Creating Communities of Place

DESCRIPTION OF THE OSP INCOME MODEL

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DESCRIPTION OF THE OSP INCOME MODELS

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ABSTRACT

This report describes the principal ideas incorporated into the Office of State Planning (OSP) Income program, a computer program intended to estimate incomes for New Jersey future residents. The program consists of two parts, called models.

The first model, referred to as the *income projection* model, is based on the methodologies described by the U.S. Department of Commerce, Bureau of Economic Analysis in its 1985 OBER Regional Projection model, and on a municipal income estimation model published by the New Jersey Economic Policy Council. In addition to projections of personal income by county, the model estimates average state per capita income, average household income for each of the state's counties, and average per capita income for each of the municipalities in the state. Forecast years are 1995, 2000, 2005, and 2010.

The second model uses the county incomes estimated by the income projection model and estimates the number of households in each of eight income groups. The model is referred to as the *income distribution* model. The income distribution model assumes that data describing the future age and race cohorts of the heads of households can be used to estimate future incomes. A smaller subroutine also estimates the mean income of the eight income groups used in this analysis.

The income program was developed for several reasons. First, it was recognized that income can serve as an additional factor which might be used to allocate housing growth in the OSP Population and Employment Distribution (PED) model, which simulates future land development patterns. Second, county estimates of personal income produced by the income projection model are used to improve the public sector operation and maintenance cost estimates generated by the OSP Operation and Maintenance (O&M) model, a part of the OSP Fiscal Impact series of computer models. Income data also is a major variable in estimating the demand or use of other infrastructure systems. Finally, the income estimates can serve as basic economic building blocks to support other research efforts, such as those estimating housing need and affordability.

I. SUMMARY

The Office of State Planning has developed several computer programs designed to assign trend growth and then to measure the impacts of this growth on selected infrastructure systems and on local and state operational and maintenance budgets. To improve this capacity, the decision was made to augment the growth assignment model to include economic considerations. A first step in this process was to define a methodology to estimate incomes for the future state residents.

The advantage of the modeling, described in this paper, is its ability to estimate county and municipal based incomes based on alternative future scenarios. Many models exist which forecast a variety of average state incomes. Several econometric consulting firms publish estimates of income at the county scale. However, many of the statewide estimates and all of the county scale estimates are costly to obtain. In addition, because only the forecasts are published, one cannot re-estimate incomes based on alternative population, employment, wage or labor force variables. Also, none of the existing forecasts produce income estimates at a municipal scale.

Two income models are presented in this paper. The first, referred to as the "***income projection***" model, estimates mean household and per capita incomes for the state's counties and municipalities. The income projection model primarily is driven by the forecast of future employment. The second model, referred to as the "***income distribution***" model, estimates the number of householders in each of eight income groups, at a county level. The income distribution model assigns householders to income groups based on the age and racial composition of the future population.

Income Projection Model

The OSP income projection model consists of three major parts: the calculation of personal income[1]; the calculation of State mean per capita[2] and the mean household income[3] in each county; and, the calculation of municipal per capita income. Diagram 1 displays the elements of the model.

The model is largely based on the methodology described by the US Department of Commerce in the Bureau of Economic Analysis' (BEA) 1985 OBERS Regional Projections[4]. As such, the model takes forecasts of population and employment, as well as estimates concerning future labor force participation rates, unemployment and wages, and then calculates incomes. However, the scale of the OSP model differs from that found in BEA. The BEA model uses national forecasts and historic state data to estimate state incomes. The OSP model uses many of the BEA methods, but by using county forecasts and county historic data the model produces both state and county specific income estimates. Finally, the OSP model estimates municipal incomes utilizing equations originally published by the New Jersey Economic Policy Council (EPC), Office of Economic Policy.

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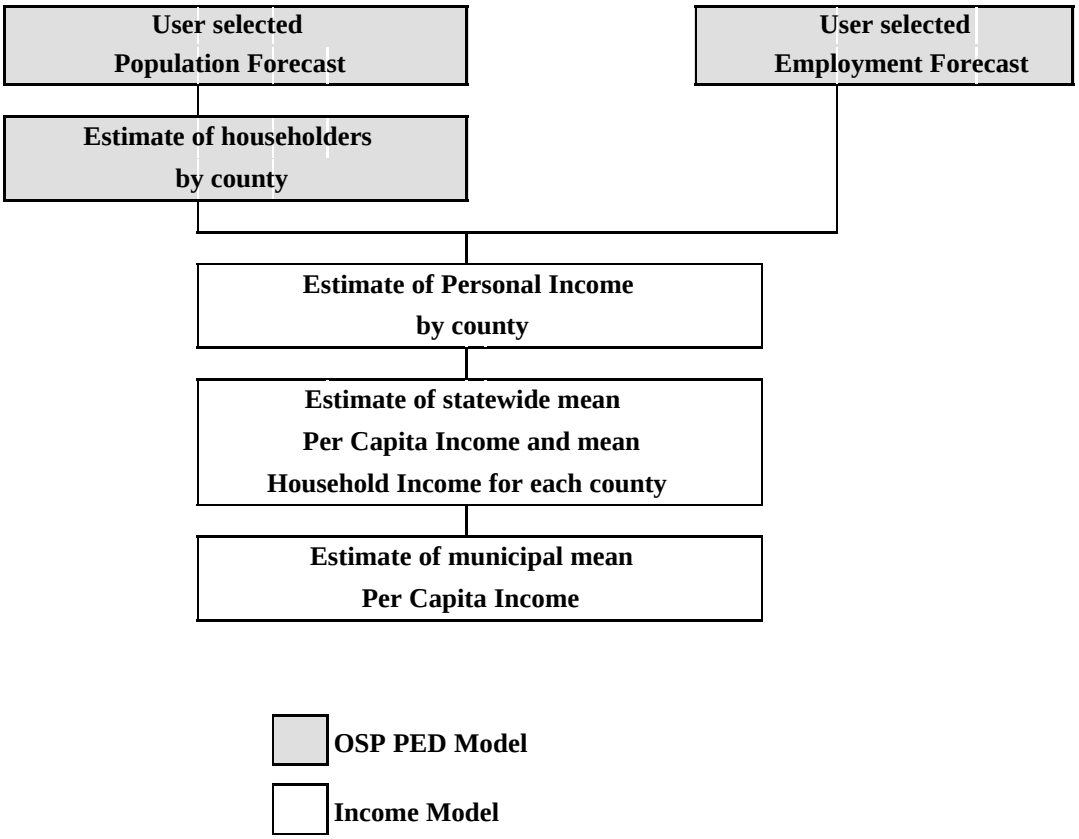
[1]Personal Income consists of the sum of the following items: total residential earnings less farm income (NJDOL does not produce an estimate of farm employment) and Social Security contributions; all residential income from property or property sources, including interest, rent income and dividends; and, transfer payments such as Social Security payments and welfare.

