Economic Impacts of a Premature Nuclear Phase-Out in Switzerland

An Applied General Equilibrium Analysis

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Downloadable Appendix

ftp://ftp.zew.de/pub/zew-docs/div/swiss-phase-out.pdf

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APPENDIX A: ALGEBRAIC MODEL SUMMARY

This section provides an algebraic summary of the equilibrium conditions for an intertemporal small open economy model designed to investigate the economic implications of an energy policy interference. For the generic model the following basic assumptions apply:

(i) Commodity prices and factor prices are fully flexible within competitive markets.

(ii) Labor is intersectorally mobile but not mobile at the international level.

(iii) Capital is freely mobile across sectors and domestic boundaries.

(iv) Labor force productivity (efficiency) increases at an exogenous growth rate.

(v) Capital stocks evolve through constant geometric depreciation and new investment.

(vi) The level of investment in a given period is determined by competitive and individually rational entrepreneurs who allocate investment across sectors in order to maximize the present value of firms. Investors have no money illusion and issues such as debt-versus equity-financing are not considered.

(viii) The public budget is balanced on an intertemporal basis.

(viii) In international trade the domestic economy is considered as sufficiently small. Therefore the effects of exports and imports on international prices can be ignored.[1] Within this small open economy framework, the model adopts the Armington assumption to differentiate between domestically produced commodities and foreign produced commodities in exports and imports. International capital flows (borrowing and lending) are endogenous, subject to an intertemporal balance of payments constraint, i.e. no change in net indebtedness over the model horizon.

(ix) Aggregate consumption and savings are derived from utility maximization of a representative household. To approximate an infinite horizon equilibrium with a finite model we assume that the representative consumer purchases capital in the post-horizon period at a price which is consistent with steady-state equilibrium growth (terminal condition).

The model is formulated as a system of nonlinear inequalities. These inequalities correspond to two classes of equilibrium conditions: zero profit and market clearance. The fundamental unknowns of the system are two vectors: activity levels and prices. In equilibrium, each of these variables is linked to one inequality condition: an activity level to a zero-profit condition and a commodity (factor) price to a market-clearance condition.

In the following algebraic exposition, the notation Π_i^X is used to denote the profit function of sector *i*, where *X* is the name assigned to this activity. Formally, all production sectors exhibit constant

[1] Foreign export demand and import supply functions are horizontal and ,hence, can be omitted within the algebraic model formulation.

returns to scale (CRTS), hence differentiating Π_i^X with respect to input and output prices provides compensated demand and supply coefficients, which appear subsequently in the market-clearance conditions.[2] All prices are expressed as present values reflecting the assumed international interest rate and consumer's intertemporal preferences, i.e. the pure rate of time preference. In order to simplify the notation, time indices are omitted from those equations which are strictly intra-period.

Zero profit conditions

Production

In domestic production, nested, separable, constant elasticity of substitution (CES) cost functions are employed to specify the substitution possibilities between inputs of capital (K), labor (L), an energy composite (E) and a material composite (M). The energy composite is made up of the outputs of the energy industries. The materials consists of the outputs of the other non-energy industries. At the top level, the materials composite is employed in fixed proportions with an aggregate of energy, capital and labor. A constant elasticity describes the substitution possibilities between the capital and energy aggregate and labor at the second level. Further, at the third level capital and the energy composite trade also off with a constant elasticity of substitution. On the output side, production is split between goods produced for the domestic market and goods produced for the world market according to a constant elasticity of transformation. The resulting intra-period zero-profit condition for the production of good *i* is:

$$\Pi_i^Y = \left(\theta_i^X \left(PX_i \left(1 - t_i^Y\right)\right)^{1+1/\sigma_i^{DX}} + \left(1 - \theta_i^X\right)\left(P_i \left(1 - t_i^Y\right)\right)^{1+1/\sigma_i^{DX}} \right)^{\frac{1}{(1+1/\sigma_i^{DX})}}$$

$$-\theta_i^M P_i^M - \theta_i^{KLE} \left[\theta_i^L \left(w\left(1+t_i^L\right)\right)^{1-\sigma_i^{KLE}} + \theta_i^{KE} \left[\theta_i^K r^{1-\sigma_i^{KE}} + \theta_i^E P_i^{E^{1-\sigma_i^{KE}}} \right]^{\frac{1-\sigma_i^{KLE}}{1-\sigma_i^{KE}}} \right]^{\frac{1}{1-\sigma_i^{KLE}}}$$

$$= 0$$

where:

θ_i^X	is the benchmark export value share in output of sector *i*,
P_i	is the output price of good *i*,
PX_i	is the export price of good *i* (expressed in domestic currency),[3]
t_i^Y	is the net production (output) tax on good *i*,

[2] Decreasing returns are accommodated in the CRTS framework through introduction of a specific factor under the assumption of perfect competition.

[3] The prices for exports PX_i and imports PM_i are expressed in domestic currency. Export prices $\overline{PX_i}$ and import prices $\overline{PM_i}$ in international currency (e.g. in \$US) are exogenous for the small open economy. The real exchange rate μ relates international prices to domestic prices, i. e. $PM_i \equiv \overline{PM_i}\,\mu$.

θ_i^M is the benchmark value share of the material composite in sector *i*,

θ_i^{KLE} is the benchmark value share of the labour and capital-energy composite in sector *i*,

θ_i^L is the benchmark value share of labour input in sector *i*,

θ_i^{KE} is the benchmark value share of the capital-energy composite in sector *i*,

θ_i^K is the benchmark value share of capital input in sector *i*,

θ_i^E is the benchmark value share of the energy composite in sector *i*,

P_i^M stands for the price of the material composite in sector i,

w is the economy-wide gross wage rate (net of payroll taxes),

r is the uniform rate of return on mobile capital (net of capital taxes),

P_i^E stands for the composite price of the energy composite input into sector *i,*

t_i^L is the payroll tax rate in sector *i*,

σ_i^{DX} is the elasticity of transformation between domestic supply and export supply,

σ_i^{KLE} is the elasticity of substitution between labor and the capital-energy composite,

σ_i^{KE} is the elasticity of substitution between capital and the energy composite,

and

Y_i is the associated dual variable, which indicates the activity level of production in sector *i*.

