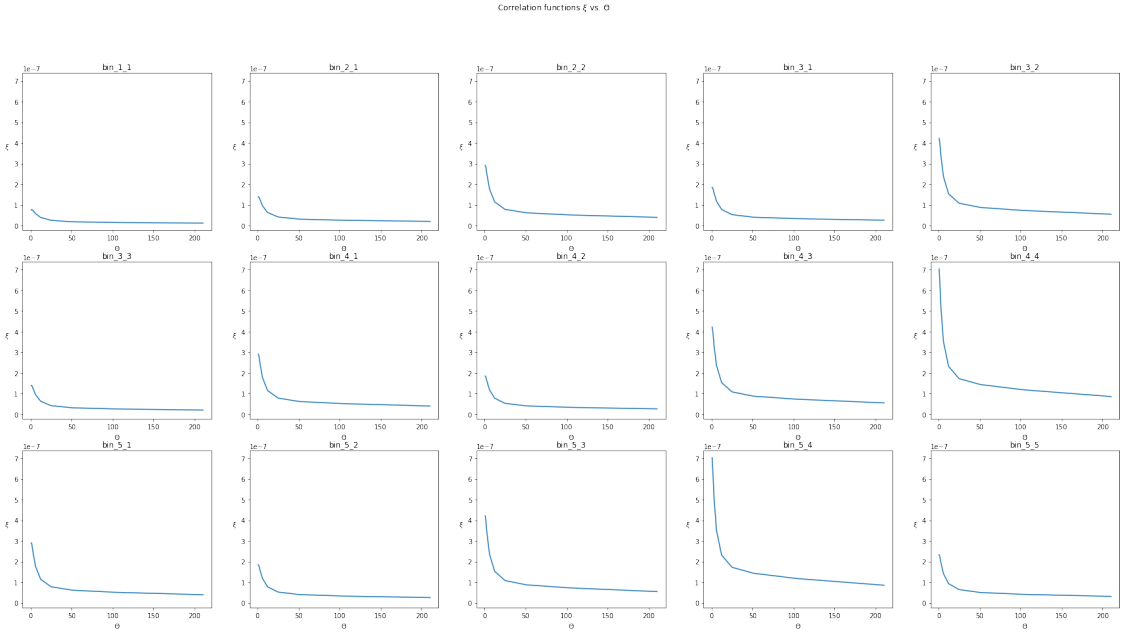
-2dx = 1.102062485331285860e-07 -1dx = 1.124031138053878084e-07 +1dx = 1.168742971628652289e-07 +2dx = 1.191538072909414418e-07

deriv = 1.881446976852305560e-06

2 Let's try out looking at what the actual correlation function looks like

[91]:
```
shear_xi_dict = km.get_values(mock_run = 30, vals_to_read =␣
↪['shear_xi_plus_binned', 'shear_xi_minus_binned'])
```

[95]:
```
fig4, ax4 = plt.subplots(3, 5, sharex='all', sharey='all', figsize=(30,15))
fig4.suptitle("Correlation functions $\\xi$ vs. $\Theta$")
for i in range(3):
    ax4[i, 0].plot(theta_dict['shear_xi_minus_binned'][i*9:i*9+9],␣
↪shear_xi_dict['shear_xi_minus_binned'][i*9:i*9+9])
    ax4[i, 1].plot(theta_dict['shear_xi_minus_binned'][i*9+9:i*9+18],␣
↪shear_xi_dict['shear_xi_minus_binned'][i*9+9:i*9+18])
    ax4[i, 2].plot(theta_dict['shear_xi_minus_binned'][i*9+18:i*9+27],␣
↪shear_xi_dict['shear_xi_minus_binned'][i*9+18:i*9+27])
    ax4[i, 3].plot(theta_dict['shear_xi_minus_binned'][i*9+27:i*9+36],␣
↪shear_xi_dict['shear_xi_minus_binned'][i*9+27:i*9+36])
    ax4[i, 4].plot(theta_dict['shear_xi_minus_binned'][i*9+36:i*9+45],␣
↪shear_xi_dict['shear_xi_minus_binned'][i*9+36:i*9+45])

for i, ax in enumerate(ax4.flatten()):
    ax.xaxis.set_tick_params(labelbottom=True)
    ax.yaxis.set_tick_params(labelleft=True)
    ax.set_title(bin_ordering[i])
    ax.set_xlabel('$\Theta$')
    ax.set_ylabel(r'$\xi$', rotation = 0, labelpad = 10)
```



[ ]: