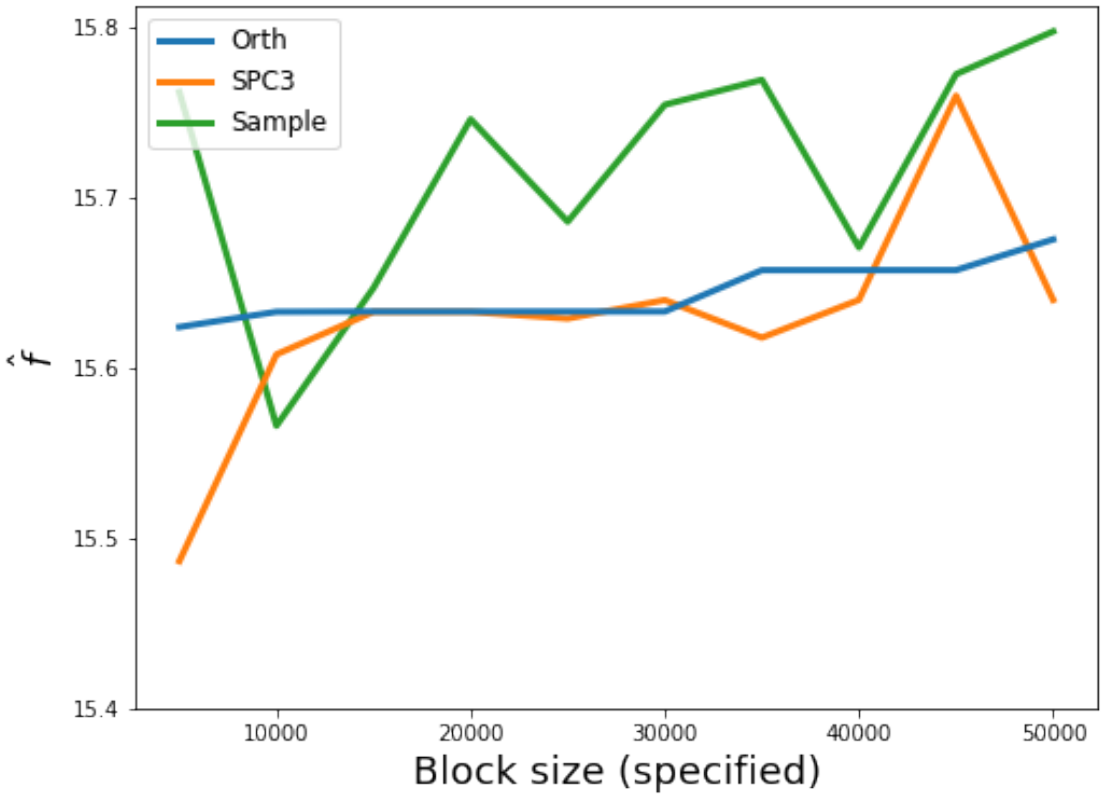
Plots for household experiments

January 31, 2018

Python code to generate the plots from the matlab experiments.