[2]State mean Per Capita Income consists of the total personal income of the state's residents divided by the state's total population.

[3]Household income is produced by subtracting that part of total personal income attributable to county residents living in group housing (dorms, nursing homes, barracks) from the total personal income of the county's residents. Mean household income results by dividing a county's total household income by the number of households in the county.

[4]U. S. Department of Commerce, Bureau of Economic Analysis. 1985 OBERS BEA Regional Projections, Volume 1, State Projections to 2035. Washington, DC : GPO, 1985

Diagram 1
OSP INCOME PROJECTION MODEL



Results produced by the OSP income projection model were compared to other published and available income estimates. Two OSP-modeled estimates of mean Statewide Per Capita income in the year 2010 are displayed in Table S-1, along with comparable income estimates prepared by BEA and by the private econometric consulting firm of Woods & Poole. It can be seen that the statewide results produced by the model are consistent with those forecasted by these agencies. Table S-2 displays the existing (1989) estimate of per capita income prepared by the New Jersey Department of Labor, and all of the forecasts shown in Table S-1, adjusted to 1989 constant dollars. It can be seen that New Jersey's future residents will have per capita incomes similar to those enjoyed by today's residents.

Table S-1
Statewide Per Capita Income for the year 2010

FORECAST	PER CAPITA INCOME	POPULATION	EMPLOYMENT
OSP (Eco. Demo)	$21,644	8,996,600	4,497,000
BEA	$19,401	8,566,525	4,719,000
Woods &Poole	$21,994	9,709,680	6,119,610
OSP (W&P)	$21,423	9,709,680	6,119,610

All amounts are 1985 Dollars

Table S-2
Comparison of Estimated 1990 and Estimated Year 2010
State Mean Per Capita Incomes
(1989 Constant Dollars)

FORECAST	PER CAPITA INCOME
NJDOL (1990)	$23,764
OSP (Eco. Demo) (2010)	$24,631
BEA (2010)	$22,058
Woods &Poole (2010)	$25,007
OSP (W&P) (2010)	$24,357

A comparison of county-scale incomes is shown in Table S-3, which reports mean household income by county as published by Woods & Poole and as estimated in two alternative runs of the OSP model, one using Department of Labor population and employment forecasts and the second using the growth forecasts prepared by Woods & Poole. The table shows that in most counties the OSP model produced slightly lower estimates of income than did Woods & Poole. This result might be attributed to the lack of farm income in the OSP model, or to slightly different assumptions about future wages. However, in several counties (Sussex, Passaic, Somerset, Morris, Middlesex, Hunterdon) the Woods & Poole income forecasts were much higher than those produced by the OSP model. This result might be due to different assumptions concerning the types (not number) of jobs employing residents in these counties.

Table S-3
Mean Household Incomes for New Jersey Counties in the Year 2000

COUNTY	Woods & Poole	OSP (W&P)	OSP (Eco. Demo)
Atlantic	$42,090	$43,261	$43,462
Bergen	$68,158	$59,953	$61,394
Burlington	$53,492	$50,137	$51,277
Camden	$47,855	$48,693	$48,877
Cape May	$39,277	$38,167	$39,775
Cumberland	$42,204	$40,966	$40,738
Essex	$49,358	$48,683	$47,901
Gloucester	$50,924	$45,057	$46,007
Hudson	$47,148	$41,327	$40,026
Hunterdon	$86,424	$54,157	$61,505
Mercer	$50,504	$50,525	$50,751
Middlesex	$65,355	$53,592	$54,010
Monmouth	$57,472	$54,927	$59,627
Morris	$77,271	$63,838	$64,498
Ocean	$46,951	$43,644	$46,786
Passaic	$62,485	$48,543	$48,586
Salem	$44,594	$39,187	$35,759
Somerset	$71,786	$61,668	$64,992
Sussex	$79,283	$45,072	$54,053
Union	$55,653	$57,075	$56,892
Warren	$48,470	$46,314	$46,513

All amounts are 1985 Dollars

Income Distribution Model

The income distribution model is based on research which reports that differences in income can be described according to the demographic characteristics of the heads of households. This result was converted into a forecasting tool by assuming that future changes in the population, especially in the age and race of the heads of future households, can be used to forecast the number of households represented in each of eight income groups. Table 244 of the 1980 Census displays the percentage of households, characterized by the age cohort and race of the household head, in each of eight income groups. Income group 1 represents the lowest mean income and income group 8 is the highest income. This information, referred to as an incomeship table, is displayed in Table S-4.

Table S-4
Incomeship Table
Representation of Race/Age Cohorts in each Income Group
New Jersey 1980

	Income Groups							
White age Cohorts	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**	**Group 7**	**Group 8**
15 to 24	.133122	.191435	.232623	.184974	.12631	.101853	.022382	.007301
25 to 34	.054387	.080801	.141678	.186427	.179019	.229664	.096743	.031281
35 to 44	.004025	.059198	.090182	.135592	.163144	.271914	.178134	.097813
45 to 54	.034685	.051771	.082274	.102537	.123544	.238959	.219186	.147045
55 to 64	.065713	.096955	.120086	.130331	.128789	.203557	.155716	.098853
65 or older	.217827	.27559	.17231	.109287	.071334	.07894	.044858	.029854
Non-White age Cohorts								
15 to 24	.3962	.254938	.167001	.095774	.049282	.027839	.005329	.003637
25 to 34	.188834	.192608	.184148	.145638	.107198	.12399	.043776	.013808
35 to 44	.239947	.134949	.13412	.124442	.103836	.146495	.083783	.032427
45 to 54	.130871	.142698	.152765	.142346	.113828	.167437	.10503	.045026
55 to 64	.209627	.170048	.155881	.12744	.10572	.123066	.072244	.035973
65 and older	.390897	.265064	.130316	.078291	.048479	.051037	.024467	.011449

The decimal fractions (incomeship factors) for each age/race cohort represent the percentage of households, headed by persons from that age/race cohort, in each of the income groups. For example, in 1980 13.3122% of all households headed by white person aged 15 to 24 earned incomes in income group 1. Forecasts of income distribution were obtained by multiplying the number of future households, headed by a person from a specific age/race cohort, times the incomeship factor reported in the 1980 Census.

Two alternatives for the 1980 incomeship factors were prepared, due to concern that the use of 1980 incomeship factors for the age cohort 65+, would result in an under-representation of that group in higher income groups and an over-representation in lower income groups. These adjustments represent prudent alternatives which would simulate the increased future conversion of assets to income, by the state's current relatively wealthy middle aged population. Table S-5 displays the alternative incomeship factors for future households headed by persons aged 65 or older.

