State and Local Government Employment and Final Demand

(May 2000; Revised March 2009)

The Bureau of Economic Analysis (BEA) reports historical state government employment separate from local government employment at the county level. This data is used to estimate state and local final demand as separate components at the county level over history. All of this information together allows us to predict state government employment and final demand separately from local government employment and final demand for the forecast period. The methodology we implemented is based on the following basic assumptions:

1. Final per capita demand for state government employees is different by state but not by local area within a state.
2. Final per capita demand for local government employees is different for each local area (*k*).
3. Local government demand is always met by the local government in area *k*, but state government demand is *not* always met by the state government in local area *k*. This is because state government employees are usually centralized within a few local areas in a state instead of being distributed throughout the state.

In addition, see *"Predicting State and Local Government Demand in Local Regions Based on Changes in Economic and Demographic Conditions"* (March 2008) for a full explanation of the state and local government final demand equations.

U.S. Model

For the U.S. model **history**, state government final demand is split from the BEA-reported state and local government final demand based on the BEA-reported state government employment as a share of state and local government employment. An analogous approach is used for estimating local government final demand.

$$FD^u_{st,t} = (E^u_{st,t}/E^u_{stloc,t}) * FD^u_{stloc,t}$$

$$FD^u_{loc,t} = (E^u_{loc,t}/E^u_{stloc,t}) * FD^u_{stloc,t}$$

Where,

$FD^u_{st,t}$ = state government final demand for the U.S. in year t
$E^u_{st,t}$ = state government employment for the U.S. in year t,
$E^u_{stloc,t}$ = state and local government employment for the U.S. in year t
$FD^u_{stloc,t}$ = state and local government final demand for the U.S. in year t
$E^u_{loc,t}$ = local government employment for the U.S. in year t
$FD^u_{loc,t}$ = local government final demand for the U.S. in year t

For the U.S. model **forecast**, state government final demand is split from the predicted state and local government final demand based on the last history year ratio of state government employment to state and local government employment. An analogous approach is used for predicting local government final demand.

$$FD^u_{st,t} = (E^u_{st,T} / E^u_{stloc,T}) * FD^u_{stloc,t}$$

$$FD^u_{loc,t} = (E^u_{loc,T} / E^u_{stloc,T}) * FD^u_{stloc,t}$$

Where,

$E^u_{st,T}$ = state government employment for the U.S. in the last history year
$E^u_{stloc,T}$ = state and local government employment for the U.S. in the last history year
$FD^u_{stloc,t}$ = state and local government final demand for the U.S. in year *t*
$E^u_{loc,T}$ = local government employment for the U.S. in the last history year

State government employment is split from the predicted state and local government employment based on the predicted state government final demand as a share of predicted state and local government final demand.

$$E^u_{st,t} = (FD^u_{st,t}/FD^u_{stloc,t}) * E^u_{stloc,t}$$

$$E^u_{loc,t} = (FD^u_{loc,t}/FD^u_{stloc,t}) * E^u_{stloc,t}$$

Where,

$E^u_{st,t}$ = state government employment for the U.S. in year *t*
$E^u_{stloc,t}$ = state and local government employment for the U.S. in year *t*
$E^u_{loc,t}$ = local government employment for the U.S. in year *t*

State Models

For a state model **history**, state government final demand and local government final demand are estimated based on econometric equations that take into account spending as a function of GDP and population.

$$FD^s_{st,t} = R^s_{st} * [(GDP^s_t/N^s_t)/(GDP^u_t/N^u_t)]^\beta * (FD^u_{st,t} / N^u_t) * N^s_t$$

$$FD^s_{loc,t} = R^s_{loc} * [(GDP^s_t/N^s_t)/(GDP^u_t/N^u_t)]^\gamma * (FD^u_{loc,t} / N^u_t) * N^s_t$$

Where,

$FD^s_{st,t}$ = state government final demand for the state in year *t*
$FD^s_{loc,t}$ = local government final demand for the state in year *t*
R^s_{st} = local calibration factor for state government expenditures for the state
R^s_{loc} = local calibration factor for local government expenditures for the state
GDP^s_t = gross domestic product for the state in year *t*
N^s_t = total population for the state in year *t*
GDP^u_t = gross domestic product for the U.S. in year *t*
N^u_t = total population for the U.S. in year *t*
β = GDP elasticity of state government expenditures
γ = GDP elasticity of local government expenditures

For a state model **forecast**, state government final demand is predicted based on the state government final demand spending per person in the state in the last history year, the change in the state government spending per person in the U.S. relative to the last history year, the state's current year population, and the state's GDP per person relative to the nation and the last history year, raised to an econometrically estimated elasticity. An analogous approach is used for predicting local government final demand.

