Appendix A: The GSL Regional Economy

Production

The GSL regional economy consists of four main production sectors: agriculture (a), mineral extraction (m), brine shrimp fishery (f), and recreation/wildlife-viewing (r). Following Gilbert and Tower (2012), each sector is endowed with constant elasticity of substitution (CES) production technology. Specifically,

$$
\begin{aligned}
Q_a(K_a, L_a, W_a) &= \gamma_a[\delta_{Ka}K_a^{\rho_a} + \delta_{La}L_a^{\rho_a} + \delta_{Wa}W_a^{\rho_a}]^{1/\rho_a} && \text{(A.1a)}\\
Q_m(K_m, L_m, W_m) &= \gamma_m[\delta_{Km}K_m^{\rho_m} + \delta_{Lm}L_m^{\rho_m} + \delta_{Wm}W_m^{\rho_m}]^{1/\rho_m} && \text{(A.1b)}\\
Q_f(K_f, L_f, N_2) &= \gamma_f[\delta_{Kf}K_f^{\rho_f} + \delta_{Lf}L_f^{\rho_f} + \delta_{2f}(cyst_2N_2)^{\rho_f}]^{1/\rho_f} && \text{(A.1c)}\\
Q_r(K_r, L_r, N_4) &= \gamma_r[\delta_{Kr}K_r^{\rho_r} + \delta_{Lr}L_r^{\rho_r} + \delta_{4r}N_4^{\rho_r}]^{1/\rho_r}, && \text{(A.1d)}
\end{aligned}
$$

where Q_i represents sector i's output level, $i \in a, m, f, r$, γ_i represents sector i's productivity scale factor, δ_{ji} input j's share factor in the production of sector i's output, $j \in K, L, W, 2, 4$, and ρ_i the degree of input substitutability in sector i (time subscript t is again dropped for expository convenience). Variables K and L are mobile factors of production – labor and capital, respectively – while W represents water input, which is mobile across the agriculture and mining sectors. The term $cyst_2N_2$ in the expression for Q_f accounts for the input role that the brine-shrimp population plays in the quantity of cysts ultimately harvested in any given period[1] Here, proportionality factor $cyst_2$ converts the adult brine-shrimp population to its corresponding cyst population, which, as explained below, is ultimately exported. Similarly, waterbird population, N_4, serves as an input in the production of recreation and wildlife-viewing, Q_r, but without the need for any attendant conversion factor per se.

Lastly, it is assumed that homogeneous and perfectly mobile inputs capital, labor, and water satisfy their respective finite full-employment conditions each period, expressed as,

$$\bar{K} = K_a + K_m + K_f + K_r, \tag{A.2a}$$

[1] As mentioned earlier, precedent for the inclusion of a commercial species' population level as an input in its associated production function can be found in Gordon (1954) and Smith (1969).

$$\bar{L} = L_a + L_m + L_f + L_r, \tag{A.2b}$$

$$\bar{W} = W_a + W_m, \tag{A.2c}$$

where $\bar{K}, \bar{L}$ and $\bar{W}$ represent period-specific, total available levels of capital, labor, and water, respectively.

The Household Sector

Following Gilbert and Tower (2012), we assume the regional economy's preferences (i.e., the household sector's aggregate preferences), are represented by a standard Cobb-Douglas utility function (U). Specifically,

$$U(C_a, C_m, C_r, C_c, G) = \alpha C_a^{\beta_a} C_m^{\beta_m} C_r^{\beta_r} C_c^{\beta_c} G^{\beta_G}, \tag{A.3}$$

where the set $\{C_a, C_m, C_r, C_c\}$ represents domestic consumption levels of the agricultural, mineral, recreation/wildlife viewing, and composite import goods, respectively. Parameter $\alpha > 0$ is the utility function's shift parameter and the β_i's represent the function's set of taste parameters, $i \in \{a, m, r, c, G\}$. Variable G represents the composite air and water pollution level resulting from mineral extraction, which is assumed proportional to the mining sector's production level Q_m, specifically $G = \phi Q_m$, $\phi > 0$.[2] While β parameters, β_a, β_m, β_r, and β_c, are each greater than zero, β_G is less than zero, reflecting the fact that pollution damages the environment and thus reduces social welfare. For simplicity we assume β_G is the (negative) average of the other (positive) taste parameters, i.e., $\beta_G = -(\beta_a + \beta_m + \beta_r + \beta_c)/4$.

Market-Clearing and Trade Balance Conditions

Following Issacson and Robson (2002), U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S Census Bureau (2001), and UNDR (2013), we model the agriculture and recreation sectors as producing solely for the domestic regional market. Brine shrimp cysts are produced solely for export and the mineral extraction industry produces partially for the domestic regional market and partially for export to the world market. Households import the composite good. As a result, the regional

[2] See Henetz (2005) and Farrell (2005) for evidence on the link between GSL mercury pollution and regional mining activities.

economy's per-period market-clearing and trade-balance equations may be expressed as,

$$Q_a = C_a, Q_r = C_r, \tag{A.4a}$$

$$Q_m = C_m + X_m, Q_f = X_f, C_c + X_c = 0, \tag{A.4b}$$

$$\hat{P}_m X_m + \hat{P}_f X_f + \hat{P}_c X_c = 0, \tag{A.4c}$$

where equations (A.4a) and (A.4b) represent the respective market-clearing conditions and equation (A.4c) the trade balance. Here, X_m, X_f, and X_c are net exports of the mining products, brine-shrimp cysts, and composite good, respectively. Their respective values are negative (imports) or positive (exports), whichever the case may be. Given our small open-economy assumption, output prices for the traded goods ($\hat{P}_m$, $\hat{P}_f$, and $\hat{P}_c$) are exogeneously determined in their respective world markets. As the corresponding trade balance equation (A.4c) shows, the total value of net exports sums to zero.