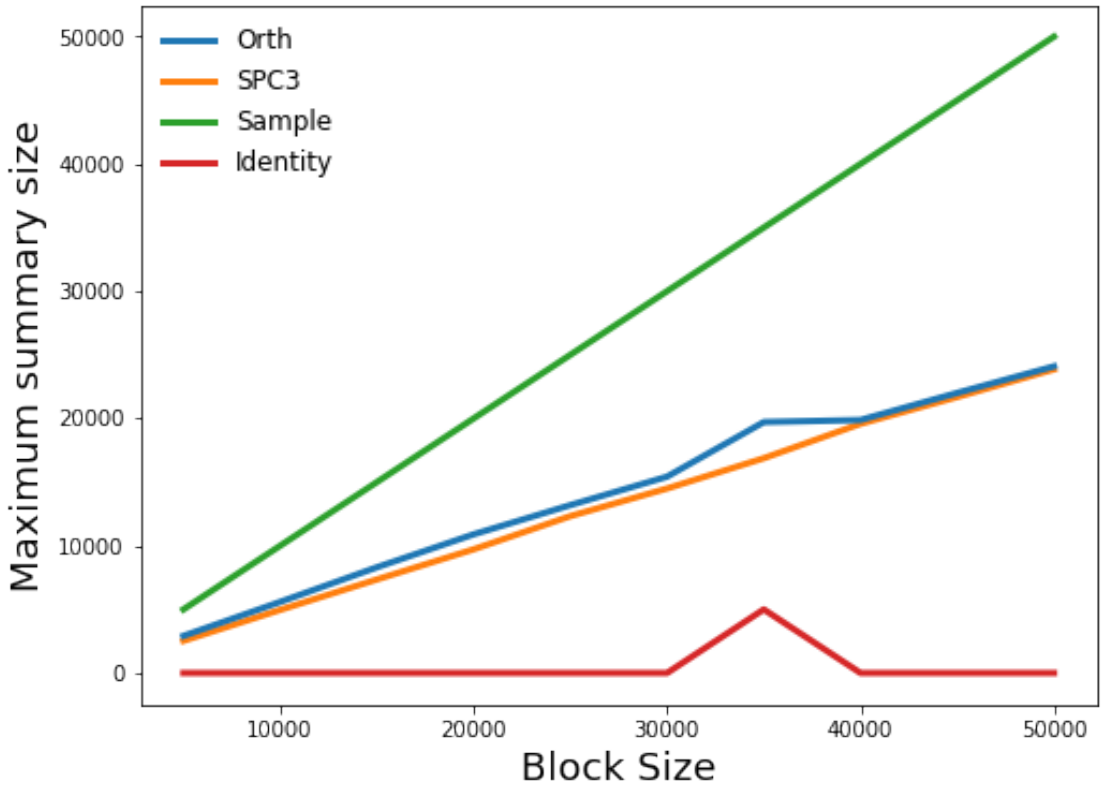
```
In [1]: import scipy.io as spio
        import matplotlib.pyplot as plt
        import matplotlib
        %matplotlib inline

In [2]: pwd

Out[2]: '/Users/cdickens/Desktop/high-leverage-rows/figures'

In [3]: mat_identity = spio.loadmat('../scripts/household/regression/household_identity.mat', s
        mat_orth = spio.loadmat('../scripts/household/regression/household_orth.mat', squeeze_
        mat_spc3 = spio.loadmat('../scripts/household/regression/household_condition_spc3.mat'
        mat_uniform = spio.loadmat('../scripts/household/regression/household_uniform_sampling

In [4]: mat_identity

Out[4]: {'__globals__': [],
         '__header__': b'MATLAB 5.0 MAT-file, Platform: MACI64, Created on: Wed Jan 31 12:33:21
         '__version__': '1.0',
         'approx_regression_time': array([  1.57314200e-03,   1.25236000e-04,   6.21940000e-05
                 8.82510000e-05,   5.15820000e-05,   4.32320000e-05,
                 1.55382631e-01,   4.96120000e-05,   4.52120000e-05,
                 5.20690000e-05]),
         'block_sizes': array([ 5000, 10000, 15000, 20000, 25000, 30000, 35000, 40000, 45000, 5
         'error': array([  0.        ,   0.        ,   0.        ,   0.        ,
                 0.        ,   0.        ,  15.07865678,   0.        ,
                 0.        ,   0.        ]),
         'number_of_samples': 2000000,
         'storage': array([   0,    0,    0,    0,    0,    0, 5000,    0,    0,    0], dtype=u
         'threshold': 0.00012,
         'total_time': array([  1.59308600e-03,   1.27586000e-04,   6.45170000e-05,
                 9.08660000e-05,   5.40700000e-05,   4.53430000e-05,
                 1.55385732e-01,   5.18650000e-05,   4.76790000e-05,