Production and distribution of electricity

The production and distribution of electricity is modeled by Leontief production functions. The cost function of technology n is:

$$\Pi_n^{EP} = \sum_s \gamma_{sn}^{EP} P_{sn}^{EP} - \sum_j \theta_{jn}^M P_j^A - \theta_n^L w\left(1 - t_n^L\right) - \theta_n^K r - PR_n = 0$$

where:

γ_{sn}^{EP} is the seasonal output of technology n in season *s*,

θ_{jn}^M is the benchmark value share of material input *j* in technology *n*,

θ_n^L is the benchmark value share of labor input in technology *n*,

θ_n^K is the benchmark value share of capital input in technology *n*,

P_{sn}^{EP} is the producer price of electricity in season *s*,

PR_n is the rent of technology *n* due to capacity restrictions,

σ_{ELE}^{DX} is the transformation elasticity between domestic electricity supply and exports,

and

EP_n is the associated dual variable, which indicates the activity level of electricity production by technology n.

Each technology exports electricity. The according cost function is:

$$\Pi_{sn}^{ES} = \left(\theta_{sn}^{X} PX_s^{E^{1+1/\sigma_{ELE}^{DX}}} + \left(1-\theta_{sn}^{X}\right) P_s^{ES^{1+1/\sigma_{ELE}^{DX}}} \right)^{\frac{1}{1+1/\sigma_{ELE}^{DX}}} - P_{sn}^{EP} = 0$$

where:

θ_{sn}^{X} is the benchmark export value share in electricity output of technology n,

PX_s^E is the export price of electricity in season s,

P_s^{ES} is the domestic wholesale price of electricity in season s,

and

ES_{sn} is the associated dual variable, which indicates the activity level of electricity supply by technology n.

The cost function for the distribution of electricity through grid technology k is (Note that the model features three distribution technologies "local", "regional" and "supraregional" that refer to the respective grids):

$$\Pi_k^{ED} = P_k^{ED} - \sum_j \theta_{jk}^{M} P_j^{A} - \theta_k^{L} w\left(1-t_k^{L}\right) - \theta_k^{K} r - \sum_s \gamma_{sk}^{ED} P_s^{EA} = 0$$

where:

θ_{jk}^{M} is the benchmark value share of material input j in distribution technology k,

θ_k^{L} is the benchmark value share of labor in distribution technology k,

θ_k^{K} is the benchmark value share of capital in distribution technology k,

γ_{sk}^{ED} is the benchmark value share of electricity distributed by grid technology k in season s,

P_k^{ED} is the consumer price for electricity distributed by grid technology k,

P_s^{EA} is the Armington price of electricity in season s,

and

ED_k is the associated dual variable, which indicates the activity level of the electricity distribution technology k.

Armington aggregation across imports and goods produced for the domestic market

Each of the individual inputs which make up the energy and the materials composite is a composite of a domestic and an imported variety which trade off with a constant elasticity of substitution. The corresponding zero-profit condition for the production of the Armington good *i* is given by:

$$\Pi_i^A = P_i^A - \left(\theta_i^{IM} \left(\left(1 + t_i^{IM} \right) PM_i \right)^{1-\sigma_i^A} + \left(1 - \theta_i^{IM} \right) P_i^{1-\sigma_i^A} \right)^{\frac{1}{1-\sigma_i^A}} = 0$$

where:

θ_i^{IM} is the benchmark value share of imports in the Armington good *i*,

P_i^A is the Armington price of the composite good *i,*

PM_i is the import price of good *i* (expressed in domestic currency),

t_i^{IM} is the (ad-valorem) tariff rate on imported goods,

σ_i^A is the Armington elasticit of substitution,

and

A_i is the associated dual variable, which indicates the activity level of Armington good production.

The zero-profit condition for the production of the Armington electricity good is:[4]

$$\Pi_s^{EA} = P_s^{EA} - \left(\theta_s^{IME} PM_s^{E^{1-\sigma^{DME}}} + \left(1 - \theta_s^{IME} \right) P_s^{ES^{1-\sigma^{DME}}} \right)^{\frac{1}{1-\sigma^{DME}}} = 0$$

where:

θ_s^{IME} is the benchmark value share of electricity imports in season s,

P_s^{EA} is the Armington price of the electricity in season s,

PM_s^E is the import price of electricity in season s (expressed in domestic currency),

and

EA_s is the associated dual variable, which indicates the activity level of Armington electricity good production.

Material composite

The material composite is produced in fixed proportions (Leontief):

$$\Pi_i^M = P_i^M - \sum_{j \notin EG} \theta_{ji}^M P_j^A = 0$$

where:

[4] We assumed a high substitution elasticitiy of $\sigma^{DME} = 10$.

θ_{ji}^{M} is the benchmark value share of the non-energy Armington good *j* (j $\notin$EG[5]) in the materials composite of sector *i*,

and

M_i is the associated dual variable, which indicates the activity level of production of the materials composite for sector *i*.

Energy composite

The energy aggregate consists of primary fossil energy and electricity. Gasoline and diesel are part of the material composite. The CES energy composite combines therefore oil, gas and electricity as energy resources used in production processes:

$$\Pi_i^E = P_i^E - \left[\sum_{j \in EG} \theta_{ij}^{EG} P_j^{A^{1-\sigma^E}} + \theta_i^{ED} \left(\sum_k a_{ik} P_k^{ED} \right)^{1-\sigma^E} \right]^{\frac{1}{1-\sigma^E}} = 0$$

where:

θ_{ij}^{EG} is the benchmark value share of energy input j in the energy aggregate of sector *i*,

θ_i^{ED} is the benchmark value share of electricity input in the energy aggregate of sector *i*,

P_i^E is the price of the energy composite good for sector *i*,

a_{ik} is an exogenous one-to-one mapping that denotes which distribution technology *k* supplies electricity to sector *i* (a_{ik} = 1 if *k* supplies to sector *i;* a_{ik} = 0 otherwise)

σ^E is the elasticity of substitution between energy inputs into the energy composite,

and

E_i is the associated dual variable, which indicates the activity level of production of the energy composite for sector *i*.

Public output

Public goods and services are produced in fixed proportions (Leontief aggregation) of commodity inputs which are composed as an Armington aggregate of domestic and imported commodities:

$$\Pi^G = P^G - \prod_i P_i^{A^{\theta_i^G}} = 0$$

where:

θ_i^G is the benchmark value share of Armington input *i* in public goods provision,

P^G is the composite price for government demand,

[5] The set *EG* consists of the energy goods light oil, heavy oil and gas.

and

G is the associated dual variable which indicates the activity level of public goods provision.

