Excess Demand Function

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- Filename: xdemand.m
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- Created: 07/08/17
- Purpose: Function that returns the fleet-wide annual excess demand for species-specific quota.

Description

The function `xdemand` computes the fleet-wide annual excess demand for quota, defined as the sum of all annual catches minus the sum of all quota allocations.

Specifically, $e_{i,s}(\mathbf{w}) = q_{i,s}(\mathbf{w}) - \omega_{i,s}$ is individual i's excess-demand function for species s for a given quota-price vector $\mathbf{w}$, which is comprised of $q_{i,s}$ and $\omega_{i,s}$: i's annual catch and allocation, respectively. Annual catch is calculated as

$$q_{i,s} = \sum_{t \in T} C_{i,t}(a^*_{i,t}(\mathbf{w}))$$

where $C_{i,t}(a)$ is i's catch in period t for fishery a, and $a^*_{i,t}(\mathbf{w})$ is i's optimal fishery choice given quota price $\mathbf{w}$.

```
function [out1,out2] = xdemand(eta,I0,m)
```

Input arguments:

- `eta` = a $NS \times 1$ vector of collocation coefficients;
- `I0` = a $NS \times d$ matrix of collocation nodes;
- `m` = a structural array containing parameter values

Output arguments:

- `out1` = a $S \times 1$ vector of average excess demand values.
- `out2` = a vector of average end-of-season quota prices

Notes:

The vector η will be provided by a Matlab solver (e.g., `fsolve`).

Preliminaries

```
c = zeros(m.model.N,m.model.S);     % Catch
t0 = I0(end);       % Starting time period
out1 = zeros(1,m.model.S);          % Excess demand
out2 = zeros(1,m.model.S);          % End-of-season quota price
```

Calculate

```
    for k = 1:m.model.shocks
        % Initial vector of information
        I = I0;
        for t=t0:m.model.T
            % Forecast of quota prices $w$ given $I$
            w = qlease(eta,I,m);
            % Obtain annual catch for each individual
            for i=1:m.model.N
                % Find optimal fishery
                fstar = vmax(t,i,w,m);
                % Obtain catch associated with optimal fishery choice
                c(i,:) = func('g',fstar,t,i,k,[],m);
            end
            % Update next period's I:
            I = I + [(sum(c(:,:),1)),1];
        end
        out1 = I(:,1:end-1) + out1;
        out2 = qlease(eta,I,m) + out2;
    end
    % Average excess demand: catch minus allocation
    out1 = (out1/m.model.shocks) - m.state.TAC;
    % Average end-of-season quota prices
    out2 = out2/m.model.shocks;

end
```

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