Formal Problem

We can now represent the regional economy's per-period optimization problem in the form of a Lagrangian function, where the objective is to maximize the household sector's welfare function (A.3) subject to full-employment conditions (A.2), production functions (A.1), and market-clearing and trade-balance conditions (A.4) period-by-period, i.e., myopically. Because the agricultural and recreation/wildlife-viewing goods are non-traded, market-clearing conditions associated with these two goods endogenously determine their associated output prices. World prices for minerals, brine shrimp, and the composite import good are determined exogenously and taken as given in the problem. The detailed optimization problem with corresponding first order conditions (FOCs) is presented in Table 6 in Appendix B. Here we present a compact form of the problem's per-period Lagrangian function,

$$\mathscr{L} = U(\mathbf{C}, G) + \Lambda[\mathbf{Q}, \mathbf{C}, \mathbf{X}] + \mathbf{M}[\bar{\mathbf{R}}, \mathbf{R_K}, \mathbf{R_L}, \mathbf{R_W}] + \phi[\mathbf{P} \cdot \mathbf{X}],$$

where consumption vector $\mathbf{C} = (C_a, C_m, C_r, C_c)$, $\Lambda = (\lambda_a, \lambda_m, \lambda_f, \lambda_r, \lambda_c)$ is the multiplier vector corresponding to the set of market-clearing and trade-balance conditions included in equation (8) (which also represent the equilibrium output prices under competitive market conditions), $\mathbf{Q} = (Q_a, Q_m, Q_f, Q_r)$, $\mathbf{X} = (X_m, X_f, X_c)$, and $\mathbf{M} = (\mu_K, \mu_L, \mu_W)$ is the multiplier vector corresponding to the full-employment conditions, with $\bar{\mathbf{R}} =$

$(\bar{\mathbf{K}}, \bar{\mathbf{L}}, \bar{\mathbf{W}})$, $\mathbf{R_K} = (K_a, K_m, K_f, K_r)$, $\mathbf{R_L} = (L_a, L_m, L_f, L_r)$, and $\mathbf{R_W} = (W_a, W_m)$. Further, $\mathbf{P} = (\hat{P_m}, \hat{P_f}, \hat{P_c})$, where ϕ is the shadow price of foreign exchange normalized to unity.

Appendix B: Tables

Table 1: Species Identification Numbers

Species Numbers	Species Names
0	Nutrient Pool
$s1$	Bacteria
$f1$	Algae
2	Brine Shrimp
3	Brine Flies (larvae and adult)
4	Waterbirds

Table 2: Biomass-Supply and Variable-Respiration Functions

Biomass-Supply	Variable-Respiration
$y_{12}(x_{s10}) = \delta_{12} x_{s10}^{\alpha_{12}}$	$f_{s1}(SA_{s1}; x_{s10}) = r_{s1}[SA_{s1}+1]x_{s10}^{\gamma_{s1}}$, where $SA_{s1} = s_{1a} + s_{1m}$
$y_{13}(x_{f10}) = \delta_{13} x_{f10}^{\alpha_{13}}$	$f_{f1}(SA_{f1}; x_{f10}) = r_{f1}[SA_{f1}+1]x_{f10}^{\gamma_{f1}}$, where $SA_{f1} = SA_{s1}$
$y_{24}(x_{21}) = \delta_{24} x_{21}^{\alpha_{24}}$	$f_2(SA_2; x_{21}) = r_2[SA_2+1]x_{21}^{\gamma_2}$, where $SA_2 = s_{2a} + s_{2m}$
$y_{34}(x_{31}) = \delta_{34} x_{31}^{\alpha_{34}}$	$f_3(SA_3; x_{31}) = r_3[SA_3+1]x_{31}^{\gamma_3}$, where $SA_3 = s_{3a} + s_{3m}$
	$f_4(x_{42}, x_{43}) = r_4(x_{42} + x_{43}) + 0.5 r_4(r_{43} x_{42} x_{43} + x_{42}^{\gamma_4} + r_{43} x_{43}^{\gamma_4})$

$$s_{1a} = \sigma_{1a}\left[\frac{W_a}{W_a + W_m}\right] \quad and \quad s_{1m} = \sigma_{1m}\left[\frac{W_m}{W_a + W_m}\right]$$
$$s_{2a} = \sigma_{2a}\left[\frac{W_a}{W_a + W_m}\right] \quad and \quad s_{2m} = \sigma_{2m}\left[\frac{W_m}{W_a + W_m}\right]$$
$$s_{3a} = \sigma_{3a}\left[\frac{W_a}{W_a + W_m}\right] \quad and \quad s_{3m} = \sigma_{3m}\left[\frac{W_m}{W_a + W_m}\right]$$

Table 3: Species' Net-Energy Functions and First-Order and Short-Run Equilibrium Conditions

Species	Net-Energy Function (Watts or Kilocalories)
Bacteria	$R_{s1} = [e_0 - e_{s10}]x_{s10} - e_{s1}[1+t_{12}e_{21}]y_{12}(x_{s10}) - f_{s1}(SA_{s1};x_{s10}) - \beta_{s1}$
Algae	$R_{f1} = [e_0 - e_{f10}]x_{f10} - e_{f1}[1+t_{13}e_{31}]y_{13}(x_{f10}) - f_{f1}(SA_{f1};x_{f10}) - \beta_{f1}$
Brine Shrimp	$R_2 = [e_{s1} - e_{21}]x_{21} - e_2[1+t_{24}e_{42}]y_{24}(x_{21}) - f_2(SA_2;x_{21}) - \beta_2$
Brine Flies	$R_3 = [e_{f1} - e_{31}]x_{31} - e_3[1+t_{34}e_{43}]y_{34}(x_{31}) - f_3(SA_3;x_{31}) - \beta_3$
Waterbirds	$R_4 = [e_2 - e_{42}]x_{42} + [e_3 - e_{43}]x_{43} - f_4(x_{42},x_{43}) - \beta_4$
Control Variables	**First Order Conditions**
x_{s10}	$e_0 = e_{s10} + e_{s1}[1+t_{12}e_{21}]y'_{12}(x_{s10}) + f'_{s1}(x_{s10};SA_{s1})$
x_{f10}	$e_0 = e_{f10} + e_{f1}[1+t_{13}e_{31}]y'_{13}(x_{f10}) + f'_{f1}(x_{f10};SA_{f1})$
x_{21}	$e_{s1} = e_{21} + e_2[1+t_{24}e_{42}]y'_{24}(x_{21}) + f'_2(x_{21};SA_2)$
x_{31}	$e_{f1} = e_{31} + e_3[1+t_{34}e_{43}]y'_{34}(x_{31}) + f'_3(x_{31};SA_3)$
x_{42}	$e_2 = e_{42} + f'_{42}(x_{42},x_{43})$
x_{43}	$e_3 = e_{43} + f'_{43}(x_{42},x_{43})$
Biomass Markets	**Short Run Equilibrium Conditions**
Nutrient Pool – Bacteria	$N_{s1}x_{s10}(e_{s10},e_{21},SA_{s1}) = Aress$
Nutrient Pool – Algae	$N_{f1}x_{f10}(e_{f10},e_{31},SA_{f1}) = Aresf$
Brine Shrimp – Bacteria	$N_2x_{21}(e_{21},e_{42},SA_2) = N_{s1}y_{12}(e_{s10},e_{21},SA_{s1})$
Brine Flies – Algae	$N_3x_{31}(e_{31},e_{43},SA_3) = N_{f1}y_{13}(e_{f10},e_{31},SA_{f1})$
Waterbirds – Brine Shrimp	$N_4x_{42}(e_{42},e_{43}) = N_2y_{24}(e_{21},e_{42},SA_2)$
Waterbirds – Brine Flies	$N_4x_{43}(e_{42},e_{43}) = N_3y_{34}(e_{31},e_{43},SA_3)$

