# Problem Set 4: Due Sunday, September 27

## Problem 1

In this problem, we will estimate a many ($\gg$3) commodity version of the model presented in Herrendorf, Rogerson, and Valentinyi (2013).

Modify the preferences of the representative consumer to have the following utility function:

$$
\begin{aligned}
u\left(c_{at},\, c_{mt}, c_{st}\right) &= \left[\sum_{i\in\{a,m,s\}} \omega_i^{\frac{1}{\sigma}} \left(c_{it}+\bar{c}_i\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}, \text{ where} \\
c_{at} &= \left[\sum_{j\in I_a} \left(\omega_j^a\right)^{\frac{1}{\sigma_a}} \left(c_{jt}+\bar{c}_j\right)^{\frac{\sigma_a-1}{\sigma_a}}\right]^{\frac{\sigma_a}{\sigma_a-1}}, \\
c_{mt} &= \left[\sum_{j\in I_m} \left(\omega_j^m\right)^{\frac{1}{\sigma_m}} \left(c_{jt}+\bar{c}_j\right)^{\frac{\sigma_m-1}{\sigma_m}}\right]^{\frac{\sigma_m}{\sigma_m-1}}, \text{ and} \\
c_{st} &= \left[\sum_{j\in I_s} \left(\omega_j^s\right)^{\frac{1}{\sigma_s}} \left(c_{jt}+\bar{c}_j\right)^{\frac{\sigma_s-1}{\sigma_s}}\right]^{\frac{\sigma_s}{\sigma_s-1}}
\end{aligned}
$$

These equations define a set of nested preferences. The top nest is exactly as in Herrendorf, Rogerson, and Valentinyi (2013). Within each bottom nest, different goods are combined to form a bundle that is, in turn, an input to the top nest. Take, for example, the nest of manufactured products. $I_m$ is the set of manufactured goods; $\sigma_m$ parameterizes how easily different manufactured goods can be substituted for one another; and $\omega_j^m$ gives the importance of good $j$ within the manufactured good bundle (where $\sum_{j\in I_m} \omega_j^m = 1$).

1. Download data from the NIPA tables (see Appendix A of the paper for the data sources). Define $I_a$, $I_m$, and $I_s$ as follows:

   - $I_a$: Food and beverages purchased for off-premises consumption.
   - $I_m$:
     - Motor vehicles and parts
     - Furnishings and durable household equipment
     - Recreational goods and vehicles
     - Other durable goods

- Clothing and footwear
- Gasoline and other energy goods
- Other nondurable goods

- $I_s$:
  - Housing and utilities
  - Health care
  - Transportation services
  - Recreation services
  - Food services and accommodations
  - Financial services and insurance
  - Other services
  - Final consumption expenditures of nonprofit institutions serving households
  - Government consumption expenditure

(a) Plot the quantity and price indices (from 1947 to the most recent period) for each of the industries in the services industry. Which service industry has had the largest price increase?

(b) Has consumption increased broadly across service industries, or is there substantial within-sector heterogeneity?

2. Write out the analogue of Equation (4) for industries within the "bottom nests." In other words, write out the expression for each service industry's expenditure as a share of overall expenditures within the service sector. And do the same for each manufacturing industry.

3. Estimate the equations that you have written in part 1 of this problem. (Hint: One of the authors, Akos Valentinyi, has posted the code related to this paper. See https://sites.google.com/site/valentinyiakos/Home/papers/st-preferences .) You will basically be running three sets of seemingly unrelated regressions: one for the top nest, one for industries within the service sector, and a third for industries within the manufacturing sector.

   (a) Display your coefficient estimates. Within the service sector, which industries have the largest and smallest values of $\bar{c}_j$?

## Problem 2

On Monday, we'll discuss Young (2015). The subsequent questions consider the draft of the paper given at

http://personal.lse.ac.uk/YoungA/StructuralTransformation.pdf

1. What is the contribution of this paper? What gap in the literature does this paper fill?

2. An assumption, part of Equation 8, states that $W_G = w_G \bar{z}_G \propto w_S \bar{z}_S = W_S$.

   (a) What role, if any, does this assumption play in deriving Equation (15)?

   (b) What role, if any, does this assumption imply for deriving Equation (11)? What would Equation (11) look if we had instead assumed that $w_G \propto w_S$?

3. Discuss the idea of using changes in federal spending as an instrument for industry labor demand. If federal spending shocks differentially cause increases in industries' total factor productivities, how would that affect our interpretation of $\hat{\xi}$? Is it reasonable for this to be an important concern? Why or why not?