Consumer good production

Consumer goods are produced in fixed proportions of Armington goods (Z-Matrix transformation with fixed coefficients):

$$\Pi_z^Z = P_z - \sum_{i \notin EG} \theta_{iz} P_i^A - \theta_z^{EG} \left[\sum_{j \in EG} \theta_{zj}^{EG} {P_j^A}^{1-\sigma^E} + \theta_z^{ED} \left(\sum_k a_{zk} P_k^{ED} \right)^{1-\sigma^E} \right]^{\frac{1}{1-\sigma^E}} = 0$$

where:

θ_{iz} is the benchmark value share of producer good *i* into the formation of consumer good *z*,

θ_z^{EG} is the benchmark value share of energy composite into the formation of consumer good *z*,

θ_{zj}^{EG} is the benchmark value share of energy input i into the formation of consumer good *z*,

θ_z^{ED} is the benchmark value share of electricity input into the formation of consumer good *z*,

P_z is the price for consumption good *z* (net of value-added taxes),

a_{zk} is an exogenous one-to-one mapping that denotes which distribution technology *k* supplies electricity to consumer good formation *z* (a_{iz} = 1 if *k* supplies to *z*; a_{iz} = 0 otherwise)

and

Z_z is the associated dual variable which indicates the activity level of consumer good production.

Non-leisure consumption composite

Substitution patterns within the aggregate of (non-leisure) consumption goods are described by a Cobb-Douglas function. The zero-profit condition for the (non-leisure) consumption composite is given by:

$$\Pi^{CG} = P^{CG} - \left(\begin{array}{l} \theta^{TRA}\left[\sum_{z\in TRA}\theta_z^{TRA}\left(\left(1+t_z^{CG}\right)P_z\right)^{1-\sigma^{TRA}}\right]^{\frac{1-\sigma^C}{1-\sigma^{TRA}}} \\ +\theta^{ENE}\left[\sum_{z\in ENE}\theta_z^{ENE}\left(\left(1+t_z^{CG}\right)P_z\right)^{1-\sigma^{ENE}}\right]^{\frac{1-\sigma^C}{1-\sigma^{ENE}}} \\ +\theta^{MISC}\left[\sum_{z\in MISC}\theta_z^{MISC}\left(\left(1+t_z^{CG}\right)P_z\right)^{1-\sigma^{MISC}}\right]^{\frac{1-\sigma^C}{1-\sigma^{MISC}}} \end{array} \right)^{\frac{1}{1-\sigma^C}} = 0$$

where:

θ^{TRA}	is the benchmark value share of the traffic composite (KBEN, KPTR) in aggregate household consumption
θ^{ENE}	is the benchmark value share of the energy composite (KHEI, KELE) in aggregate household consumption
θ^{MISC}	is the benchmark value share of the rest composite in aggregate household consumption
P^{CG}	is the price for the (non-leisure) consumption composite *(*gross of value-added taxes),
t_z^{CG}	is the value-added tax rate on inputs of consumption goods into aggregate consumption,
σ^C	is the elasticity of substitution between the transport composite, the energy (heating) aggregate and the other consumption goods composite,
σ^{TRA}	is the elasticity of substitution between private and public transport in consumption demand
σ^{ENE}	is the elasticity of substitution between oil, gas and electricity in consumption demand
σ^{MISC}	is the elasticity of substitution between other consumption goods

and

CG	is the associated dual variable which indicates the activity level of household consumption of commodities (excluding leisure).

Full consumption

Intra-period household demand is given as a separable nested CES function which describes the trade-off between leisure and consumption. The zero-profit condition reads as:

$$\Pi^C = P^C - \left[\theta^F w^{1-\sigma^F} + \left(1-\theta^F\right)P^{CG^{1-\sigma^F}}\right]^{\frac{1}{1-\sigma^F}} = 0$$

where:

P^C is the composite price index of aggregate leisure and goods consumption,

θ^F is the benchmark value share of leisure in intra-period household consumption,

σ^F is the substitution elasticity between leisure and the consumption composite,

and

C is the associated dual variable which indicates the activity level of aggregate household consumption (commodities and leisure).

Capital formation and investment

An efficient allocation of capital, i.e. investment over time assures the following intertemporal zero-profit conditions which relates the cost of a unit of investment, the return to capital and the purchase price of a unit of capital stock in period *t*.[6]

$$\Pi_t^K = p_t^K - r_t^K - (1 - \delta) p_{t+1}^K = 0$$

and

$$\Pi_t^I = \sum_i \theta_i^I P_{it}^A - p_{t+1}^K = 0$$

where:

p_t^K is the value (purchase price) of one unit of capital stock in period *t*,

δ is the capital depreciation rate,

θ_i^I is the benchmark value share of Armington input *i* in the homogeneous investment good,

$\sum_i \theta_i^I P_{it}^A$ is the cost of a unit of investment in period *t,*[7]

and

K_t is the associated dual variable, which indicates the activity level of capital stock in period *t,*

I_t is the associated dual variable, which indicates the activity level of aggregate investment in period *t*.[8]

The same conditions apply for capital formation and investment into discrete energy technologies (with the addition of technology-specific capital stock indices).

6 The optimality conditions for capital stock formation and investment are directly derived from the maximization of lifetime utility by the representative household taking into account its budget constraint, the equation of motion for the capital stock and the condition that output in each period is either invested or consumed. Note that in our algebraic exposition we assume an investment lag of one period.

7 The investment good is produced subject to a Leontief technology which combines Armington inputs in fixed proportions.

8 As written, we have taken explicit account of the non-negativity constraint for investment.

Market Clearance[9]

Domestic supply

Producer goods produced for the domestic market enter Armington production:

$$Y_i \frac{\partial \Pi_i^Y}{\partial (P_i\,(1-t_i^Y))} = A_i \frac{\partial \Pi_i^A}{\partial P_i}$$

where P_i is the associated dual variable.

The market clearance conditions for domestic electricity supply by technology *n* and season *s* are:

$$EP_n \frac{\partial \Pi_n^{EP}}{\partial P_{sn}^{EP}} = ES_{sn} \frac{\partial \Pi_{sn}^{ES}}{\partial P_{sn}^{EP}}$$

where P_{sn}^{EP} denote the associated dual variables.

The market clearance conditions for aggregate seasonal electricity supply is:

$$\sum_n ES_{sn} \frac{\partial \Pi_{sn}^{ES}}{\partial P_s^{ES}} = EA_s \frac{\partial \Pi_s^{EA}}{\partial P_s^{ES}}$$

where P_s^{ES} is the associated dual variable.

Armington supply

Armington goods enter intermediate demand for the production of producer goods and consumer goods as well as government and investment demand:

$$A_i = \sum_j \left(M_j \frac{\partial \Pi_j^M}{\partial P_i^A} + E_j \frac{\partial \Pi_j^E}{\partial P_i^A} \right) + \sum_z Z_z \frac{\partial \Pi_z^Z}{\partial P_i^A} + I \frac{\partial \Pi^I}{\partial P_i^A} + G \frac{\partial \Pi^G}{\partial P_i^A}$$
$$+ \sum_n EP_n \frac{\partial \Pi_n^{EP}}{\partial P_i^A} + \sum_k ED_k \frac{\partial \Pi_k^{ED}}{\partial P_i^A}$$

where P_i^A is the associated dual variable.