Table S-5
Incomeship Alternatives for Houses Headed by Persons Aged 65+

	grp1	grp2	grp3	grp4	grp5	grp6	grp7	grp8
white								
1980 Census	.21782	.27559	.17231	.10928	.07133	.07894	.04485	.02854
50% adjustment	.14177	.18627	.14619	.11980	.10006	.14125	.10029	.06435
25% adjustment	.17873	.23093	.15925	.11455	.08570	.11009	.07257	.04710
non white								
1980 Census	.39089	.26506	.13032	.07829	.04848	.05104	.02447	.01145
50% adjustment	.30026	.21756	.14309	.10287	.07710	.08705	.04356	.02371
25% adjustment	.34558	.24131	.13671	.09058	.06279	.06904	.03641	.01758

Table S-6 presents the resulting estimate of income distribution using the county household income estimates, produced by the Income projection model and shown in Table S-2, and using the incomeship tables using the age 65+ alternative termed 25% adjustment.

Table S-6
Estimated Number of Households in Each Income Group
for the Forecast Year 2010

	Group1	Group2	Group3	Group4	Group5	Group6	Group7	Group8
Atlantic	13361	15401	16110	16440	15781	24032	16577	9613
Bergen	40861	47265	47688	47872	45684	69329	47951	27958
Burlington	24068	26235	26280	25837	23909	35095	23097	12968
Camden	28221	32119	32764	32624	30590	45368	30375	17372
Cape May	4823	6453	6824	7035	6809	10310	7125	4221
Cumberland	6906	8298	8427	8456	7994	11916	8004	4611
Essex	54720	52119	49255	45545	40238	57513	37099	20184
Gloucester	9418	12410	13261	13885	13548	20628	14195	8338
Hudson	27789	31487	32104	31980	30063	44829	30281	17411
Hunterdon	4302	6208	6567	6959	6911	10691	7492	4474
Mercer	20182	22033	22005	21554	19993	29667	19876	11264
Middlesex	33200	40470	414599	41941	40216	61046	42370	24974
Monmouth	28367	36123	36460	36971	35570	54005	38311	22010
Morris	20326	23990	24898	25399	24282	36539	24686	14131
Ocean	20071	28327	29524	30814	30131	45900	31597	18698
Passaic	23115	27368	27888	27935	26418	39518	26871	15604
Salem	3159	3790	3832	3822	3590	5324	3578	2069
Somerset	12000	14604	14984	15284	14783	22657	15827	9318
Sussex	5494	7602	8224	8766	8586	12929	8650	5001
Union	24633	27088	26626	26031	24283	36238	24682	14239
Warren	4131	5169	5200	5258	5028	7543	5128	2998

Mean incomes of each of the income groups also were estimated. The mid-point of the 1980 income group income range was assumed to be the mean value for the group. These assumed 1980 income group mean incomes then were divided by the 1980 State household income, so that each income group was described in terms of its percentage of the state mean household income. These percentages then were multiplied by the estimated future county mean household income to yield a first cut approximation of each income group's mean value. Final values were derived by adjusting these first cut approximations to insure that the total estimate of householders times the estimated mean incomes equaled the total household income estimated for the county in the income model. Table S-7 displays the estimates of mean

household income, for each income group for each county, using the same data reported in the other tables shown in this summary.

Table S-7
Estimated Mean County Household Incomes (1985 constant dollars)
for All Eight Income Groups in the Year 2010

	Mean HH Income	Group1	Group2	Group3	Group4	Group5	Group6	Group7	Group8
Atlantic	$43,467	$5,584	$14,928	$24,272	$33,616	$42,959	$56,975	$80,335	$94,350
Bergen	$61,396	$8,567	$21,765	$34,963	$48,160	$61,358	$81,155	$114,149	$133,946
Burlington	$51,283	$9,254	$20,278	$31,302	$42,326	$53,349	$69,885	$97,445	$113,981
Camden	$48,882	$7,790	$18,298	$28,806	$39,313	$49,821	$65,583	$91,852	$107,614
Cape May	$39,790	$4,324	$12,878	$21,431	$29,984	$38,538	$51,368	$72,751	$85,581
Cumberland	$40,737	$6,058	$14,815	$23,572	$32,329	$41,086	$54,221	$76,113	$89,249
Essex	$47,908	$11,727	$22,026	$32,324	$42,622	$52,921	$68,368	$94,114	$109,562
Gloucester	$46,008	$4,738	$14,628	$24,518	$34,408	$44,298	$59,133	$83,857	$98,692
Hudson	$40,028	$6,229	$14,833	$23,438	$32,042	$40,646	$53,553	$75,064	$87,971
Hunterdon	$61,506	$4,996	$18,218	$31,439	$44,660	$57,882	$77,714	$110,767	$130,600
Mercer	$50,754	$8,845	$19,755	$30,665	$41,575	$52,486	$68,851	$96,126	$112,492
Middlesex	$54,012	$6,881	$18,491	$30,102	$41,712	$53,323	$70,738	$99,765	$117,180
Monmouth	$59,630	$7,482	$20,301	$33,119	$45,937	$58,755	$77,982	$110,028	$129,255
Morris	$64,498	$8,839	$22,704	$36,568	$50,433	$64,297	$85,094	$119,755	$140,552
Ocean	$46,786	$4,720	$14,777	$24,834	$34,891	$44,948	$60,034	$85,177	$100,263
Passaic	$48,586	$7,087	$17,531	$27,975	$38,419	$48,863	$64,529	$90,640	$106,306
Salem	$35,738	$5,487	$13,169	$20,851	$28,534	$36,216	$47,739	$66,945	$78,469
Somerset	$64,992	$7,767	$21,738	$35,708	$49,679	$63,650	$84,606	$119,533	$140,490
Sussex	$54,046	$5,527	$17,145	$28,763	$40,381	$51,999	$69,425	$98,470	$115,897
Union	$56,896	$9,635	$21,865	$34,096	$46,326	$58,554	$76,902	$107,478	$125,823
Warren	$46,511	$6,364	$16,362	$26,360	$36,356	$46,356	$61,353	$86,349	$101,346

Uses for the Income Model

The results of the model can used for a variety of purposes, in addition to improving OSP's population and employment distribution model. First, the income projection data can be used to improve the performance of the Office of State Planning's model which estimates Public Sector Operation and Maintenance (O & M) Costs[5]. This O & M model used EPC-developed municipal estimates of per capita income to estimate public sector revenues and expenditures. While the EPC equations are sensitive to changes in employment, they are insensitive to changes in the type of employment or changes in wages. By linking the EPC model to the results of the income projection model, better estimates of future O & M costs can be calculated, since the resultant municipal income forecasts will reflect the income projection model's sensitivity to sectorial changes in the state's economy. But perhaps the most beneficial use for the income model is to produce estimates of the income characteristics of the future population, which could be used to analyze housing affordability and to test land development policies that might influence housing prices.