                 5.44990000e-05])}
```

```
In [5]: import numpy as np
        mins = [np.min(mat_orth['error']), np.min(mat_spc3['error']),
                    np.min(mat_uniform['error'])]

        min_val = np.min(mins)
        max_val = np.max([np.max(mat_orth['error']), np.max(mat_spc3['error']),
                    np.max(mat_uniform['error'])] )
        np.arange(min_val, max_val, 0.1)

Out[5]: array([ 15.48638173,  15.58638173,  15.68638173,  15.78638173])

In [6]: fig, ax = plt.subplots(figsize=(8,6))


        ax.plot( mat_orth['block_sizes'], mat_orth['error'], label = 'Orth', linewidth=3.0, zor
        ax.plot( mat_spc3['block_sizes'], mat_spc3['error'], label = 'SPC3', linewidth=3.0, zor
        ax.plot( mat_uniform['block_sizes'], mat_uniform['error'], label = 'Sample',linewidth=3
        #ax.plot( mat_identity['block_sizes'], mat_identity['error'], label = 'Identity', linew


        #ax.set_yscale('log')
        #ax.set_xscale('log')
        ax.set_ylabel('$\hat{f}$', fontsize=18)
        ax.set_xlabel('Block size (specified)', fontsize=18)
        #ax.set_title("Error vs Block Size", fontsize=18)
        ax.legend(loc=2, fancybox=True, fontsize=12)
        ax.set_yticks(np.arange(15.4, 15.8, 0.1))


        fig.savefig('household_error_vs_block_size.pdf', dpi=1000, facecolor='w', edgecolor='w
                orientation='portrait', papertype=None,
                transparent=False, bbox_inches=None, pad_inches=0.1,
                frameon=True)
```

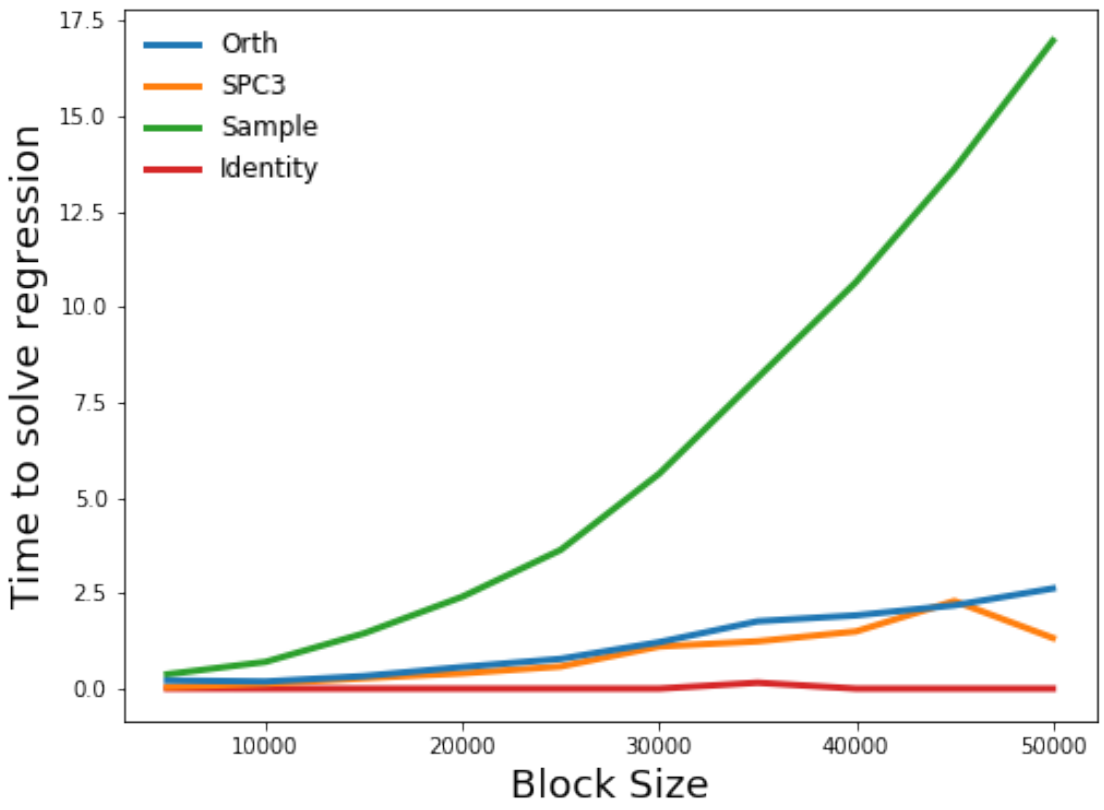


Identity method removed as consistently outputting empty blocks and hence $\hat{f} = 0$. The value $\hat{f}$ is the approximation of the LP from the summary.

