Industry Equilibrium

TheoryGuru applications

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Load Economicreasoning package only if it is not already loaded

```
If[Length@Names["PLTools`*"] < 10,
 Get["http://economicreasoning.com"]]
```

Clear symbols that are about to be used

```
Remove[f, L, k, p, d, c, Y, w, r, x, SL, Sk]
```

Setup

Homogeneous cost function

```
c[w_, r_, Y_] := Y w ch[r / w];
```

Industry model

```
Pricing = p == c[w, r, 1] (* average cost = marginal cost *);
```

```
IndustryDemand = Y == d[p];
```

```
FactorDemands = {L == Y ∂c(w, r, 1)/∂w, k == Y ∂c(w, r, 1)/∂r};
```

```
Production = Y == f[L, k];
```

Definitions

```
DefineShares = {SL == w L / p Y, Sk == r k / p Y};
```

```
DefinePctPriceChanges = {Δp == dp/dx / p, Δw == dw/dx / w, Δr == dr/dx / r};
```

```
DefinePctQuantityChanges = {ΔY == ∂x Y / Y, ΔL == ∂x L / L, Δk == ∂x k / k};
(* x indicates the thing that is changing, e.g.,
time, or a comparison between two markets *)
DefineElasticities = {ϵd == p / d[p] d'[p], σ == (ΔL - Δk) / (Δr - Δw)};
iqpositive =
  {p > 0, Y > 0, L > 0, k > 0, w > 0, r > 0, 0 < SL < 1, f^(1,0)[L, k] > 0, f^(0,1)[L, k] > 0};
```

Results

Marginal cost equals average cost, holding factor prices constant

$$\frac{\partial c(w, r, Y)}{\partial Y} == \frac{c[w, r, Y]}{Y}$$

```
True
```

Output price change is the revenue-share-weighted input price change

```
TheoryGuru[{FactorDemands, ∂x Pricing,
  DefineShares, DefinePctPriceChanges},
 Δp == SL Δw + Sk Δr]
```

```
True
```

Scale effect of a wage change depends on labor's share and the price-elasticity of industry demand

```
TheoryGuru[{ Δr == 0, IndustryDemand, FactorDemands,
  ∂x Pricing, ∂x IndustryDemand,
  DefineShares, DefinePctPriceChanges,
  DefinePctQuantityChanges, First@DefineElasticities},
 ΔY == ϵd SL Δw]
```

```
True
```

Factor shares add to one

```
TheoryGuru[{Pricing, FactorDemands, DefineShares},
 SL == 1 - Sk]
```

```
True
```

```
TheoryGuru[{Δr == 0, Pricing, FactorDemands,
  dFactorDemands/dx, dProduction/dx,
  Last@DefineShares, DefinePctPriceChanges, DefinePctQuantityChanges},
 ΔY == ΔL + Sk (Δk - ΔL)]
```

```
True
```

Two of Marshall's Laws

```
TheoryGuru[{Δr == 0, Pricing, IndustryDemand, FactorDemands,
  dPricing/dx, dIndustryDemand/dx, dFactorDemands/dx, dProduction/dx,
  DefineShares, DefinePctPriceChanges,
  DefinePctQuantityChanges, DefineElasticities},
 ΔL == (ϵd SL - Sk σ) Δw]
```

```
True
```

LR and SR demand for the other factor *k*

LR: *k* adjusts

```
TheoryGuru[
 {ΔY == ϵd SL Δw, ΔY == ΔL + Sk (Δk - ΔL), ΔL == (ϵd SL - Sk σ) Δw, SL + Sk == 1, iqpositive},
 Δk == (ϵd + σ) SL Δw,
 keepall → True]
```

```
True
```

SR: *k* is fixed

```
TheoryGuru[{Δk == 0, SL + Sk == 1, IndustryDemand, FactorDemands,
  dPricing/dx, dIndustryDemand/dx, dFactorDemands/dx, dProduction/dx, DefineShares,
  DefinePctPriceChanges, DefinePctQuantityChanges, DefineElasticities},
 Δr (SL σ - ϵd Sk) == (ϵd + σ) SL Δw]
```

```
True
```

Variable interpretations