The remaining sections of this report describe in detail the research, methodologies and rationals used in developing the income program's models. The following summarizes each of the remaining chapters in this report:

Chapter 2 - The reasons for performing the study;
Chapter 3 - Detailed description of the income model and its results;
Chapter 4 - Detailed description of the income distribution model and its results;
Chapter 5 - Identification of related research subjects resulting from this analysis.

[5]New Jersey Office of State Planning. **Draft**: Projecting State and Local Operating Budgets under Various Growth Scenarios. Trenton, NJ: OSP, 1990

II. ORIGINS OF THE MODEL

Expert Review

Since September 1987 the Office of State Planning has been developing two computer models intended to distribute population and employment (PED model) to municipalities in order to simulate New Jersey's future land development. The first model assigns growth based on historic growth rates and patterns. This model is referred to as the "Trend" growth forecast. Once this model was completed, a "Plan" simulating model could be developed by modifying the Trend model to include State Development and Redevelopment Plan policies. By using these models the differences between Trend and Plan could be quantified and studied.

At the heart of the Trend model are three major concepts. First, growth assignments to regions (counties or groups of counties) are the product of forecasts or projections developed by other agencies. This concept assumes that the purpose of the State Plan is to accommodate growth and that the effect of Plan's policies would be to distribute growth differently than Trend. Second, growth is allocated from regions to municipalities based on the historic growth rate of the municipalities. Third, only that part of the regional growth allocation that can be developed, given each municipality's development character (density) and supply of available land, is ultimately included in the municipality's growth forecast. Growth that cannot be locally accommodated is reassigned to other municipalities in the region. The Trend model assumed that if land was available for development then all locations were equally attractive for development, and that all demand could locate anywhere there was land and a history of growth.

In March 1988 and again in April 1990, research projects completed by the OSP were reviewed by a committee of planning, demographic, economic and computer modeling experts. During these reviews, panelists recommended that the OSP Trend growth model could be improved by including economic considerations in the growth simulation model[6]. During the March 1988 expert review session, a panelist[7] recommended that the OSP model's municipal growth assignments needed to become sensitive to local market conditions, such as the existing price for land and/or facilities and the local effects of diminished land supply to land cost as municipalities develop. During the April 1990 expert review sessions, it was recommended[8] that the OSP modeling needed to take into account more economic variables or economic incentives, e.g., the comparative price of land in rural and suburban locations, the local package of tax rates and services.

Study Definition

In consideration of the comments received about the PED model, planning and regional economic literature was reviewed to identify critical elements that needed to be added to the model. This review identified the importance of income as a variable in any supply and demand equation. It also identified personal income as the most general measure of economic activity and income[9]. From an estimate of total personal income, other computer models might be constructed to estimate the location of growth, given the price/income characteristics of each municipality. Therefore, the research and social

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[6]The OSP model assigns growth based on historic growth rates and analysis of land availability. By definition, the growth produced by the model assumes that the suburban growth patterns established after WWII would continue to absorb increasing development levels until saturated. The model is based on growth patterns described in the OSP publication Population Trends and Projects, June 1989.

[7]Dr. Robert Burchell, Research Professor at the Rutgers University, Center for Urban Policy Research.

[8]Dr. Michael Danielson, Professor of Politics and Public Affairs, Woodrow Wilson School, Princeton University and Dr. Julian Wolpert, Professor of Geography, Public Affairs and Urban Planning, Woodrow Wilson School, Princeton University.

[9]U.S. Department of Commerce, Bureau of Economic Analysis. 1985 OBERS BEA Regional Projections, Volume 1, State Projections to 2035. Washington, DC : GPO, 1985

science literature was analyzed to determine alternative methods to estimate personal income. Two general approaches were identified, an input-output model and a step-down model.

In an input-output model the workings of the economy and the interrelationships of parts of the economy are simulated by equations. The model derives its name because certain information thought to be crucial, such as total population and employment trends, are put into the model. The model would then produce, or output, forecasts of basic economic significance, such as future Gross National Product (GNP). From an input-output model additional calculations can produce estimates of personal income.

A step-down model takes selected results from a regional or national input - output model, and estimates that portion of the total regional growth that might occur locally. For example, a step-down model might take national estimates of GNP, estimate growth by industrial groups, assign part of that growth to a state, and, finally, estimate the state's future employment. From the estimate of employment and wages, personal income can be derived.

In addition to a step-down model, incomes produced by such a model needed to be distributed to future households. Without such data an estimate of mean county income would be of marginal use. For example, if the future mean county household income were $50,000, does this mean that all households had incomes of $50,000, or does it mean that half of the households had very low incomes and half had very high incomes? Therefore, a model to estimate the distribution of incomes was identified as an equally important element of this study.

III. INCOME PROJECTION MODEL

Overview

The OSP income projection (IP) model is a type of step-down model, because it is reliant on population and employment forecasts produced at a national scale, and then estimates the income implications of the forecasted mix of people and jobs at a state, county and municipal scale. It is patterned after two methodologies. Part of the IP model is based on methods described by BEA to estimate state incomes given population and employment forecasts for each state and historic data about earning and wages in each state. The IP model develops income estimates for the state's counties, given county scale forecasts and county scale historic data. An additional subroutine in the IP model then steps the county forecasts down to municipalities by modifying the separately forecasted municipal income estimates produced by another methodology (originally published by the former New Jersey Economic Policy Council, Office of Economic Policy[10]) to conform with the county-scale income estimates. However, because the municipal estimates produced by the "EPC" model are "modified" to equal the county income forecasts developed using the BEA model, it can be argued the IP model is principally based on the BEA model.

The income model first estimates personal income by separately calculating its component elements for each county in New Jersey. Personal income consists of three income components: earnings; property and proprietary income and transfer payments. The following text briefly describes the how each type of income is calculated.

> earnings - County-located job estimates are multiplied by the estimated future wage for each type of job to yield total estimated wages for all jobs in the county. This total worker wage is converted into total residential earnings utilizing a relationship between the ratio of county located jobs and households, and the ratio of county worker earnings and county household earnings. Finally, an estimated Social Security tax is deducted to yield total household earnings.
>
> property and proprietary income - Property and proprietary income are calculated at 22% of earnings.
>
> transfer payments - Two types of transfer payments are calculated: pensions to the elderly and public assistance payments. "Pension" payments are calculated by `paying' all persons aged 65 or older an amount equal to 4.3% of earnings to simulate Social Security payments, and an amount equal to 84% of the state average property and proprietary income to simulate other old age and retirement payments. Welfare payments were estimated based on a demographically sensitive regression analysis.