Note: $Aress$ and $Aresf$ represent the fixed sizes of the nutrient pool for bacteria and algae, respectively. As benchmarks, $Aress$ is calibrated by $Aress = N_{s1}x_{s10}$, and $Aresf$ by $Aresf = N_{f1}x_{f10}$. The explicit functional forms of partial derivatives of $f_i(\cdot)$ and $y_{ik}(x_{ij})$ are shown as follows,

$$f'_{s1}(x_{s10};SA_{s1}) = \gamma_{s1}r_{s1}[SA_{s1}+1]x_{s10}^{\gamma_{s1}-1},\ y'_{12}(x_{s10}) = \alpha_{12}\delta_{12}x_{s10}^{\alpha_{12}-1}$$

$$f'_{f1}(x_{f10};SA_{f1}) = \gamma_{f1}r_{f1}[SA_{f1}+1]x_{f10}^{\gamma_{f1}-1},\ y'_{13}(x_{f10}) = \alpha_{13}\delta_{13}x_{f10}^{\alpha_{13}-1}$$

$$f'_2(x_{21};SA_2) = \gamma_2 r_2[SA_2+1]x_{21}^{\gamma_2-1},\ y'_{24}(x_{21}) = \alpha_{24}\delta_{24}x_{21}^{\alpha_{24}-1}$$

$$f'_3(x_{31};SA_3) = \gamma_3 r_3[SA_3+1]x_{31}^{\gamma_3-1},\ y'_{34}(x_{31}) = \alpha_{34}\delta_{34}x_{31}^{\alpha_{34}-1}$$

$$f'_{42}(x_{42};x_{43}) = r_4 + 0.5r_4[r_{43}x_{43} + \gamma_4 x_{42}^{\gamma_4-1}]$$

$$f'_{43}(x_{42};x_{43}) = r_4 + 0.5r_4[r_{43}x_{42} + \gamma_4 r_{43}x_{43}^{\gamma_4-1}].$$

Table 4: Species' Population-Updating Equations

Species	Population-Updating Equations
$s1$	$N_{s1}^{t+1} = N_{s1}^{t} + \frac{N_{s1}^{t}}{v_{s1}^{ss}}\left[y_{12}^{ss}\left(1-\frac{1}{s_{s1}}\right)+\frac{1}{s_{s1}}\right]\left[v_{s1}+R_{s1}^{*}\right] - N_{s1}^{t}\left[y_{12}^{t}\left(1-\frac{1}{s_{s1}}\right)+\frac{1}{s_{s1}}\right]$
$f1$	$N_{f1}^{t+1} = N_{f1}^{t} + \frac{N_{f1}^{t}}{v_{f1}^{ss}}\left[y_{13}^{ss}\left(1-\frac{1}{s_{f1}}\right)+\frac{1}{s_{f1}}\right]\left[v_{f1}+R_{f1}^{*}\right] - N_{f1}^{t}\left[y_{13}^{t}\left(1-\frac{1}{s_{f1}}\right)+\frac{1}{s_{f1}}\right]$
2	$N_{2}^{t+1} = N_{2}^{t} + \frac{N_{2}^{t}}{v_{2}^{ss}}\left[y_{24}^{ss}\left(1-\frac{1}{s_{2}}\right)+\frac{1}{s_{2}}\right]\left[v_{2}+R_{2}^{*}\right] - N_{2}^{t}\left[y_{24}^{t}\left(1-\frac{1}{s_{2}}\right)+\frac{1}{s_{2}}\right] - H_{c}^{t}$
3	$N_{3}^{t+1} = N_{3}^{t} + \frac{N_{3}^{t}}{v_{3}^{ss}}\left[y_{34}^{ss}\left(1-\frac{1}{s_{3}}\right)+\frac{1}{s_{3}}\right]\left[v_{3}+R_{3}^{*}\right] - N_{3}^{t}\left[y_{34}^{t}\left(1-\frac{1}{s_{3}}\right)+\frac{1}{s_{3}}\right]$
4	$N_{4}^{t+1} = N_{4}^{t} + \frac{N_{4}^{t}}{s_{4}}\left[\frac{v_{4}+R_{4}^{*}}{v_{4}^{ss}} - 1\right]$

Note: $y_{12}^{ss} = y_{12}(x_{s10}^{ss})/w_{s1},\ y_{13}^{ss} = y_{13}(x_{f10}^{ss})/w_{f1},\ y_{24}^{ss} = y_{24}(x_{21}^{ss})/w_{2},\ y_{34}^{ss} = y_{34}(x_{31}^{ss})/w_{3}$

Table 5: Values of Ecological Parameters and Initial Variables

Embodied Energy	Tax in Supply	Supply	Basal Metabolism
e_0 = 1500	t_{12}=0.0000688280	α_{12}^{GSL}=0.5	β_{s1}=1.4198593*
e_{s1} = 1300	t_{13}=0.0000130773	α_{13}^{GSL}=0.5	β_{f1}=1.88082521*
e_{f1} = 1300	t_{24}=0.0090030127	α_{24}^{GSL}=0.5	β_2=56.03115663*
e_2 = 1000	t_{34}=0.0115926425	α_{34}^{GSL}=0.5	β_3=29.21489220*
e_3 = 500			β_4=61,870.1
δ^{GSL} Parameters	**Respiration Parameters**	**r^{GSL} Parameters**	**Life Spans**
δ_{12}^{GSL}=0.01053687*	γ_{s1}^{GSL}=1.3	r_{s1}^{GSL}=2,381.249*	s_{s1}=5
δ_{13}^{GSL}=0.00233150*	γ_{f1}^{GSL}=1.3	r_{f1}^{GSL}=2,391.057*	s_{f1}=5
δ_{24}^{GSL}=0.13640192*	γ_{2}^{GSL}=1.3	r_{2}^{GSL}=514.0552*	s_2=5
δ_{34}^{GSL}=0.24634991*	γ_{3}^{GSL}=1.3	r_{3}^{GSL}=553.338*	s_3=5
	γ_{4}^{GSL}=1.3	r_{4}^{GSL}=157.5466*	s_4=15
	γ_{43}^{GSL}=1.3	r_{43}^{GSL}=0.02332145*	
Salinity Adjustment	**Solar Input**	**Weights**	**Species and Energy Constraint**
σ_{1a}=0.75	ps=0.09	w_{s1}=0.007	$Aress$=1,478,332*
σ_{2a}=0.75	qs=0.4	w_{f1}=0.007	$Aresf$=2,892,059*
σ_{3a}=0.75	pf=0.09	w_2=0.776154462	$etaco$=0.005
σ_{1m}=0.75	qf=0.04	w_2=0.776154462	
σ_{2m}=0.75		w_3=0.887	
σ_{3m}=0.75			