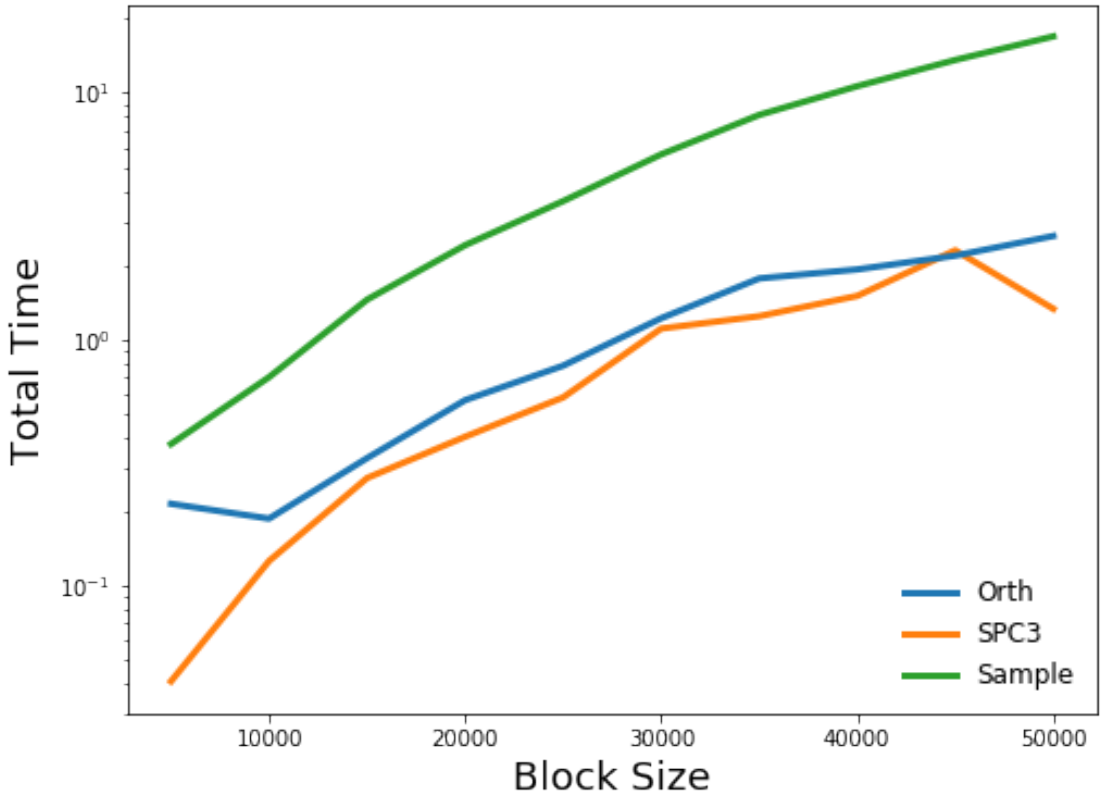
```
In [7]: fig, ax = plt.subplots(figsize=(8,6))


        ax.plot( mat_orth['block_sizes'], mat_orth['storage'], label = 'Orth', linewidth=3.0, z
        ax.plot( mat_spc3['block_sizes'], mat_spc3['storage'], label = 'SPC3', linewidth=3.0, z
        ax.plot( mat_uniform['block_sizes'], mat_uniform['block_sizes'], label = 'Sample',linew
        ax.plot( mat_identity['block_sizes'],mat_identity['storage'],label = 'Identity', linewi
        #ax.set_yscale('log')
        #ax.set_xscale('log')
        ax.set_ylabel('Maximum summary size', fontsize=18)
        ax.set_xlabel('Block Size', fontsize=18)
        #ax.set_title("Max rows stored (in stream) vs Block Size")
        ax.legend(loc=0, frameon=False, fontsize=12)

        fig.savefig('household_space_vs_block_size.pdf', dpi=1000, facecolor='w', edgecolor='w
                orientation='portrait', papertype=None,
                transparent=False, bbox_inches=None, pad_inches=0.1,
                frameon=True)
```




```
In [8]: fig, ax = plt.subplots(figsize=(8,6))

        ax.plot( mat_orth['block_sizes'], mat_orth['approx_regression_time'], label = 'Orth',
        ax.plot( mat_spc3['block_sizes'], mat_spc3['approx_regression_time'], label = 'SPC3',
        ax.plot( mat_uniform['block_sizes'], mat_uniform['approx_regression_time'], label = 'Sa