$$FD^{s}_{st,t} = [(GDP^{s}_{t}/N^{s}_{t})/(GDP^{u}_{t}/N^{u}_{t})/(GDP^{s}_{T}/N^{s}_{T})/(GDP^{u}_{T}/N^{u}_{T})]^{\beta} * [(FD^{u}_{st,t} / N^{u}_{t}) / (FD^{u}_{st,T} / N^{u}_{T})] * (N^{s}_{t}/ N^{s}_{T}) * FD^{s}_{st,T}$$

$$FD^{s}_{loc,t} = [(GDP^{s}_{t}/N^{s}_{t})/(GDP^{u}_{t}/N^{u}_{t})/(GDP^{s}_{T}/N^{s}_{T})/(GDP^{u}_{T}/N^{u}_{T})]^{\gamma} * [(FD^{u}_{loc,t} / N^{u}_{t}) / (FD^{u}_{loc,T} / N^{u}_{T})] * (N^{s}_{t}/ N^{s}_{T}) * FD^{s}_{loc,T}$$

Where,

GDP^{s}_{T} = gross domestic product for the state in the last history year
GDP^{u}_{T} = gross domestic product for the U.S. in the last history year
N^{s}_{T} = total population for the state in the last history year
N^{u}_{T} = total population for the U.S. in the last history year
$FD^{s}_{st,T}$ = state government final demand for the state in the last history year
$FD^{u}_{st,T}$ = state government final demand for the U.S. in the last history year
$FD^{s}_{loc,T}$ = local government final demand for the state in the last history year
$FD^{u}_{loc,T}$ = local government final demand for the U.S. in the last history year

State government employment is predicted by applying the state government employment per dollar of state government final demand in the state to the predicted state government final demand in the state. An analogous approach is used for predicting local government employment.

$$E^{s}_{st,t} = [(E^{u}_{st,t} /FD^{u}_{st,t})/(E^{u}_{st,T} /FD^{u}_{st,T})] * (E^{s}_{st,T} /FD^{s}_{st,T}) * FD^{s}_{st,t}$$

$$E^{s}_{loc,t} = [(E^{u}_{loc,t} /FD^{u}_{loc,t})/(E^{u}_{loc,T} /FD^{u}_{loc,T})] * (E^{s}_{loc,T} /FD^{s}_{loc,T}) * FD^{s}_{loc,t}$$

Where,

$E^{s}_{st,t}$ = state government employment for the state in year *t*
$E^{s}_{loc,t}$ = local government employment for the state in year *t*
$E^{s}_{st,T}$ = state government employment for the state in the last history year
$E^{s}_{loc,T}$ = local government employment for the state in the last history year

County Models

For a county model **history**, state government final demand and local government final demand are estimated based on econometric equations that take into account spending as a function of GDP and population. The local calibration factor of the state is adjusted for the region's state and local government employment per capita.

$$FD^{k}_{st,t} = R^{s}_{st} * [(E^{k}_{st,T}/N^{k}_{T})/(E^{s}_{st,T}/N^{s}_{T})] * [(GDP^{k}_{t}/N^{k}_{t})/(GDP^{u}_{t}/N^{u}_{t})]^{\beta} * (FD^{u}_{st,t} / N^{u}_{t}) * N^{k}_{t}$$

$$FD^{k}_{loc,t} = R^{s}_{loc} * [(E^{k}_{loc,T}/N^{k}_{T})/(E^{s}_{loc,T}/N^{s}_{T})] * [(GDP^{k}_{t}/N^{k}_{t})/(GDP^{u}_{t}/N^{u}_{t})]^{\gamma} * (FD^{u}_{loc,t} / N^{u}_{t}) * N^{k}_{t}$$

Where,

$FD^{k}_{st,t}$ = state government final demand for local area *k* in year *t*
$FD^{k}_{loc,t}$ = local government final demand for local area *k* in year *t*
$E^{k}_{st,T}$ = state government employment for local area *k* in the last history year

$E^k_{loc,T}$ = local government employment for local area k in the last history year
N^k_T = total population for local area k in the last history year
GDP^k_t = gross domestic product for local area k in year t
N^k_t = total population for local area k in year t

For a county model **forecast**, state government final demand is predicted based on the state government final demand spending per person in the county in the last history year, the change in the state government spending per person in the U.S. relative to the last history year, the local area's current year population, and the local area's GDP per person relative to the nation and the last history year, raised to an econometrically estimated elasticity. An analogous approach is used for predicting local government final demand.

$$FD^k_{st,t} = [(GDP^k_t/N^k_t)/(GDP^u_t/N^u_t)/(GDP^k_T/N^k_T)/(GDP^u_T/N^u_T)]^{\beta} * [(FD^u_{st,t} / N^u_t) / (FD^u_{st,T} / N^u_T)] * (N^k_t / N^k_T) * FD^k_{st,T}$$

$$FD^k_{loc,t} = [(GDP^k_t/N^k_t)/(GDP^u_t/N^u_t)/(GDP^s_T/N^s_T)/(GDP^u_T/N^u_T)]^{\gamma} * [(FD^u_{loc,t} / N^u_t) / (FD^u_{loc,T} / N^u_T)] * (N^k_t / N^k_T) * FD^k_{loc,T}$$