Variables	Initial Values
Biomass Demand	x_{s10}=0.007068638
	x_{f10}=0.007068638
	x_{21}=0.656089993
	x_{31}=0.401
	x_{42}=156
	x_{43}=156
Species Populations	N_{s1}=209,139,538
	N_{f1}=409,139,538
	N_2=386,392
	N_3=200,000
	N_4=200
Biomass Energy Price	e_{s10}=191.6095*
	e_{f10}=250.6058*
	e_{21}=117*
	e_{31}=195*
	e_{42}=90*
	e_{43}=45*

Table 6: Formal Optimization Problem for the GSL Regional Economy

Objective: $U = \alpha C_a^{\beta_a} C_m^{\beta_m} C_r^{\beta_r} C_c^{\beta_c} G^{\beta_G}$
Subject to, i) $Q_a = C_a$, $Q_m = C_m + X_m$, $Q_f = X_f$, $Q_r = C_r$, $C_c + X_c = 0$ (Market-Clearing Conditions) ii) $\bar{K} = K_a + K_m + K_f + K_r$, $\bar{L} = L_a + L_m + L_f + L_r$, $\bar{W} = W_a + W_m$ (Full-Employment Conditions) iii) $\hat{P}_m X_m + \hat{P}_f X_f + \hat{P}_c X_c = 0$ (Trade-Balance Condition)
First Order Conditions (FOCs): i) $\frac{\partial U}{\partial C_a} = \lambda_a$, $\frac{\partial U}{\partial C_m} = \lambda_m$ $\frac{\partial U}{\partial C_r} = \lambda_r$, $\frac{\partial U}{\partial C_c} = \lambda_c$ ii) $\lambda_m = \phi \hat{P}_m$, $\lambda_f = \phi \hat{P}_f$, $\lambda_c = \phi \hat{P}_c$, where ϕ is normalized to unity iii) $\lambda_a \frac{\partial Q_a}{\partial K_a} = \lambda_m \frac{\partial Q_m}{\partial K_m} = \lambda_f \frac{\partial Q_f}{\partial K_f} = \lambda_r \frac{\partial Q_r}{\partial K_r} = \mu_K$ iv) $\lambda_a \frac{\partial Q_a}{\partial L_a} = \lambda_m \frac{\partial Q_m}{\partial L_m} = \lambda_f \frac{\partial Q_f}{\partial L_f} = \lambda_r \frac{\partial Q_r}{\partial L_r} = \mu_L$ v) $\lambda_a \frac{\partial Q_a}{\partial W_a} = \lambda_m \frac{\partial Q_m}{\partial W_m} = \mu_W$ vi) market-clearing, full-employment, and trade-balance conditions hold

Note that the first order conditions are derived from the following Lagrangian function,

$$\begin{aligned}
\mathscr{L} = U &+ \lambda_a(Q_a - C_a) + \lambda_m(Q_m - C_m - X_m) + \lambda_f(Q_f - X_f) + \lambda_r(Q_r - C_r) + \lambda_c(C_c - X_c) \\
&+ \mu_K(\bar{K} - K_a - K_m - K_f - K_r) + \mu_L(\bar{L} - L_a - L_m - L_f - L_r) + \mu_W(\bar{W} - W_a - W_m) \\
&+ \phi(\hat{P}_m X_m + \hat{P}_f X_f + \hat{P}_c X_c).
\end{aligned}$$

Table 7: Values of Economic Parameters and Initial Variables

Sectors	Factor Productivity	Factor Substitutability
Agriculture (a)	γ_a=2.89937061*	ρ_a=0.1
Mining (m)	γ_m=2.76880520*	ρ_m=0.1
Brine-Shrimp Fishery (f)	γ_f=0.19452063*	ρ_f=0.1
Recreation (r)	γ_r=0.04637760*	ρ_r=0.1
Composite (c)		
Share Parameter (Capital)	Share Parameter (Labor)	Share Parameter
δ_{Ka}=0.27361600*	δ_{La}=0.27361600*	δ_{Wa}=0.45276800*
δ_{Km}=0.51294360*	δ_{Lm}=0.21217673*	δ_{Wm}=0.27487967*
δ_{Kf}=0.87841463*	δ_{Lf}=0.12158537*	δ_{2f}=0.25*
δ_{Kr}=0.91491276*	δ_{Lr}=0.08508724*	δ_{4r}=0.375 *
Output Price(exogenous)	Taste Parameter	Shift Parameter in Utility
$\hat{P}_f$=1	β_a=0.23076923*	α=9.81493045*
$\hat{P}_m$=3	β_m=0.23076923*	
$\hat{P}_c$=2	β_r=0.23076923*	
	β_c=0.30769231*	
	β_{poll}=-0.25*	

Variables	Initial Values
Output, Consumption, and Net Exports	Q_a=C_a=150
	Q_m=C_m=150 (X_m=0)
	Q_f=X_f=200
	Q_r=C_r=150*
	C_c=$-X_c$=200*
Capital	K_a=40
	K_m=80
	K_f=180*
	K_r=140*
Labor	L_a=40
	L_m=30
	L_f=20
	L_r=10
Specific Factor	W_a=70*
	W_m=40*
Factor Price	r_k=1
	r_l=1
	r_w=1
Output Price (endogenous)	P_a=2
	P_r=2
Utility	U=650
Gross Domestic Product	GDP=650
Pollution	G=37.5*
Harvest	H_c=104,000*

Table 8: Brine Shrimp and Waterbird Populations under Drought, Moratorium, and Input Taxation

Key Periods	Brine Shrimp			Waterbirds		
	Drought	Moratorium	Input Tax	Drought	Moratorium	Input Tax
3	257,590	257,590	257,590	194.32	194.32	194.32
4	236,116	255,794	250,816	189.61	189.61	189.61
5	222,623	252,195	244,485	184.51	185.01	184.89
6	214,660	248,850	239,709	179.42	180.63	180.33
7	230,108	265,267	255,664	175.95	178.03	177.49
8	249,291	265,840	261,187	174.34	177.25	176.49
9	264,395	272,023	269,844	174.22	177.29	176.48
10	274,927	278,213	277,257	175.06	177.97	177.20
11	281,804	282,944	282,597	176.44	179.04	178.35
12	286,048	286,136	286,089	178.05	180.30	179.70
13	288,499	288,100	288,193	179.68	181.59	181.08
14	289,782	289,191	289,341	181.24	182.84	182.41
15	290,337	289,706	289,870	182.65	183.97	183.62