Once personal income for each county is calculated, other types of incomes can be determined. The sum of all county estimates of earnings, property and proprietary incomes and transfer payments (all personal incomes for all the counties) equals the total personal income for the state. The sum of all statewide personal income divided by the total state population results in mean state per capita income. Household income by county was estimated by subtracting the estimated personal income for persons living in group housing (college dorms, military barracks, prisons, nursing homes) from the total personal income in each county and then dividing the total residual household income by the total number of future households.

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[10]Joseph Seneca, Adam Broner, Lawrence Falk and Jong You, "Managing the State Economy: The Fiscal Implications of Growth and Decline," in 18th Annual Report of the Economic Policy Council and Office of Economic Policy (Trenton: State of New Jersey, 1986).,pp. 3-39.

DIAGRAM 1
PERSONAL INCOME MODEL ELEMENTS

* earnings

- Employment by 2 digit sector by county
- BEA estimate of future wages by sector (state wide)
- Wage adjustments by county based on historic wage data
- Adjustment of county residential earnings
  - % work in county
  - % work outside county
- Social security netted from earnings

*transfer payments

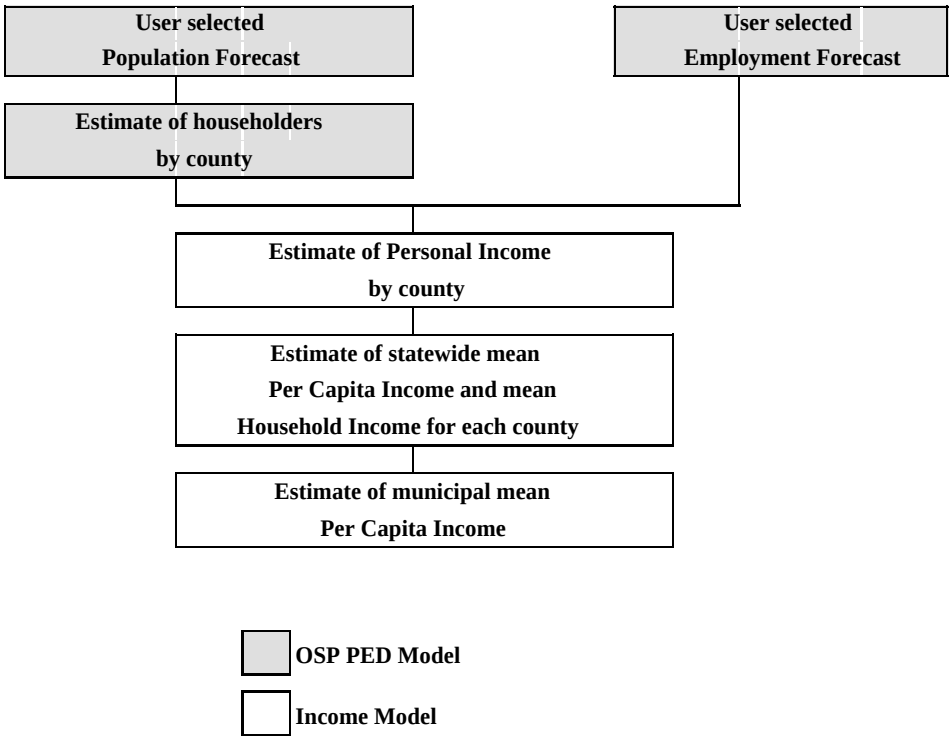
- Pensions
  - social security
  - retirement income
- Public Assistance
  - user selected % unemployment
  - user selected labor force participation rate
  - statistically significant estimate of welfare by demographic group

*property income

- Fixed % of earnings

The final part of the IP model estimates municipal per capita income. The model utilizes a method to estimate municipal per capita income, based on the changes in municipal population and employment, developed by the NJ Economic Policy Council (EPC). The IP model then adjusts the results of the EPC model so that the sum of its county's municipal incomes are equal to county-based estimates of total personal income developed by the OSP model.

DIAGRAM 2
OSP INCOME MODEL



The remainder of this chapter describes the algorithms, data, and research findings utilized in the IP model. Separate sections describe the methodologies used to estimate each of the following: personal income, household income, per capita income, and municipal per capita income.

Personal Income

The algorithms, used to calculate personal income, use data produced by other OSP models and require that the model user enter several other parameters by selecting from alternatives offered in the program. The model utilizes data produced by the OSP population and employment distribution model[11] (PED model). The PED's user-selected population forecast provides detail about the size of the future population and its characteristics (age, race and sex). The employment forecast selected during the PED model provides the basis to identify the number of future county-located jobs identified by two digit Standard Industrial Code (SIC). Another input to the income model is the PED model's estimate of householders, persons living in group quarters, and future households. Additional user-selected inputs to the model are an estimate of the future year unemployment rate and an estimate of the future year labor force participation rate. The model also contains data or assumptions, discussed in the following text,

[11]New Jersey Office of State Planning. **Draft**: Distributing Population and Employment Forecasts to Municipalities. Trenton, NJ: OSP, 1990

concerning: employment by type of industry; future state-wide wages and regional wages; future Social Security tax rates; and future social security payments and other retirement payments.

Earnings

Earnings consist of the total wages paid to residents of a county, regardless of the location of the resident's jobs (in-state or out-of-state), less all Social Security tax payments. The approach used to calculate earnings is based on the method reported by the U.S. Department of Commerce, Bureau of Economic Analysis, as cited earlier in this report. As developed by BEA, the method is part of a model designed to step-down state forecasts from the national input-output model, and then to estimate various economic indices including personal income.

The BEA method first estimates the earnings that would result from all jobs located in a state, regardless of whether the job is held by a state resident. This estimate of total earning for all jobs in the state is then multiplied by the historic ratio of state's residential earning to the earnings from all jobs located in the state to yield residential earnings. The OSP model uses a similar approach, except that it uses a worker-earnings-to-resident-earnings adjustment factor based on the ratio of future jobs to future households in the county. The following general algorithm describes the earning-estimating process.

Earnings = ((Jobs x Wages) - Social Security) x Residential Earnings Adjustment

The following parts of this section describe each of the elements in the above equation.

Jobs - The estimate of total future jobs in each county is obtained from user-selected or user-entered decisions made in the PED model. This total employment forecast is distributed into an estimate of employment in each of ten specific type of industries[12] by multiplying the forecast by the percentage of total county employment represented by each industry. Where detail about this industrial distribution is included in the forecast of employment, the model uses the exact percentage derived from the forecast itself. Where such detail is not provided, the model uses percentages derived from the N.J. Department of Labor's, Economic - Demographic[13] projection[14]. The result of this phase is an estimate of total employment in each of ten types of industry for each county.