Armington supply of electricity enters the distribution function of electricity provision to different consumer groups:

$$EA_s = \sum_k ED_k \frac{\partial \Pi_k^{ED}}{\partial P_s^{EA}}$$

where P_s^{EA} is the associated dual variable.

Electricity consumption

[9] We exploit Shepard's Lemma to provide a compact representation of compensated demand and supply functions.

Electricity distributed by (grid) technology *k* enters the demand of the production sectors and the consumer goods production:

$$ED_k = \sum_{i \in k} E_i \frac{\partial \Pi_i^E}{\partial P_i^{ED}} + \sum_{z \in k} Z_z \frac{\partial \Pi_z^Z}{\partial P_z^{ED}}$$

where P_k is the associated dual variable.

Intermediate energy supply

The sector-specific intermediate energy composite enters production:

$$E_i = \sum_j Y_j \frac{\partial \Pi_j^Y}{\partial P_i^E}$$

where P_i^E is the associated dual variable.

Intermediate material supply

The sector-specific intermediate material composite enters production:

$$M_i = \sum_j Y_j \frac{\partial \Pi_j^Y}{\partial P_i^M}$$

where P_i^M is the associated dual variable.

Consumer goods supply

Consumer goods enter final consumption demand:

$$Z_z = CG \frac{\partial \Pi^{CG}}{\partial (P_z (1 - t_z^{CG}))}$$

where P_z is the associated dual variable.

Non-leisure consumption

Non-leisure consumption enters the aggregate consumption (including leisure):

$$CG = C \frac{\partial \Pi^C}{\partial P_{CG}}$$

where P_{CG} is the associated dual variable.

Government provision

Public good provision increases at the exogenous (steady-state) growth rate of the economy:

$$G_t = G_{t-1}(1 + gr)$$

where:

gr is the exogenous growth rate,

$\overline{G}_0$ is the base year level of public good provision,

and

P_{CG} is the associated dual variable.

Imports

The supply-demand balance for imported goods is:

$$IM_i = A_i \frac{\partial \Pi_i^A}{\partial (PM_i(1 + t_i^{IM}))}$$

where:

IM_i is the level of imports of good *i*

and

PM_i is the associated dual variable.

The supply-demand balance for imports of electricity is:

$$IM_s^E = EA_s \frac{\partial \Pi_s^{EA}}{\partial PM_s^E}$$

where:

IM_s^E is the level of imports of electricity in season s.

and

PM_s^E is the associated dual variable.

Exports

The supply-demand balance for exported goods is:

$$EX_i = Y_i \frac{\partial \Pi_i^Y}{\partial (PX_i(1 - t_i^Y))}$$

where:

EX_i is the level of exports of good *i*.

and

PX_i is the associated dual variable.

The supply-demand balance for exports of electricity is:

$$EX_s^E = \sum_n ES_{sn} \frac{\partial \Pi_{sn}^{ES}}{\partial PX_s^E}$$

where:

EX_s^E is the level of exports of electricity in season s

and

PX_s^E is the associated dual variable.

Foreign closure

As to the trade balance with respect to the rest of the world a simple foreign closure rule is used: In the small open economy framework, CIF import prices and FOB export prices are exogenous and unaffected by the level of imports and exports. An intertemporal balance of payments constraint (trade closure) assures no change in net indebtedness over the model horizon.[10]

$$\sum_{t=1}^{T}\left(\sum_i PM_{it}\, IM_{it}\right)+\left(\sum_s PM_{st}^E IM_{st}^E\right)=\sum_{t=1}^{T}\left(\sum_i PX_{it}\, EX_{it}\right)+\left(\sum_s PX_{st}^E EX_{st}^E\right)$$

Labor

The intra-period supply-demand balance for labor is written:

$$\overline{E}-\frac{\partial \Pi^C}{\partial w} = \overline{E}-F = \sum_i Y_i \frac{\partial \Pi_i^Y}{\partial (w(1+t_i^L))} + \sum_n EP_n \frac{\partial \Pi_n^{EP}}{\partial (w(1+t_n^L))} + \sum_k ED_k \frac{\partial \Pi_k^{ED}}{\partial (w(1+t_k^L))}$$

where:

$\overline{E}$ is the total endowment with time which grows at the exogenous (steady-state) rate gr of the economy,[11]

F is the demand for leisure,

and

w is the associated dual variable.

Capital

The supply-demand balance for capital services is written:

$$rK = \sum_i Y_i \frac{\partial \Pi_i^Y}{\partial r} + \sum_n EP_n \frac{\partial \Pi_n^{EP}}{\partial r} + \sum_k ED_k \frac{\partial \Pi_k^{ED}}{\partial r}$$

where:

[10] N.B.: In this framework, international flows of capital goods (borrowing and lending) are endogenous.

[11] We represent growth in terms of Harrod-neutral technological progress in producing labor or leisure services per unit of actual time (efficiency growth).

K is the aggregate capital stock for domestic production

and

r is the associated dual variable.

Current period's investment augments the capital stock in the next period.[12] Capital stocks are updated as an intermediate calculation between periods.[13] The stock-flow accounting relationship for capital (equation of motion for the capital stock) can be written as:

$$K_{t+1} = (1-\delta)K_t + I_t$$

Income Balances

Household

The representative household chooses to allocate lifetime income across consumption in different time periods:

$$\max U(u(C_1,F_1), u(C_2,F_2),\ldots, u(C_T,F_T)) = \sum_{t=1}^{T} \rho^t u(C_t,F_t)$$

$$\text{s.t.}$$

$$\sum_{t=1}^{T} P^C{}_t C_t = \sum_{t=1}^{T} w_t \overline{E}_t + p_1^K K_1 + \sum_{t=1}^{T} r_t K_t + \sum_{t=1}^{T} TR_t + \sum_{t=1}^{T}\sum_n \phi^H EP_{nt} PR_{nt}$$

where:

ρ^t is the pure rate of time preference which determines the intertemporal allocation of consumption, and

TR is an exogenous lump-sum transfer between the government and the household.

ϕ^H is the share of capacity rents, which the household receives.

For the intra-period utility function we assume the functional form $u(C_t,F_t) = \frac{1}{C_t^{\alpha} F_t^{1-\alpha}}$ which is consistent with an intertemporal elasticity of substitution equal to 0.5.

Government

Government income consists of tax revenues from the representative household, which assures a balanced budget (fiscal closure). The intertemporal income balance of the government is given by:

[12] Capital accumulation (i. e. the level of savings and investment) is determined by firms managers who allocate investment across sectors to maximize the present value of firms.