        ax.plot( mat_identity['block_sizes'],mat_identity['approx_regression_time'],label = 'Id
        #ax.set_yscale('log')
        #ax.set_xscale('log')
        ax.set_ylabel('Time to solve regression', fontsize=18)
        ax.set_xlabel('Block Size', fontsize=18)
        #ax.set_title("Time to solve regression vs Block Size")
        ax.legend(loc=0, frameon=False, fontsize=12)

        fig.savefig('household_regression_time_vs_block_size.pdf', dpi=1000, facecolor='w', edg
                orientation='portrait', papertype=None,
                transparent=False, bbox_inches=None, pad_inches=0.1,
                frameon=True)
```

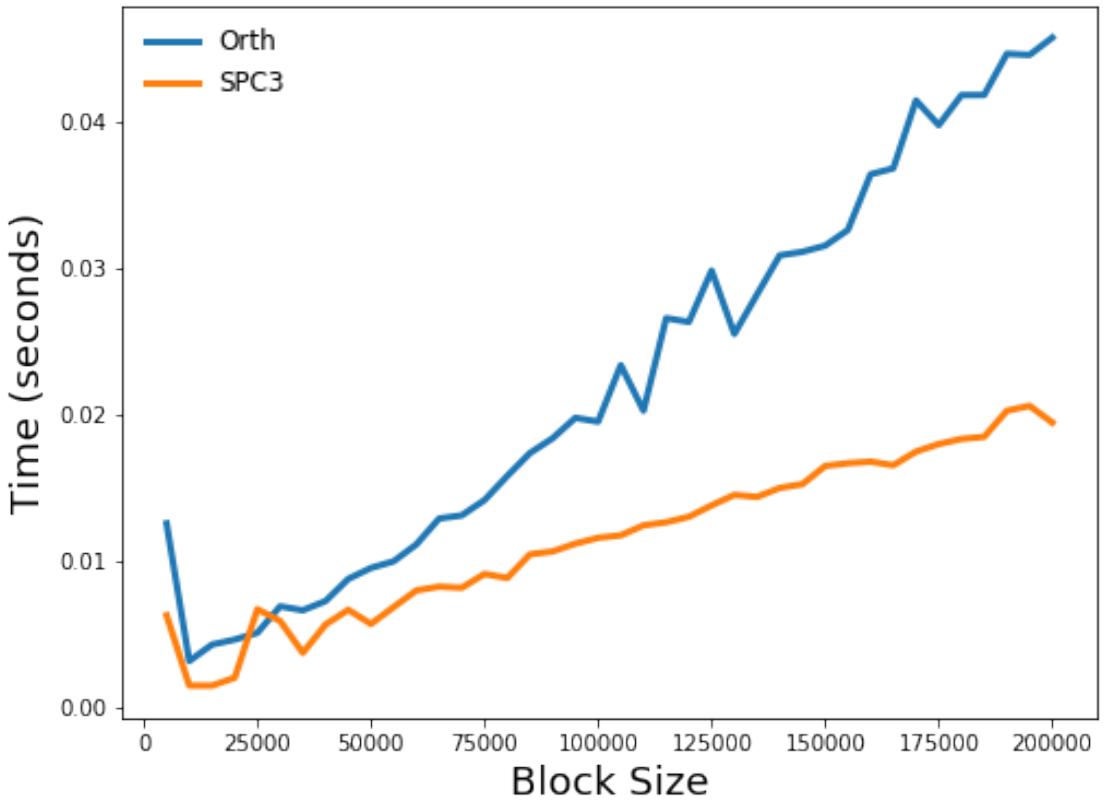


In [9]:
```
fig, ax = plt.subplots(figsize=(8,6))


ax.plot( mat_orth['block_sizes'], mat_orth['total_time'], label = 'Orth', linewidth=3.0
ax.plot( mat_spc3['block_sizes'], mat_spc3['total_time'], label = 'SPC3', linewidth=3.0
ax.plot( mat_uniform['block_sizes'], mat_uniform['approx_regression_time'], label = 'Sa
#ax.plot( mat_identity['block_sizes'], mat_identity['total_time'], label = 'Identity',
#ax.plot(mat_spc3['block_sizes'], mat_spc3['full_regression_time'], color='black', lab
ax.set_yscale('log')
#ax.set_xscale('log')
ax.set_ylabel('Total Time', fontsize=18)
ax.set_xlabel('Block Size', fontsize=18)
#ax.set_title("Total Time  vs Block Size")
ax.legend(loc=4, frameon=False, fontsize=12)