Wages - Two separate steps are used to estimate wages. First, estimates of future average statewide wages, by type of industry, were derived from information published by BEA. Specifically, BEA publishes estimates of total future employment by type and total future wages by type of employment for New Jersey[15]. Statewide wages were derived by dividing total wages by total workers for each type of industry. The results were then converted from 1972 constant dollars to 1985 constant dollars, so that the wages would be expressed

[12]The industries are those identified by a two digit identification in the Standard Industrial Classification (SIC) and include: Mining, Construction, Manufacturing, Transportation, Communications and Utilities, Wholesale, Retail, Finance and Insurance and Real estate (FIRE), Services, and Public sector employment.

[13]NJ Department of Labor, Division of Labor Market & Demographic Research, Bureau of Occupational Research. Employment Projections Volume III: Industry Outlook for New Jersey 1986 - 2000. Trenton, NJ: DOL, 1989

[14]The DOL report cited in footnote 13 provided information up to the year 2000. Additional unpublished forecasts were provided to OSP by DOL for the years 2005 and 2010.

[15]U. S. Department of Commerce, Bureau of Economic Analysis. 1985 OBERS BEA Regional Projections, Volume 1, State Projections to 2035. Washington, DC : GPO, 1985 p. 64 - 65.

in the same dollar format used elsewhere in OSP's models. Future average statewide wages were developed for each industry from the BEA data for the years 1995, 2000, 2005 and 2010.

The second step estimates a county-specific factor for each type of industry so that statewide wages can be adjusted to reflect regional payment differences. Data about employment and wages in 1982 and 1985, by industrial type, were collected by OSP from ES 202[16] files maintained by the NJ Department of Labor. The data in these ES 202 files report both statewide and county at-place employment identified by type of industry and the average wage paid to employees in that industry. From this data set, average wages for each of the ten, two-digit, SIC industries were constructed by dividing total workers in an industry by total wages paid to workers in that industry. The average wage paid to workers in the same industry in each county then was divided by the statewide average wage to produce a county wage payment factor.

Future year estimates of wages were produced by multiplying the appropriate (year and industry type) state-wide average wage by the county payment adjustment factor for that industry to produce an estimate of the average wage paid by industry in each county in the state.

Social Security Tax Rates - Future Social Security rates were taken from the BEA Regional Projection publication cited earlier in this report (BEA OBERS 1985). The rates used in the model are: for 1995, .075; for 2000, .079; for 2005, .083; and, for 2010, .096.

Residential Earnings Adjustment - BEA adjusts the ratio of state-located job-earnings to state residential-earning using historic ratios of worker earnings to residential earnings. This adjustment to wages is necessary because in many states significant numbers of residents work out of state and in other states many of the state-located jobs are held by out-of-state workers.

However, OSP was unable to find data of this type at a county scale. In addition, had such data been available for a single year, its use might have been questionable since the smaller scale of a county might be more susceptible to short term change. For example, the rapid growth of casino jobs in Atlantic City might result in a fundamental change in the numbers of persons living and working in the county. (The increased concentration of jobs, together with increased access via rail and roadway might result in significantly more out-of-county workers and earnings, than might have been predicted by historic data.) Therefore, due to this lack of time series data, a different method had to be devised to estimate county residential earnings.

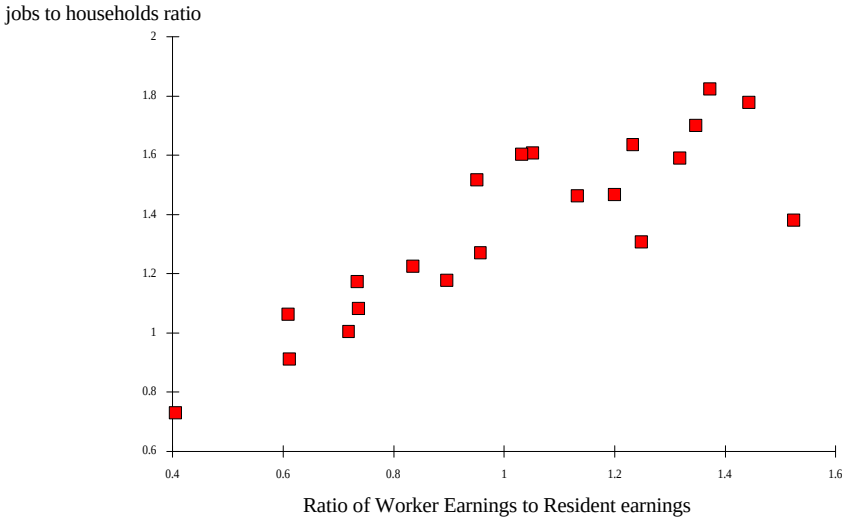
Therefore, OSP examined the hypothesis that the ratio between worker earnings (wages for all jobs located in a county) and residential earnings (wages for all county resident workers) was correlated with the ratio between the number of jobs and the number of households in the county. This relationship assumed that if there were more jobs than households, then worker earning would be greater than residential earning. Conversely, if there were

[16]ES 202 files summarize information about at-place employment and wages. The data for these files are state-required reporting by employers, part of the process to provide unemployment insurance to employees.

more households than jobs, residential earnings would be greater than worker earnings. If this relationship was true than the wages adjustment could be based strictly on the known information about the number of jobs and the number of households estimated in the PED model.

Data about numbers of jobs and worker earnings were compiled from the ES 202 files for 1982. (Data for 1980 were not available.) County information about the number of households with earnings and the average earnings was taken from the 1980 US Census[17]. Chart 1 displays the results of mapping the ratio of worker earnings to household earnings and the ratio of county-located jobs to county located households for each of the state's counties.

CHART 1
RATIO OF WORKER EARNING TO HOUSEHOLD EARNINGS
COMPARED TO THE RATIO OF JOBS TO HOUSEHOLDS



A regression of the data was produced with a resultant R^2 of .48683. This modest correlation probably resulted from the smallness of the sample and possibly differences in the relationship of the two ratios that might reflect real conditions unique to each county, such as proximity to Philadelphia or New York. Therefore, the method to estimate household earnings, given computed worker earning and estimates of the number of jobs and households in each county, used the regressed best fit line equation of Y = 1.295015X to produce a first estimate of the adjustment. Then, this first estimate was adjusted along the Y axis to its 1980 location (relative to the best fit line predicted in the equation), so that the uniqueness of the county was simulated.