Table 9: Present Values of Rolling and Base EV

Scenario	Rolling EV	Base EV
With Harvest	4.78	43.98
Drought	9.07	119.23
Moratorium	10.03	161.02
Fishery Input Tax	9.47	141.73

Table 10: Multi-Sector Regulatory Scenarios

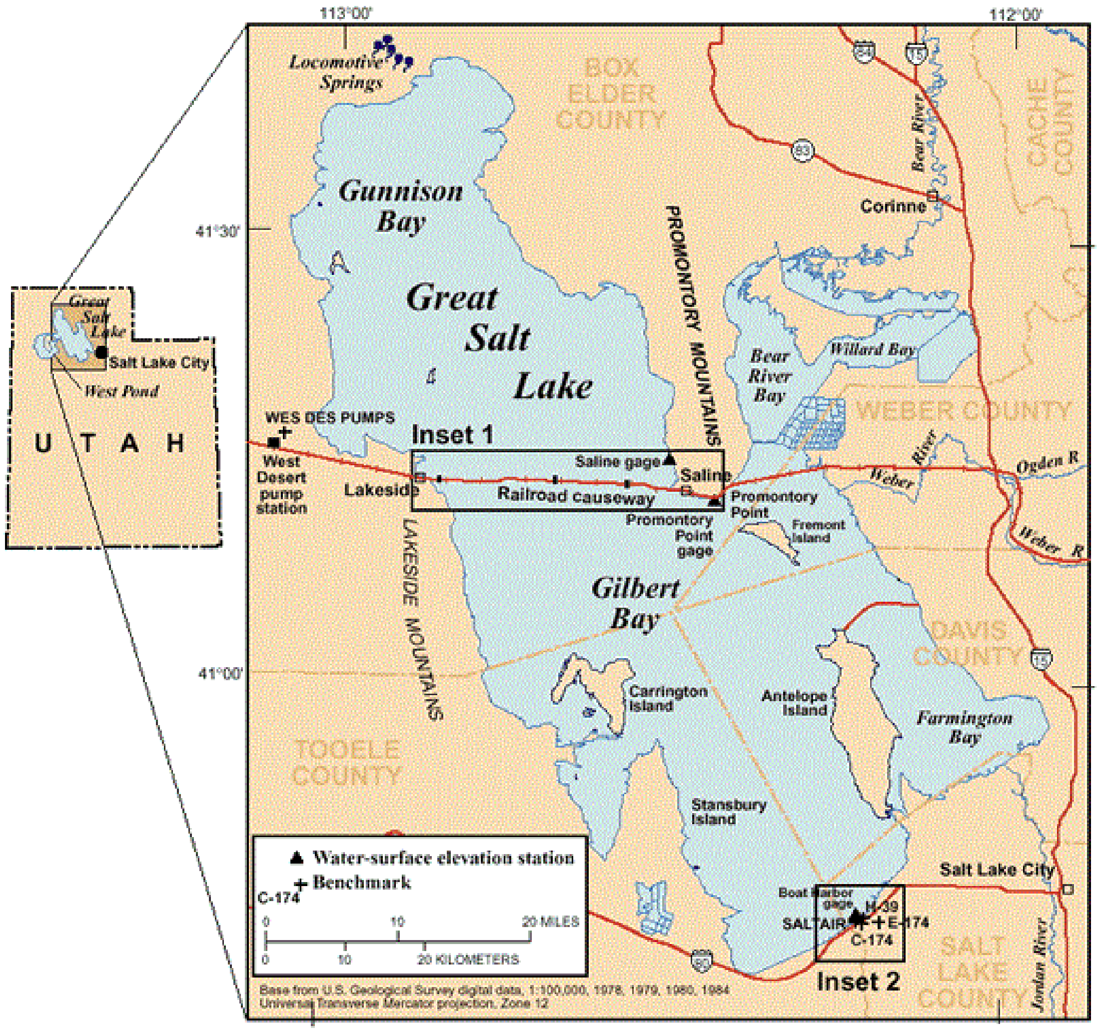
Scenarios
Moratorium and Mining Input Tax (30%)
Moratorium and Mining Output Tax (30%)
Fishery Input Tax (50%) and Mining Input Tax (30%)
Fishery Input Tax (50%) and Mining Output Tax (30%)

Table 11: Present Values of Rolling and Base EV

Single/Multiple Sector Regulations	Rolling EV	Base EV
Drought	9.07	119.23
Moratorium	10.03	161.02
Moratorium and Output Tax on Mining	6.78	74.33

Appendix C: Figures

Figure 1: The Great Salt Lake (GSL) Map



Source: U.S. Geological Survey (USGS)
`http://ut.water.usgs.gov/greatsaltlake/elevations/gslcorrection.html`