Where,

GDP^k_T = gross domestic product for local area k in the last history year
$FD^k_{st,T}$ = state government final demand for local area k in the last history year
$FD^k_{loc,T}$ = local government final demand for local area k in the last history year

For a single-region model, state government employment is predicted based on the assumption that if the number of employees per dollar of final demand in the local area equals or exceeds the state average in the last history year, then the proportion of local demand supplied locally is set equal to one and the additional output is an export from that county. An example of this is a county where the state capitol is located. Likewise, if the number of employees per dollar of final demand in the local area is less than the state average in the last history year, then the proportion of local demand supplied locally is less than one, leading to less local employment than the local demand for state services would, on its own, suggest.

$$RPC^k_{st,T} = ((FD^s_{st,T} / E^s_{st,T}) * E^k_{st,T}) / FD^k_{st,T}$$

$$EXP^k_{st,t} = ((E^k_{st,T} - (FD^k_{st,T} * (E^s_{st,T} / FD^s_{st,T}))) / E^u_{st,T}) * E^u_{st,t}$$

If RPC < 1 $\quad E^k_{st,t} = [(E^u_{st,t}/FD^u_{st,t})/(E^u_{st,T}/FD^u_{st,T})] * (E^s_{st,T} /FD^s_{st,T}) * RPC_{st,T} * FD^k_{st,t}$

If RPC = 1 $\quad E^k_{st,t} = \{[(E^u_{st,t}/FD^u_{st,t})/(E^u_{st,T}/FD^u_{st,T})] * (E^s_{st,T} /FD^s_{st,T}) * FD^k_{st,t}\} + EXP^k_{st,t}$

Where,

$RPC^k_{st,T}$ = proportion of the local demand that is supplied locally for local area k in the last history year
$EXP^k_{st,t}$ = amount of state government employment in local area k based on demand from outside of local area k

For a multiregion model, state government employment is predicted based on the assumption that there is state government "trade" that flows between the regions. Some regions "export" state government employees (e.g. counties where a state capitol is located) while other regions "import" state government employees.

$$EXPMR^{k}_{st,t} = \Sigma({}^{k}f^{s}_{T} * IMPMR^{l}_{st,t})$$

If all regions are in one state $\quad {}^{k}f^{s}_{T} = EXPMR^{k}_{st,T} / \Sigma IMPMR^{l}_{st,T}$

where $l \in s$ and $\Sigma IMPMR^{l}_{st,T}$ = sum of imports for all counties in the state

If a multi-county model when *k* and *g* are not in the same state $\quad {}^{k}f^{g}_{T} = 0$

If positive $\quad EXPMR^{k}_{st,T} = ((FD^{s}_{st,T} / E^{s}_{st,T}) * E^{k}_{st,T}) - FD^{k}_{st,T}$

If negative $\quad EXPMR^{k}_{st,T} = 0$

If positive $\quad IMPMR^{l}_{st,T} = FD^{l}_{st,T} - ((FD^{s}_{st,T} / E^{s}_{st,T}) * E^{l}_{st,T})$

If negative $\quad IMPMR^{l}_{st,T} = 0$

If positive $\quad IMPMR^{l}_{st,t} = FD^{l}_{st,t} - (((FD^{s}_{st,T}/E^{s}_{st,T})*((FD^{u}_{st,t}/E^{u}_{st,t})/(FD^{u}_{st,T}/E^{u}_{st,T}))*E^{l}_{st,t})$

If negative $\quad IMPMR^{l}_{st,t} = 0$

If RPC < 1 $\quad E^{k}_{st,t} = [(E^{u}_{st,t}/FD^{u}_{st,t})/(E^{u}_{st,T}/FD^{u}_{st,T})] * (E^{s}_{st,T} /FD^{s}_{st,T}) * RPC^{k}_{st,T} * FD^{k}_{st,t}$

If RPC = 1 $\quad E^{k}_{st,t} = [(E^{u}_{st,t}/FD^{u}_{st,t})/(E^{u}_{st,T}/FD^{u}_{st,T})] * (E^{s}_{st,T} /FD^{s}_{st,T}) * (FD^{k}_{st,t} + EXPMR^{k}_{st,t})$

Where,

$EXPMR^{k}_{st,t}$ = amount of state government in local area *k* attributable to demand in the other model regions, for time period *t*

${}^{k}f^{s}T$ = state government "trade flow" coefficient for local area *k* within a state *s*, for the last history year

$IMPMR^{l}_{st,t}$ = amount of state government that local area *l* (where *l* ϵ *s*) demands but is not able to supply, in time period *t*

Local government employment is predicted by applying the local government employment per dollar of local government final demand in the county in the last history year, updated for the current year's change in national local government employment per dollar of local government final demand relative to the last history year, to the predicted local government final demand in the local area.

$$E^{k}_{loc,t} = [(E^{u}_{loc,t}/FD^{u}_{loc,t})/(E^{u}_{loc,T}/FD^{u}_{loc,T})] * (E^{k}_{loc,T} /FD^{k}_{loc,T}) * FD^{k}_{loc,t}$$