The result of this portion of the earnings equation is an estimate of residential earnings for householders. To these householder earnings must be added the earnings of non-householder (group quarters) county residents. This final adjustment is made later in the model.

[17]US Department of Commerce, Bureau of the Census. 1980 Census of Population, General Social and Economic Characteristics - New Jersey, Volume 1. Washington, DC : GPO, 1983 table 180

Property and Proprietary Income

BEA projects property and proprietary income[18] utilizing the historic ratio of property income per capita for a state compared to the property income per capita for the nation. The resulting ratio is multiplied by the national projected property income estimate to yield property income per person in the state. Finally, this per capita estimate was multiplied by the future population to result in an estimate of total property income for the state.

The result of this BEA method was utilized in calculating property income in the OSP model. BEA reports property income and total earnings in its forecast for New Jersey (BEA 1985, table 1). OSP divided the total BEA estimate of property income by the total estimate of earning, and noted that the result was very close to a constant rate of 22%. Therefore in the OSP estimation of property income, it is assumed that property and proprietary income can be estimated as follows:

(earnings) X (.22) = property and proprietary income

An additional assumption made by OSP was that this equation also applied if the property income constant were multiplied by either household earnings or group housing earnings. The basis for this assumption is the knowledge that the BEA method used to calculate property income is founded on a per capita basis.

The result of this phase is the estimation of residential household property and proprietary income. As with earnings, the model subsequently will calculate and include property income from persons living in group quarters.

Transfer Payment Income

The OSP model separately estimates income accruing to retirees, including Social Security payments, income from private retirement programs (pensions) and income to persons receiving public assistance. The following describes the methods used to calculate each type of transfer payment.

> Social Security - BEA estimates that the future total Social Security payments, together with unemployment compensation, will equal .043 times earnings. This constant method is incorporated into the OSP model.
>
> Public Assistance - OSP investigated several methods to estimate public assistance payments, including the use of a per capita multiplier and the identification of specific population groups that might be correlated with payments. Results from the multiplier method seemed unable to reflect likely changes in the population. For example, the fertility decline since the 1970's results in a reduced future worker-age cohort. Perhaps because of this reduced labor force at a time of employment growth, forecasts predict higher labor force participation rates[19]. These circumstances suggest that fewer people would be in need of assistance, resulting in a lowering of the payment per capita. Sufficient data to develop a graduated per capita compensation schedule was not available.

[18]BEA identifies the income as "dividends, interest and rent", not property and proprietary income. It is assumed in this paper that the BEA income is equivalent to the income referred to as property and proprietary income.

[19]The ratio of persons employed or actively seeking work divided by the total number of persons produces the labor force participation rate. Rates typically are prepared for groups of persons with similar characteristics, such as age, race and sex.

Extensive data to identify a population group correlated to public assistance payments also could not be discovered. However, the 1980 Census reported data about the amount of public assistance paid to householders[20] in each county. In addition, the NJ Department of Labor was able to supply information about the age, race, and sex of the 1980 population as well as information about the labor force participation rate organized by age, race, and sex cohorts. From this DOL data it was possible to determine the number of persons in each cohort who were in the labor force (either working or seeking work), the number of persons not in the labor force, and, finally, the number of persons not in the labor force nor employed. It was reasoned that, since public assistance is dependent on income qualification levels, there might be some relationship between persons not working and public assistance payments. Despite the limited sample size, restricted by the data to 21 data points (one for each county), a correlation with an R^2 of .88 was discovered between the number of black females not employed and the total amount of public assistance paid to householders[21], as reported in the Census. Chart 2 displays the relationship. In the chart, the shaded points represent the intersection of the population cohort and the public assistance payment while the open points display the location of the best fit line regressed from the data.

Based on this correlation, OSP developed its methodology to estimate future public assistance payments. The number of working-aged black females, by county, was determined from the population forecast. The model user then selects a labor force participation rate from one of the tables included in the model, including the 1980 labor force participation rate, and forecasted future labor force participation rates for the years 1995, 2000, 2005 and 2010 prepared by the New Jersey Department of Labor[22]. In fact the OSP model allows the user to select any of the years (1980, 1995, 2000, 2005 or 2010) and use that year's participation rates as a constant, regardless of the model's forecast year. The OSP model also requires the model user to select a future unemployment rate from choices ranging from 2% to 14%. The following algorithm is used in the model.

(total black females) X (labor force participation rate) X (1-unemployment rate)=
number of black females employed

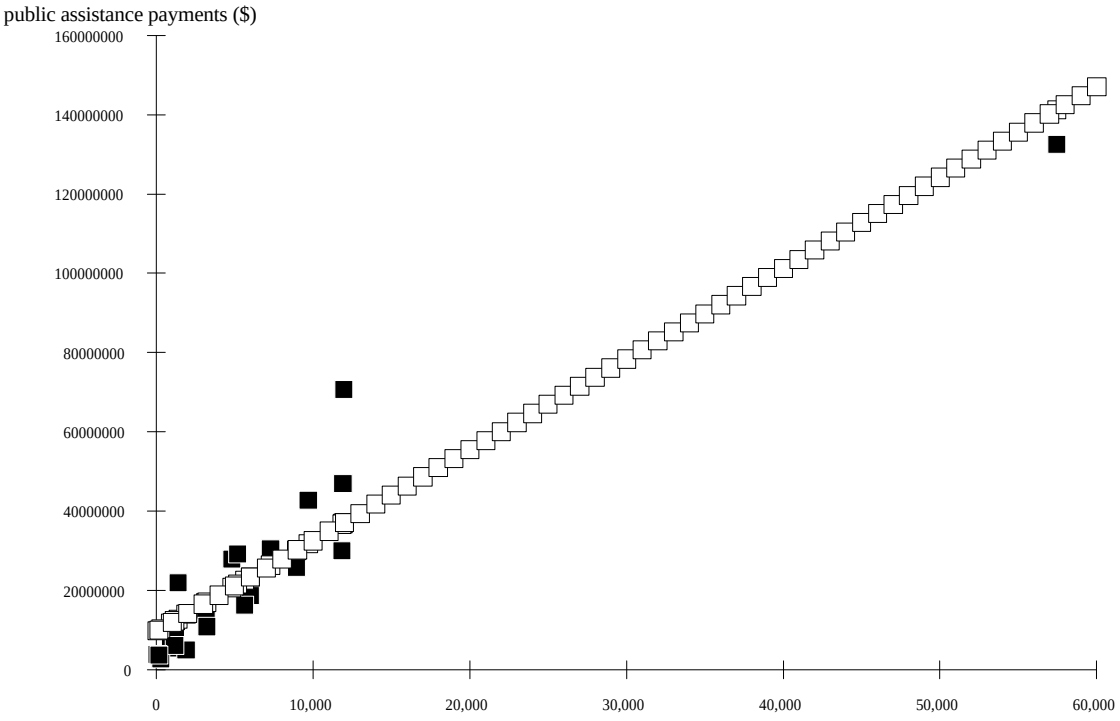
(total black females) - (number of black females employed) =
number of black females not working

[20]US Department of Commerce, Bureau of the Census. 1980 Census of Population, General Social and Economic Characteristics - New Jersey, Volume 1. Washington, DC : GPO, 1983 table 180

[21]Other racial and sex groups were tested as part of this analysis, but correlations of these groups showed either no relationship to public assistance or less correlation. For example, the group all women showed significance and displayed moderate R squared values, while the group white females showed significance, but very low R squared values. The best fit was achieved using black females not working, as described in the text.