Figure 2: The Great Salt Lake (GSL) Bioeconomy

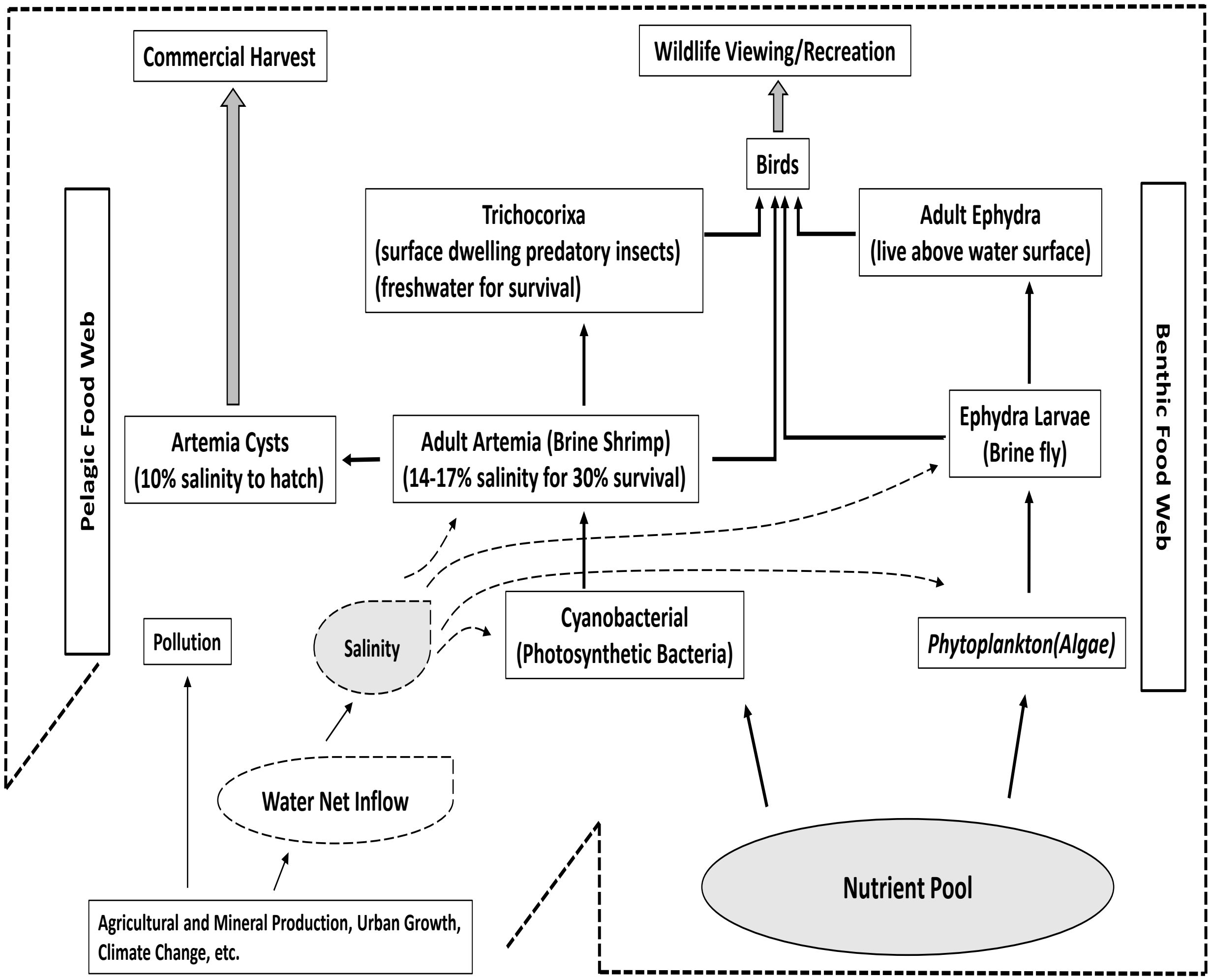


Figure 3: Species Populations

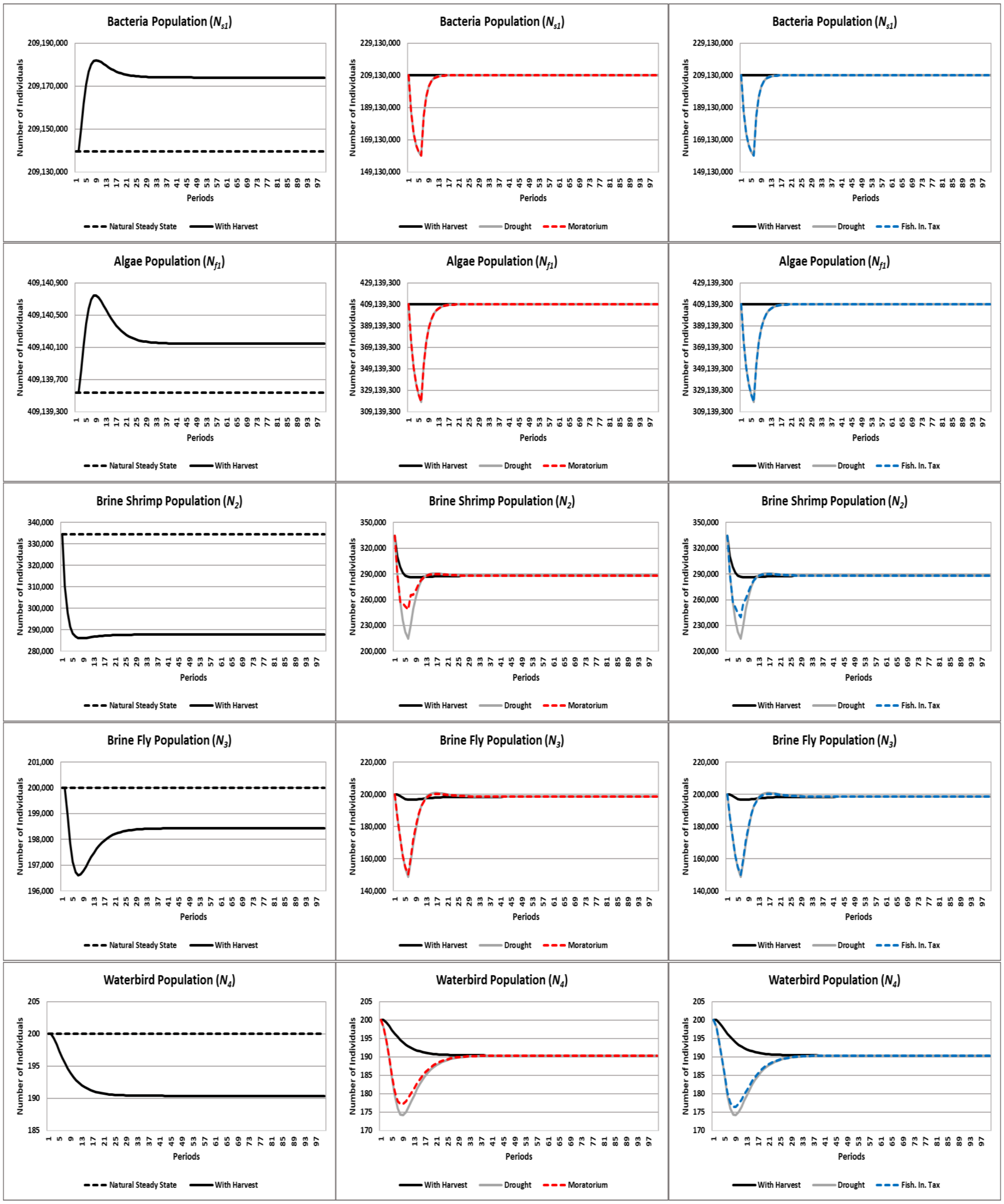


Figure 4: Output Markets