[13] In our simulations, we assume that the capital stock is augmented by new investment with a three-year and depreciated at a constant geometric rate.

$$\sum_{t=1}^{T}\sum_{z}(P_z t_z^C CG \frac{\partial \Pi^{CG}}{\partial (P_z(1+t_z^{CG}))})$$
$$+\sum_{t=1}^{T} w_t \sum_{i} t_i^L w_t Y_{it} \frac{\partial \Pi_{it}^{Y}}{\partial (w_t(1+t_{it}^L))}$$
$$+\sum_{t=1}^{T} w_t \sum_{n} t_n^L w_t EP_{nt} \frac{\partial \Pi_{nt}^{EP}}{\partial (w_t(1+t_{nt}^L))}$$
$$+\sum_{t=1}^{T} w_t \sum_{k} t_k^L w_t ED_{kt} \frac{\partial \Pi_{kt}^{ED}}{\partial (w_t(1+t_{kt}^L))}$$
$$+\sum_{t=1}^{T}\sum_{i} t_i^Y P_{it} Y_{it} \frac{\partial \Pi_{it}^{Y}}{\partial (P_{it}(1-t_i^Y))}$$
$$+\sum_{t=1}^{T}\sum_{i} t_i^Y PX_{it} EX_{it}$$
$$+\sum_{t=1}^{T}\sum_{i} t_i^{IM} PM_{it} IM_{it}$$
$$+\sum_{t=1}^{T}\sum_{n} \phi^G EP_{nt} PR_{nt}$$
$$=\sum_{t=1}^{T} P_t^G G_t$$

where:

ϕ^G is the share of capacity rents accruing to the government.

Terminal Constraint

The finite horizon poses some problems with respect to capital accumulation. Without any terminal constraint, the capital stock at the end of the model's horizon would have no value and this would have significant repercussions for investment rates in the periods leading up to the end of the model horizon. In order to correct for this effect we define a terminal constraint which forces terminal investment to increase in proportion to final consumption demand:

$$\frac{I_T}{I_{T-1}} = \frac{C_T}{C_{T-1}}.$$

APPENDIX B: DISAGGREGATION AND PARAMETERIZATION

Table B1: Overview of production sectors

ID	Sector	ASWZ*
AGR	Agriculture, hunting, forestry and fishing	0
ELE	Electricity	111
GAS	Gas	112
WAS	Water supply	113
NAH	Manufacture of food products	21
GET	Manufacture of beverages	22
TAB	Manufacture of tobacco products	23
TEX	Manufacture of textiles	24 wo. 2414
KLE	Manufacture of wearing apparel, dressing and dyeing of fur	25
HOL	Manufacture of products of wood, cork and furniture	26
SAE	Manufacture of wood	261
PAP	Manufacture of paper and paper products	27
GRA	Publishing, printing and reproduction of recorded media	28
LED	Tanning and dressing of leather, and manufacture of luggage	29
CHE	Manufacture of chemicals and chemical products	31, 2414
OEL	Refined petroleum products producing gasoline (BEN), diesel (DIE), light oil (OIL_L), and heavy oil (OIL_H)	314
PLA	Manufacture of rubber and plastic products	32
NME	Manufacture other non-metallic mineral products, mining and quarrying	33, 121, 123
MET	Manufacture of basic metals and fabricated metal products	34
MFB	Manufacture of machinery, equipment and vehicles	35
ETE	Manufacture of office, accounting and electrical machinery	36, 37, 38
BAU	Construction	41
AUS	Installation and interior works	42
GRO	Wholesale trade, repairing cars	51-531, 532, 54
DET	Retail trade	55, 56
HOT	Hotels and restaurants	57
EIS	Railroad transport, cable and rack railways	61
TRA	Other transport and transport via pipelines	62, 63, 64, 65
TEL	Post and telecommunications	66
BAN	Financial intermediation except insurance and pension funding	71
VER	Insurance and pension funding except compulsory social security	72
IMO	Real estate activities (incl. leasing of real estate)	73
CON	Renting of equipment and other business activities, repair	74-76, 84, 85, 87
STU	Research and development, education, and social work	81, 82, 88
GES	Health work	83
HAU	Private households, non-profit organizations	86, 89
STA	Public administration and defense	91
SOZ	Compulsory social security	92

* Allgemeine Systematik der Wirtschaftszweige

Table B2: Overview of consumption categories

ID	Consumption category
KNAH	Food
KGET	Semi-luxury
KKLW	Clothes, Furniture, Cleaning
KWON	Rents
KELE	Electricity
KHEI	Oil and gas
KGES	Health care
KAUT	Cars
KBEN	Fuel
KPTR	Public transport
KFRE	Education, recreation
KDIV	Other goods and services
KFOR	Expenditures abroad

Table B3: Overview of key substitution elasticities

Substitution elasticity	Description	Value
σ^{KLEM}	Substitution elasticity between the material aggregate and the labor-capital-energy composite	0
σ^{M}	Substitution elasticity between material inputs (including diesel and gasoline)	0
σ^{KLE}	Substitution elasticity between labor and the capital-energy composite	See Table B4
σ^{KE}	Substitution elasticity between capital and the energy composite	0.20
σ^{E}	Substitution elasticity between energy inputs	0.25
σ^{DX}	Transformation elasticity between domestic supply and exports	See Table B4
σ_i^{A}	Armington substitution elasticity	See Table B4
σ^{F}	Substitution elasticity between leisure and the consumption composite	1.67
σ^{C}	Substitution elasticity between the transport composite, (non-fuel) energy composite and other consumption goods	0.80
σ^{TRA}	Substitution elasticity between private and public transport in consumption demand	0.20
σ^{ENE}	Substitution elasticity between between oil, gas and electricity in consumption demand	0.60
σ^{MISC}	Substitution elasticity between other consumption goods	1.00

Table B4: Values of sector-specific substitution elasticities

Sector	σ^{KLE}	σ^{EXP}	σ^{ARM}
AGR	0.68	2.00	1.50
GAS	0.80	2.00	1.50
WAS	0.80	2.00	1.50
NAH	0.71	2.00	1.50
GET	0.71	2.00	1.50
TAB	0.71	2.00	1.50
TEX	0.90	2.00	2.00
KLE	0.90	2.00	2.00
HOL	0.74	2.00	2.00
SAE	0.74	2.00	2.00
PAP	0.74	2.00	3.50
GRA	0.74	2.00	2.00
LED	0.90	2.00	1.50
CHE	0.96	2.00	1.00
OEL	0.96	2.00	1.50
PLA	0.74	2.00	1.00
NME	0.74	2.00	5.00
MET	0.74	2.00	3.00
MFB	0.74	2.00	1.50
ETE	0.74	2.00	1.50
BAU	0.80	2.00	1.50
AUS	0.80	2.00	1.50
GRO, DET, HOT, EIS, TRA, TEL, BAN, VER, IMO, CON, STU, GES, HAU, STA, SOZ	0.80	1.50	1.50

