

# Problem Set 3: Due Monday, October 20.

## 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:

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

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. Write out the analogue of Equation (4) of the paper using this nested structure.
2. 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

Plot the quantity and price indices (from 1947 to the most recent period) for each of the industries in the services industry. Has consumption increased broadly across service industries, or is there substantial within-sector heterogeneity?

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> .) It may be necessary to restrict  $\bar{c}_j = 0$  for one of the manufacturing industries and one of the service industries. If this is the case, feel free to employ this restriction.
  - (a) Display your coefficient estimates.
  - (b) Can you reject the null hypothesis of  $\bar{c}_j = 0$  for all industries within the manufacturing sector? Within the service sector?
  - (c) Can you reject the null hypothesis that  $\sigma_m = \sigma_s = \sigma$ ?
  - (d) Plot the analogue of Figure 7 for each of the industries within the service sector. For which industries were income effects the most important?

## Problem 2

I will send you one of your classmate's two-page descriptions (related to the final paper project).

In two to three pages, evaluate your classmate's proposal. Within your evaluation, answer the following questions: Has your classmate...

- ... clearly posed the question that he/she will try to answer?
- ... explained why the question is of broader interest to macroeconomists? If not, try to provide some motivation for your classmate's proposed project.
- ... linked the question to the existing literature? If not, discuss the relevant literature.
- ... outlined how he/she will answer the posed question? Does the strategy that he/she has outlined seem feasible? Is the empirical methodology that your classmate has outlined appropriate to answer the question at hand?