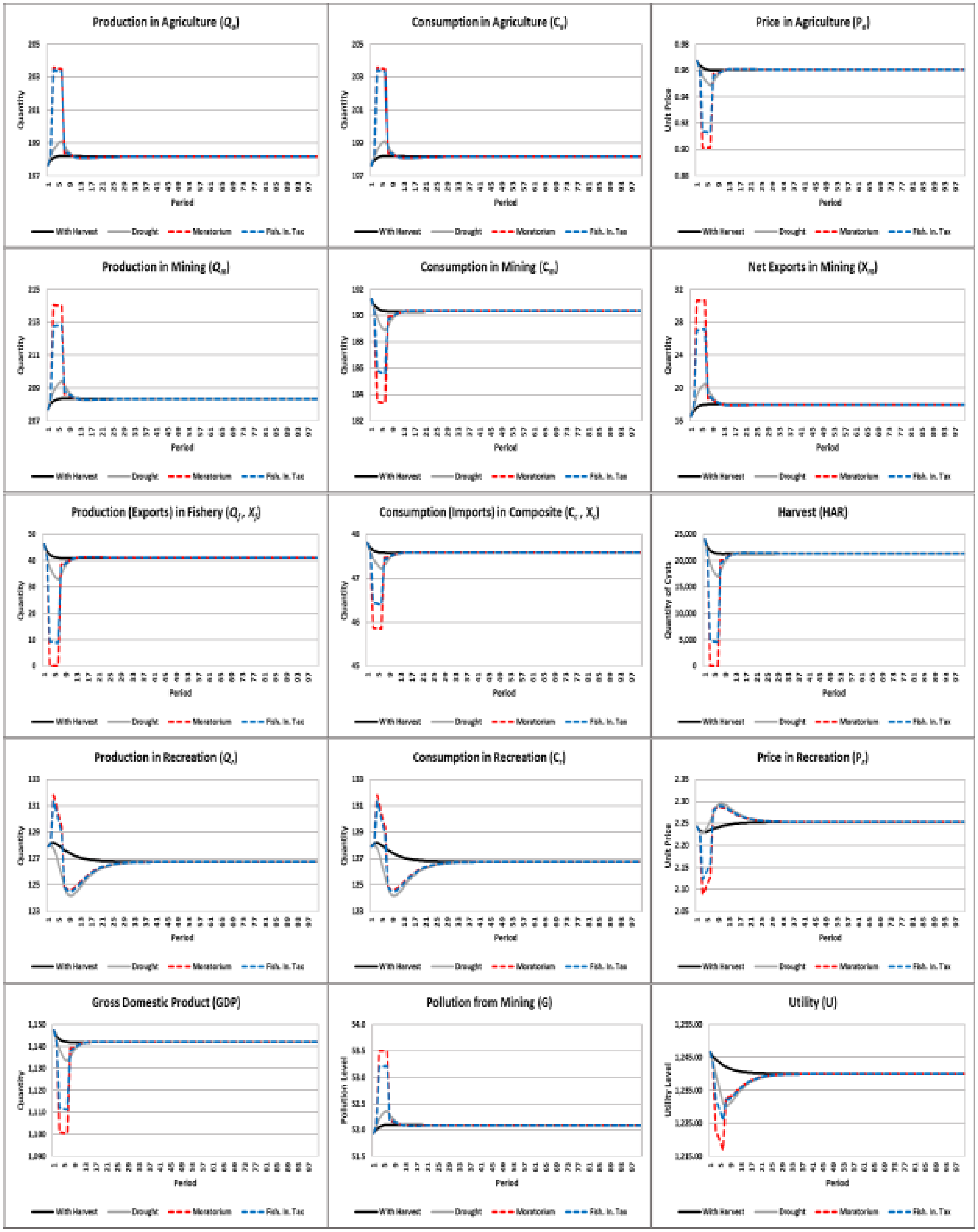


Figure 5: Rolling and Base Equivalent Variation (EV) Paths

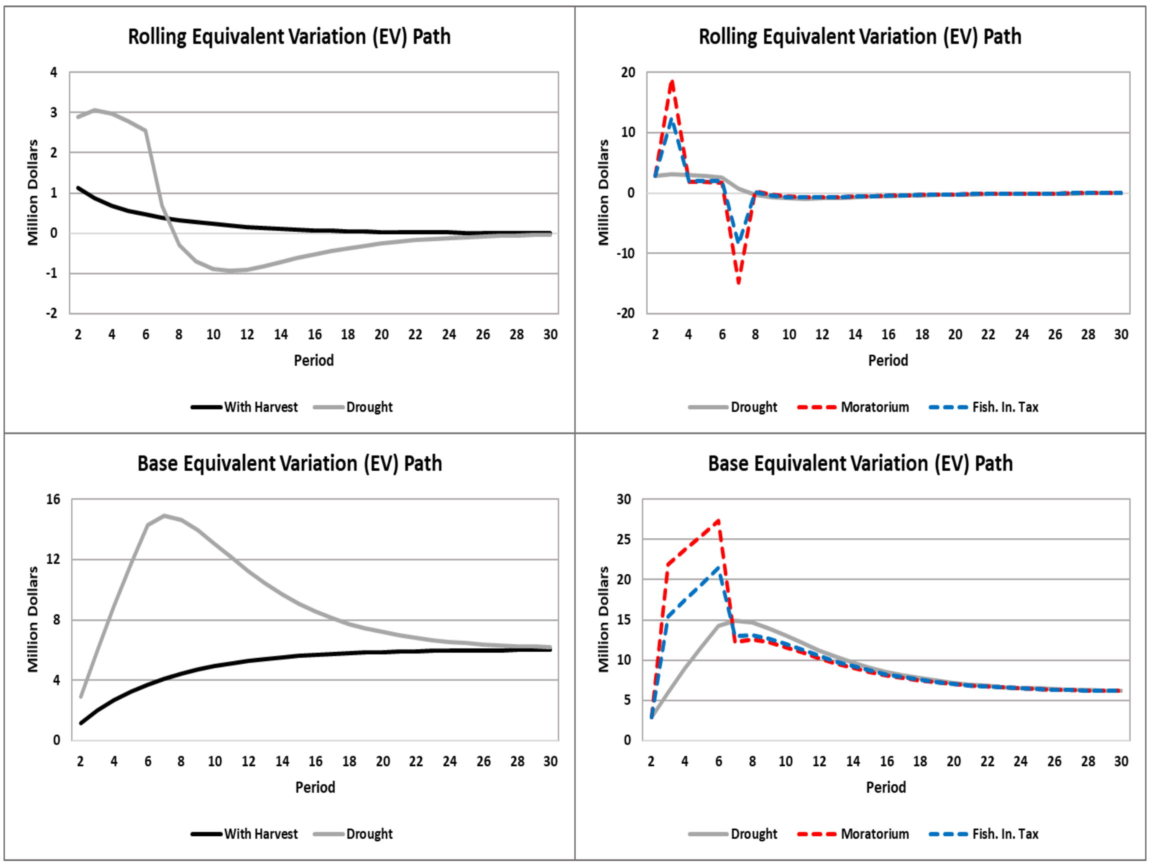


Figure 6: Species Populations: Moratorium and Output Tax on Mining

