

UMP

$$\max_{x \geq 0} u(x) \text{ s.t. } p \cdot x \leq w$$

EMP

$$\min_{x \geq 0} p \cdot x \text{ s.t. } u(x) \geq u$$

Solution Set

Walrasian Demand

$$x(p, w) = x^*$$

Hicksian Demand

$$h(p, u) = x^*$$

$$x(p, w) = h(p, v(p, w))$$

$$h(p, u) = x(p, e(p, u))$$

Roy's Identity

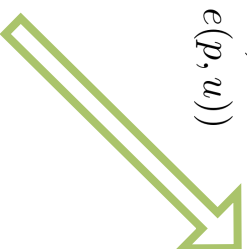
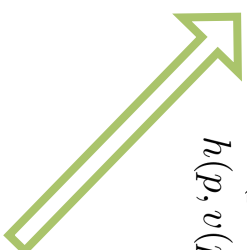
$$x_\ell(p, w) = \frac{-\partial v(p, w) / \partial p_\ell}{\partial v(p, w) / \partial w}$$

$$v(p, w) = u(x(p, w))$$

$$e(p, u) = p \cdot h(p, u)$$

Shephard's Lemma

$$h_\ell(p, u) = \frac{\partial e(p, u)}{\partial p_\ell}$$



Plug in $e(p, u)$ for w , set equal to u , solve for $e(p, u)$

Value Function

Indirect Utility

$$v(p, w) = u$$

Expenditure

$$e(p, u) = w$$

$$v(p, e(p, u)) = u$$

$$e(p, v(p, w)) = w$$



Plug in $v(p, w)$ for u , set equal to w , solve for $v(p, w)$