APPENDIX C: SWISS SOCIAL ACCOUNTING MATRIX (1998)

	Intermediate Demand													
	AGR	ELE	GAS	WAS	NAH	GET	TAB	TEX	KLE	HOL	SAE	PAP	GRA	LED
AGR	1,148.8	0.1			8,334.4	180.9	270.9	92.2	17.8	126.2	135.0	41.5		42.6
ELE	160.4	3,989.4	1.3	34.8	137.9	19.8	4.7	100.6	11.7	88.2	9.0	151.7	58.9	2.7
GAS	2.4	53.4	5.1	0.3	29.1	7.8	1.7	7.7	2.5	6.9	0.7	34.7	12.2	0.0
WAS	34.1	0.1			49.7			0.6	0.9	20.0		55.7		
NAH	1,164.8	6.7			4,094.0	251.1	0.0		2.6	21.3		0.0		
GET		0.2				77.1				9.5				
TAB		0.4					60.4			21.0				
TEX	3.2	1.0						779.8	561.4	125.0		6.7		3.5
KLE	2.2	0.1			1.5				156.7	16.9				
HOL	92.6	1.7			30.9		5.3		2.6	935.5		27.4		4.4
SAE		0.7								872.5	90.8	48.6		
PAP	24.7	0.6			266.8	38.0	92.3	17.8	14.1	65.7		1,157.9	1,412.6	4.8
GRA	100.8	1.2			361.7	58.2	31.7	1.0			3.1	88.3	1,376.9	5.0
LED		2.4							0.6	28.5			22.5	48.1
CHE	404.1				162.9	40.8	61.6	354.8	9.7	144.3	37.7	201.3	691.8	20.3
BEN	28.1	0.7	0.4	0.5	22.0	1.7	0.7	3.8	4.5	14.5	4.5	3.6	24.3	1.3
DIE	54.2	0.0	0.0	0.0	9.1	1.2	0.5	0.5	0.3	5.7	5.6	1.7	1.7	0.4
OIL_L	5.6	1.8	0.3	0.4	22.9	1.4	0.5	5.2	1.9	8.0	0.8	3.4	8.3	0.4
OIL_H		42.4	0.8		3.5	0.2		1.6	0.1			14.2		0.2
PLA	64.3	1.7			186.2	25.6	18.9	31.3	38.9	330.0	3.5	82.0	153.9	32.6
NME	173.1	159.9	30.5	15.8	212.9	163.3	5.1		8.6	187.6		63.2		
MET	160.8	228.1	13.9	14.0	271.5	80.8	30.8	7.1	34.2	476.4	6.1	35.1	75.3	20.3
MFB	270.2	377.6	61.4	84.0	257.9	66.1	44.5	90.3	38.1	111.6	29.3	111.7	219.4	26.7
ETE	120.7	244.5	54.3	17.3	109.5	49.3	32.4	38.2	42.5	276.8	15.0	109.8	95.6	28.6
BAU	476.6	17.6		21.5	11.0	6.1		0.8	12.1	89.3	9.0	13.5		4.8
AUS	190.0	128.7		13.6	56.9	93.0	14.9	18.3	32.5	63.8	11.1	30.0	48.1	12.9
GRO	467.5	122.5			1,008.0	179.3	67.8	155.8	124.3	457.7	44.7	227.1	240.7	52.2
DET	17.0	8.0			970.4	79.6	24.6	41.0	49.7	534.4	32.3	96.2	109.7	15.5
HOT	22.3	4.8			79.3	44.0	30.1	40.1	68.3	173.0	9.3	35.3	127.1	21.2
EIS	96.0	6.1	8.8		357.2	25.2	43.1	15.4	19.9	44.2	6.1	61.9	102.1	7.9
TRA	381.9	17.6	28.1	13.1	433.5	12.8	19.2	66.8	21.3	176.0	105.6	37.6	23.8	13.9
TEL	42.3	16.0			121.4	39.0	13.8	36.0	48.6	144.2	8.3	44.7	114.1	23.6
BAN	85.7	13.1			117.0	20.2		40.2	52.4	127.5	11.8	37.0	61.7	15.3
VER	84.5	186.0			52.8	8.7	17.9	18.2	23.4	79.3	9.2	28.8	24.7	9.8
IMO	10.9	4.1			61.0	7.0	10.5	3.2	19.7	66.4		11.5	30.0	4.1
CON	391.3	390.8	15.5	17.4	810.8	405.7	424.0	179.7	275.7	500.4	40.5	252.6	815.8	46.5
STU		4.1			9.1					20.4				
GES	1.8	5.2												
HAU														
STA		7.2			18.8					9.2				
SOZ														
LAB	6,246.0	1,003.1	135.4	399.5	3,400.7	511.5	265.7	887.1	762.8	3,321.5	381.2	953.9	3,848.3	283.3
CAP	790.7	4,267.3	471.2	702.0	2,409.0	1,195.7	2,131.8	777.4	209.3	709.7	189.7	789.2	1,252.8	166.6
KNAH														
KGET														
KKLW														
KWON														
KELE														
KHEI														
KGES														
KAUT														
KBEN														
KPTR														
KFRE														
KDIV														
KFOR														
HH														
FRM														
GOV														
SAV														
ROW	3,127.0	607.2	241.8		3,393.4	1,110.1	54.8	2,204.4	5,408.5	2,407.5	809.2	2,875.6	1,692.0	1,471.7
SPAY	1,312.9	208.4	26.0	35.0	700.3	76.9	33.9	158.8	142.2	703.4	51.1	180.6	780.1	32.8
TAX		702.1												
TARIFF	193.3				198.0	61.6			86.7	16.0				
Colsum	17,953.0	12,834.4	1,094.8	1,369.4	28,772.9	4,939.7	3,814.1	6,175.7	8,307.2	13,536.3	2,060.4	7,914.2	13,424.6	2,424.1