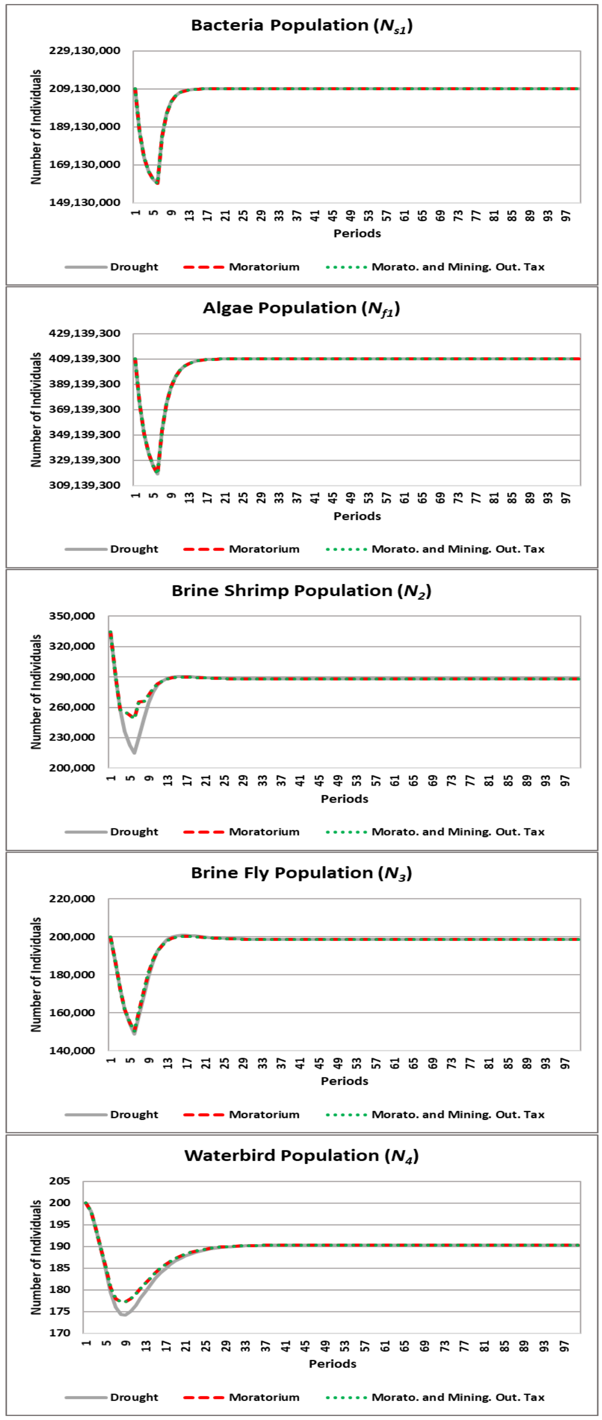


Figure 7: Output Markets: Moratorium and Output Tax on Mining

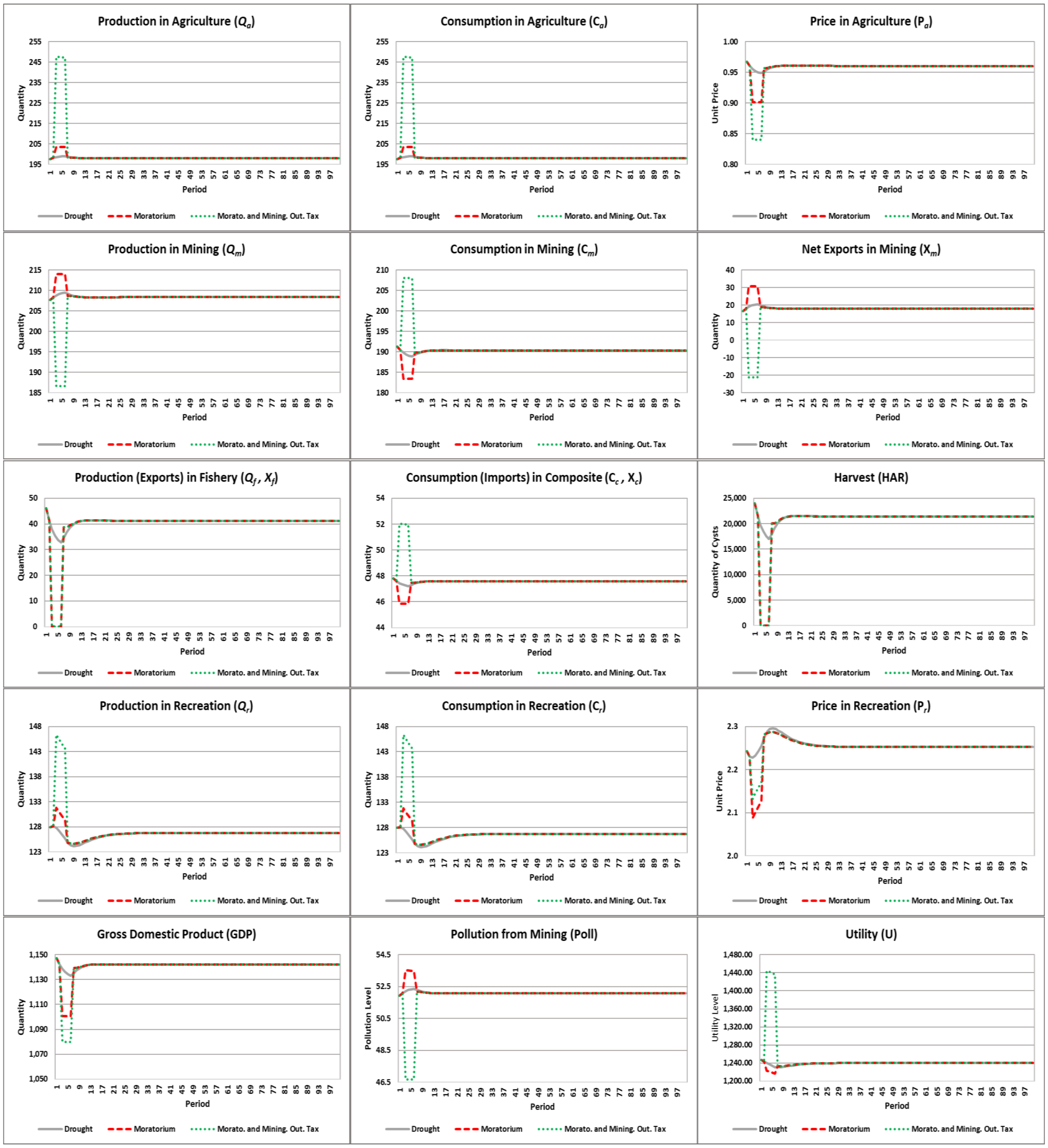


Figure 8: Rolling and Base EV Paths: Moratorium and Output Tax on Mining