# General Demand and Utility Function Properties

1. **U = f(q1, q2, …, qn)**

Income Constraint

1. **Y – all i pi qi = 0**

Utility maximization subject to the budget constraint implies

1. **all i i ij = -j**

i = piqi/y, and

ij = lnqi/lnpi

1. **all i i ij = 0**

ij = lnqi/lnpj utility constant < 0 if i=j

1. **ij = ij - j i**

i = lnqi/lny

1. **all i i i = 1**
2. **all j ij = 0**
3. **all j ij = -i**

## Ag demand model

We could use a utility approach for agricultural demand. We assume a 3-good model.

U = U(S,N,M)

M=materials (non-food)

S=Staples

N=Non-staples

We don’t necessarily need to know U, but rather we only need to know some U exists that has neoclassical properties, even if we cannot describe it in a simple closed-form expression.

We can develop our demand system by prescribing income and Hicks elasticity coefficients subject to neoclassical model constraints.

Key properties that food demands should have.

* Absolute food demand rises with income
  + **S S + N N < 0.5 (expenditure on food increases with income, prices constant and expenditure on food increases less rapidly with income than expenditures on other things, prices constant)**
  + **S S + N N < N N (expenditure on food increases less rapidly with income than expenditures on other things, prices constant)**
* At high income levels, food demand saturates
  + **Limit as Y🡪****S S + N N = 0**
* Share of staples in diet declines with income
  + **S S = 1 -N N -M M< N N**
* Staples are a Giffen good at low income levels.
  + **SS = SS - S S > 0**
  + **ii < 0 (for all i)**
  + **S < 0 (Giffen goods are all inferior goods)**
* Demand for Staples increases when the price of Non-Staples increases
  + **SN = SN - N S > 0**

# Demand functions for our model

Where, we have

* **ij = ij - j i**
* **i = PiQi/Y**
* **all i i i = 1**
* **all j ij = 0**
* **all j ij = -i**

## Setting Parameter Values

We have 7 degrees of freedom when the number of goods is 3.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Hicks Elasticities | S | N | M | Income Elasticity |
| S | **SS** | **SN** | Determined | **S** |
| N | **NS** | **NN** | Determined | **N** |
| M | Determined | Determined | **MM** | Determined |

We can probably make **ij** constants, but that needs to be tested.

To saturate food demands we need to make **** a function of Y.

Note that we need to solve for qi because the ai plays an important role, and thus, we need to find a q consistent with the other parameters.

Ln (Qs) = ln(As) + ****ss ln(Ps) + ****sn ln(Pn****

Ln (Qs) = ln(As) + (**ss - s s**)ln(Ps) + (**sn - s s**) ln(Pn****

Shares

* **s** = AsPs****ss-1)Pn****snY****s-1)
* **n** = AnPs****nsPn****nn-1)Y****n-1)
* **Ln(s)** = ****ss-1)**Ln(**Ps**) + **sn **Ln(**Pn**) + **s-1**Ln(**Y**) +** ln(As)
* **Ln(n)** = ****ns **Ln(**Ps**) + **nn-1** Ln(**Pn**) + **n-1**Ln(**Y**) +** ln(An)

**ij = ij - j i**

* **Ln(s)** = **ss - s s** -1**Ln(**Ps**) + sn - n s** **Ln(**Pn**) + **s-1**Ln(**Y**)+**ln(As)
* **Ln(n)** = **ns - s nLn(**Ps**) + nn - n n** -1** Ln(**Pn**) + **n-1**Ln(**Y**)+**ln(An)
* **Ln(s)+ssLn(**Ps**)**+**nsLn(**Pn**)** = **ss**-1**Ln(**Ps**)+snLn(**Pn**)+**s-1**Ln(**Y**) +**ln(As)
* **Ln(n)+snLn(**Ps**)**+**nnLn(**Pn**)** = **nsLn(**Ps**)+nn**-1** Ln(**Pn**)+**n-1**Ln(**Y**) +**ln(An)
* **Ln(s)+s(sLn(**Ps**)**+**nLn(**Pn**))** = **ss**-1**Ln(**Ps**)+snLn(**Pn**)+**s-1**Ln(**Y**) +**ln(As)
* **Ln(n)+n(sLn(**Ps**)**+**nLn(**Pn**))** = **nsLn(**Ps**)+nn**-1** Ln(**Pn**)+**n-1**Ln(**Y**) +**ln(An)

Question, is there a simple way to approximate this by, e.g. iterating?