Intermediate Demand

CHE	OEL	PLA	NME	MET	MFB	ETE	BAU	AUS	GRO	DET	HOT	EIS	TRA	TEL	BAN	VER
		54.9	12.3	35.4	31.9	127.5				22.1	1,270.2					
451.7	3.4	69.3	85.0	273.1	228.7	177.2	125.9	50.5	58.8	571.0	352.4	381.8	126.2	70.9	124.6	48.8
99.3		5.5	41.2	41.0	33.2	31.3	4.0	2.4	7.9	24.0	25.0	5.0	9.5	7.7	5.9	2.3
		5.8	7.7	53.8	50.4	127.4				52.5	70.8					
16.0		7.6	8.8	36.6	35.7	122.2				14.5	2,238.8					
				24.3	20.8	100.3				0.9	605.8					
			7.9	36.8	34.8	115.1			74.0	70.4	635.0					18.2
		54.7	18.2	38.4	138.5	166.1		21.8		21.5	49.5			6.6		5.3
		1.9	10.9	31.5	31.3	119.0				30.2	212.1			54.5		18.1
		8.0	56.4	114.5	194.8	201.2	247.1	1,543.2		104.6	42.9			35.2		3.1
		10.8	7.3	36.8	84.2	189.9	123.0	211.3		17.6						
274.0		82.0	122.8	67.5	77.3	355.2		22.6	81.5	206.8	84.4					32.8
98.4		55.6	152.5	109.4	290.6	457.7			216.5	1,353.4	260.2	15.8	178.6	230.4	264.2	154.8
				22.6	17.1	104.4										
11,690.9	150.0	1,418.0	289.7	449.8	478.2	1,436.9	93.1	550.9		64.4	183.3	1.7		17.8		42.8
17.9	0.2	5.3	6.9	28.8	50.0	41.1	70.6	53.7	75.5	67.8	94.8	10.8	236.0	16.8	27.3	21.4
7.1	0.2	0.3	14.5	3.3	5.9	7.6	188.3	39.7	59.4	4.3	27.2	0.7	863.0	1.2	1.6	1.2
23.8	56.2	3.6	15.6	14.1	34.1	19.0	6.3	5.4	14.8	45.0	51.4	9.5	18.0	14.7	11.7	4.6
6.8		0.2	21.2	2.0	3.4	0.4										
491.2	6.1	568.2	77.9	160.4	1,201.2	1,679.1	117.9	262.7		97.8	34.5	4.1	25.3	20.0		5.7
342.1		74.7	1,892.8	874.5	251.7	703.1	4,104.8	935.4		39.0	336.8	6.0		25.0		
488.6	41.1	134.1	168.0	8,339.8	4,843.6	4,421.7	1,039.7	1,011.2		77.9	100.1	87.2	60.5	32.2		39.8
411.9	62.9	108.4	268.3	354.6	12,043.9	1,496.3	125.1	594.6	97.2	299.0	182.1	32.5	514.5	151.1	7.0	97.8
237.3	46.2	118.3	113.0	336.4	3,598.6	9,040.0	339.5	783.8	450.4	390.0	319.6	47.1	172.2	447.5	71.4	304.7
		21.2	45.2	65.5	170.8	141.4	1,426.2			169.6	31.6	461.7	52.7	60.9		34.3
36.6	50.7	75.9	101.0	124.7	250.6	248.2		9.3		222.0	12.0	196.7	60.8	322.8	66.0	129.2
1,087.2	646.2	221.6	313.8	846.2	1,497.8	1,717.6	714.0	419.1	1,144.1	241.3	769.6	9.9	125.3	76.6	1.3	51.2
187.9	123.5	80.3	187.8	305.4	710.9	751.9	651.7	622.9		131.8	1,252.7	11.8	57.5	42.9		31.0
281.8		93.1	104.4	197.7	634.9	872.8	71.9	3.7	1,468.0	116.7	105.5	2.4	636.3	36.0	235.2	145.6
221.5	81.4	31.7	107.7	397.7	56.1	223.1	56.3	25.7	492.0	125.9	8.8	764.7	166.8	434.8	31.2	48.4
239.0	13.5	72.6	74.0	660.0	669.6	567.2	941.3	637.1	1,106.0	100.9	449.2	13.0	1,531.9	107.8	47.0	66.6
344.9	5.4	82.6	66.5	151.3	411.7	645.9	160.3	184.7	503.1	611.2	433.6	11.7	178.0	2,014.8	328.7	373.8
95.1	6.7	59.0	87.4	135.7	442.4	641.3	225.5	92.6	1,291.3	565.8	577.6	9.2	86.4	54.9	10,092.6	2,397.4
45.5		42.9	57.7	81.2	129.3	249.1	232.5	62.6	373.8	229.1	195.1	7.3	374.6	4.6		210.2
		25.6	26.8	55.4	82.9	188.0	103.8	101.3	59.7	1,269.9	296.6	1.5	11.2	53.9	1.0	14.1
2,521.6	215.0	470.4	812.0	701.8	2,686.0	3,252.3	1,547.8	752.7	3,221.8	1,710.3	1,027.5	47.0	256.0	40.8	933.5	3,371.7
			7.6	40.1	95.8	168.3				114.9	17.5					45.2
						60.4										
				32.4	83.0	133.9				11.4						
4,847.0	53.2	1,436.3	1,985.0	6,095.0	11,329.3	10,805.0	10,073.5	8,134.6	12,461.1	16,527.2	8,619.6	3,389.1	6,173.9	5,181.0	8,464.7	4,011.3
12,476.5	228.1	1,367.1	1,814.7	3,573.1	8,773.3	7,981.2	2,555.2	1,900.2	7,988.9	4,168.5	2,867.9	93.2	2,458.4	5,818.5	29,411.1	3,118.7
15,231.8	2,332.1	3,509.1	3,370.9	9,825.1	26,410.5	20,316.8	47.2			25.3		3.7	1,793.2	920.5		
961.1		289.8	407.9	1,307.2	2,421.6	2,372.1	2,115.6	1,702.6	2,415.1	3,516.9	1,808.4	694.5	1,229.6	1,076.4	1,757.4	830.9
	5,259.5			32.2	219.4	135.9										
53,234.4	9,381.6	10,666.1	12,969.2	36,113.4	80,855.8	72,712.2	27,508.2	20,738.2	33,661.0	33,433.5	25,649.6	6,319.7	17,396.5	17,378.7	51,883.4	15,680.9