fig.savefig('household_total_time_vs_block_size.pdf', dpi=1000, facecolor='w', edgecolo
        orientation='portrait', papertype=None,
        transparent=False, bbox_inches=None, pad_inches=0.1,
        frameon=True)
```



0.0.1 Basis times

```
In [10]: basis_orth = spio.loadmat('../scripts/household/basis_times/household_condition_spc3_
         basis_spc3 = spio.loadmat('../scripts/household/basis_times/household_orth_basis_times

In [11]: fig, ax = plt.subplots(figsize=(8,6))

         ax.plot( basis_orth['block_sizes'], basis_orth['time_for_basis'], label = 'Orth' , li
         ax.plot( basis_spc3['block_sizes'], basis_spc3['time_for_basis'], label = 'SPC3', lin
         #ax.set_yscale('log')
         #ax.set_xscale('log')
         ax.set_ylabel('Time (seconds)', fontsize=18)
         ax.set_xlabel('Block Size', fontsize=18)
         #ax.set_title("Time to compute basis  vs Block size", fontsize=18)
         ax.legend(loc=0, frameon=False, fontsize=12)


         fig.savefig('household_basis_time_vs_block_size.pdf', dpi=1000, facecolor='w', edgecol
                 orientation='portrait', papertype=None,
                 transparent=False, bbox_inches=None, pad_inches=0.1,
                 frameon=True)
```


Orth
SPC3
Time (seconds)
0.00
0.01
0.02
0.03
0.04
0
25000
50000
75000
100000
125000
150000
175000
200000
Block Size