Intermediate Demand									Consumption Categories							
IMO	CON	STU	GES	HAU	STA	SOZ	LAB	CAP	KNAH	KGET	KKLW	KWON	KELE	KHEI	KGES	KAUT
194.9	266.5	4.7	128.7	140.7	81.6	7.9			4,231.7	273.7				28.1		
12.8	226.3	33.6	89.7	79.6	430.8	11.5							3,147.3			
1.7	29.2	4.3	11.6	10.3	37.6	1.5								489.2		
	19.7	9.5	49.0		11.7							749.9				
0.9	293.8	4.4	57.4	369.8	119.0	33.2			16,782.7	195.4						
	66.5		2.4	63.5						3,569.9						
7.1	72.5	11.2								1,692.9						
	83.7	6.3	54.6	35.1	20.6						1,037.0				7.2	
2.9	236.7	12.4	59.7	104.6	162.0	8.5					5,598.5					
42.2	223.5	2.2	25.6	16.2	77.2						3,114.0	116.5		26.2		
			3.3											83.6		
12.3	259.9	111.0	28.9	27.4	72.3	31.2						37.2			489.6	
23.2	563.4	3,040.3	83.2	158.8	306.7	21.0										
	4.6		14.9								1,552.9					
8.6	1,118.8	24.9	708.1	442.3	262.4	714.7					825.1	62.4		94.6	3,398.3	
3.8	131.6	9.4	25.2	22.2	82.5	3.2										
0.5	16.9	0.7	1.9	1.4	7.3	0.2										
3.1	55.5	8.2	22.0	19.5	71.4	2.8								1,097.1		
8.1	160.9	15.0	91.9	36.9	67.8	23.2					72.8	31.0			150.7	798.2
8.3	111.9	9.8	222.3	39.4	51.6						618.0	159.0		87.0		
29.6	190.3	26.8	34.8	39.8	295.8	10.2					1,126.4	50.6		38.3	49.7	
46.1	402.8	44.9	101.0	136.3	1,593.3	68.3					295.2					12,158.8
127.6	2,221.3	116.8	2,030.5	234.0	846.9	332.3					3,204.8	25.0		67.7	865.7	478.9
2,808.1	241.1	42.3	40.5	102.1	1,144.0											
1,719.6	562.5	14.2	50.2	113.0	508.0	50.5						985.8				
26.7	477.8	63.3	308.3	201.9	281.4	161.5			4,933.6	1,087.6	1,591.6	47.4		228.5	1,191.9	969.7
20.8	361.1	38.7	87.2	267.2	523.5	969.8			9,704.7	2,256.5	4,674.7	91.2		55.6	1,679.7	1,478.2
47.6	1,199.9	145.5	41.0	122.7	189.3	70.7			1,381.8	6,712.4						
12.5	73.6	16.7	35.3	39.4	128.4	49.6										
72.5	398.8	53.5	183.6	151.7	177.1	32.1					82.0					
44.1	532.9	181.7	186.5	130.2	386.0	89.8										
1,896.4	1,299.7	46.3	96.7	830.8	450.9	80.9										
416.8	1,062.3	90.9	382.5	73.5	162.1	13.5										
10.1	145.7	23.2	168.3	23.5	210.4	6.8						29,417.7				
705.0	7,700.2	156.3	1,026.8	925.2	965.8	110.5					1,251.8	633.5			3,981.5	
	530.2	158.0	37.5		105.5											
			47.7		59.3	1,131.9									2,286.0	
															2,481.3	
160.0	45.4		31.6		50.6	620.3									6,958.3	
1,070.6	25,389.9	3,585.2	10,225.3	979.0	8,709.6	487.2										
23,922.2	2,754.9	864.3	148.9	8,594.9	17,591.9	4,571.9										
							192,433.3	56,201.8								
								85,774.4								
								28,873.3								
10.7	43.0	683.1	23.3		4.4	2.3		256.5								
206.7	5,406.1	744.2	2,172.2	182.0	1,833.3	75.5										
33,684.1	54,981.4	10,403.9	19,139.7	14,715.0	38,079.8	9,794.3	192,433.3	171,106.0	37,034.5	15,788.3	25,045.0	32,407.2	3,147.3	2,295.8	23,539.8	15,883.9

Consumption Categories					Other Demand					
KBEN	KPTR	KFRE	KDIV	KFOR	HH	FRM	GOV	SAV	ROW	Rowsum
		66.9	163.0						419.7	17,953.0
									832.6	12,834.4
										1,094.8
										1,369.4
			218.5	155.2					2,522.0	28,772.9
			205.7	3.4					189.4	4,939.7
			139.0	304.9				1.0	511.5	3,814.1
			58.6	5.8				8.7	2,857.0	6,175.7
			131.0					0.7	1,303.3	8,307.2
			31.8					5,462.1	747.4	13,536.3
									279.9	2,060.4
		219.4	58.9						2,064.2	7,914.2
		2,193.9	266.7	64.3					837.3	13,424.6
				3.0					602.6	2,424.1
		148.5	63.0	37.7				40.6	26,287.4	53,234.4
4,368.1									310.4	5,892.2
267.4										1,603.0
									101.4	1,789.6
										96.8
		234.8	51.1	15.6					3,187.3	10,666.1
								16.1	1,039.7	12,969.2
		79.9	62.9	22.9				3,191.2	8,524.5	36,113.4
		479.6						23,269.5	23,624.0	80,855.8
		2,351.3	364.2	958.6				8,860.0	31,576.2	72,712.2
								19,687.4	99.1	27,508.2
								14,065.3	48.7	20,738.2
485.5		753.5	478.9	569.5				5,545.4	1,226.5	33,661.0
416.3		1,752.8	932.1	817.1				90.9	86.7	33,433.5
		3,891.4		6,120.1				12.8	53.6	25,649.6
	589.5	668.3		281.0				10.9	347.0	6,319.7
	976.9	2,647.7		1,640.6					2,332.2	17,396.5
		7,268.4	84.7	538.0				12.5	763.7	17,378.7
			7,287.7					15,084.9	7,366.2	51,883.4
			8,998.4					13.7	1,628.3	15,680.9
			357.6	747.8				9.3	43.8	33,684.1
		580.5	2,636.0	309.3				4,605.7	1,258.2	54,981.4
		913.8	118.9	102.5			7,089.5		824.8	10,403.9
				81.9			15,465.6			19,139.7
		1,993.4	10,237.3					3.0		14,715.0
		501.8		309.5			29,093.2		12.9	38,079.8
							9,794.3			9,794.3
										192,433.3
										171,106.0
					37,034.5					37,034.5
					15,788.3					15,788.3
					25,045.0					25,045.0
					32,407.2					32,407.2
					3,147.3					3,147.3
					2,295.8					2,295.8
					23,539.8					23,539.8
					15,883.9					15,883.9
					5,537.4					5,537.4
					1,566.4					1,566.4
					26,746.0					26,746.0
					32,945.8					32,945.8
					13,088.9					13,088.9
							100,396.4			349,031.5
										85,774.4
										28,873.3
					22,427.0	58,685.3	18,879.5			99,991.8
					2,253.6	9,984.8	1,458.0			123,909.5
					41,011.4					80,980.9
					48,313.3	17,104.2				66,119.7
										6,202.7
5,537.4	1,566.4	26,746.0	32,945.8	13,088.9	349,031.5	85,774.4	182,176.6	99,991.8	123,909.5	2,270,450.6