[22]NJ Department of Labor, Division of Labor Market & Demographic Research, Bureau of Occupational Research. Population and Labor Force Participation Projections for New Jersey: 1990 to 2030, Volume 1. Trenton, NJ : JNDOL, 1989

CHART 2
COMPARISON OF BLACK FEMALES NOT WORKING
TO PUBLIC ASSISTANCE PAYMENT



The resultant estimate of black females in each county not working nor in the labor force is input to the regressed best fit equation and produces an estimate of public assistance payments to householders in the future year. Finally, since the regression is based on 1979 dollars, the estimate of total payments is inflated to 1985 dollars, consistent with all other costs or revenues in the OSP model.

Pensions - The final element of transfer payments, according to BEA, consists of income to persons over the age of 65 derived from "old-age, survivors, disability and health insurance (OASDHI) programs and under government employee retirement programs"[23]. BEA further estimates that the total per capita value of these payments to persons aged 65+ will equal 84% of the total per capita personal income (BEA 1985, p. xii). Given that this category of payment is the last element of total personal income for persons living in households, it is possible to solve this problem using the following algorithm.

[23]U.S. Department of Commerce, Bureau of Economic Analysis. 1985 OBERS BEA Regional Projections, Volume 1, State Projections to 2035. Washington, DC : GPO, 1985 p. xi.

$$\frac{\text{Earnings + Property + SS + PA}}{\text{(pop 65+/total pop)}} = \text{total HH pension income}$$

$$\frac{\text{total HH pension income}}{\text{(total pop - total grp. qrts)}} = \text{total est. HH PI}$$

total est. HH PI X .84 X pop 65+ = total pensions

where

Pop = Population
PI = Personal Income
HH= Household
SS = Social Security income
PA = Public Assistance income
grp. qrts =persons living in group quarters

Per Capita Income Calculation

If the products of all the incomes produced by the model are added together it results in an estimate of total householder personal income. Dividing this number by the total number of householders yields total per capita personal income for all persons living in households. Per capita income for persons living in group quarters was estimated by using the statewide per capita incomes reported in the 1980 Census[24]. In 1979 per capita income in households was $8,224.00 while per capita incomes for persons living in group quarters was $2,965.00. Total per capita personal income for persons living in group quarters was estimated by multiplying the per capita personal income for persons living in households by .36053 (2965/8224). Total personal income for persons living in group quarters was estimated by multiplying the total number of group quarter dwellers times the resultant estimate of per capita personal income for persons living in group quarters.

Total personal income then was estimated by adding the total personal income for householders and the total personal income for persons living in group quarters.

Estimation of County Household Income and Statewide Per Capita Income

The IP model aggregates data at the county scale, and separately calculates householder income and group quarter income. In addition, the PED model calculated the total number of future households for any and all counties. Therefore, average household income for any county was determined by dividing that county's total householder personal income by the estimated number of households in that county.

Mean statewide per capita income is calculated by dividing the total personal income by the total population of the state.

Estimation of Municipal Per Capita Income

OSP previously published a methodology to estimate future public sector Operational and Maintenance costs[25]. An important element in that method was the projection of municipal per capita incomes based on statistical analysis preformed and published by the NJ Economic Policy Council (EPC),

[24]US Department of Commerce, Bureau of the Census. 1980 Census of Population, General Social and Economic Characteristics - New Jersey, Volume 1. Washington, DC : GPO, 1983 table 71

[25]New Jersey Office of State Planning. **Draft**: Projecting State and Local Operating Budgets under Various Growth Scenarios. Trenton, NJ: OSP, 1990

Office of Economic Policy[26]. While that analysis reported the relationship between changes in the number of persons and jobs in a municipality and changes to the per capita income of the municipality, its estimate of per capita income did not account for changes in the type of employment, future changes to wages, or changes in the composition of the labor force. Although it could be argued that this model might be useful to estimate relative (one municipality to another) incomes, its estimates of per capita income are suspect.

The IP model estimates municipal per capita income by marrying the BEA and EPC models. The sum of the EPC model's estimate of municipal per capita income in each county is modified to agree with the county estimates of total personal income, generated by the BEA-based IP model. Individual municipal per capita incomes result from this shift-share like adjustment. The result is an estimate of municipal per capita income that is sensitive to changes in the nature of employment, demographic changes, and shifts in the relationship of people and jobs.

Comparison of Forecasts

The results of the OSP income projection model have been compared to the statewide per capita income estimates produced by the BEA 1985 OBERS model and by Woods & Poole[27], and to the county-based mean household income forecasts published by Woods & Poole Economics, Inc.[28,29] These comparisons were done for two reasons. The first reason was to see if the results of the OSP model could emulate the products of the BEA model, upon which the OSP model was based. The second was to display the extent to which the OSP model might produce results similar to the Woods & Poole model, if the OSP model were to use the Woods & Poole forecasts of population and employment.

Table 1 displays the statewide per capita incomes forecasted by the various models. The OSP model listed first in the table uses the population and employment forecasts from the NJ Department of Labor's Economic and Demographic model. The second OSP estimate was produced using Woods & Poole population and employment estimates.

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[26]New Jersey Economic Policy Council, Office of Economic Policy. "The Fiscal Implications of Growth and Decline", 18th Annual Report. Trenton, NJ: EPC, 1986

[27]The Woods & Poole estimates are the product of two models. First, a national input-output model is run. Secondly, W & P has divided the United States into 183 economic subregions. For each of these subregions employment is separately estimated using a method W&P refer to as an "export-base" model. In this model all employment is termed basic or nonbasic; basic being industries dependent on national or international economies. Steel production is an example of a basic industry. Growth in nonbasic industries is linked to the growth of basic industries. For each subregion W&P's model includes historic data about employment growth, wages etc. The employment of each subregion then is independently calculated and adjusted to agree with the results of the national forecast. From the regional estimates of employment and population, forecasts of wages and then income are derived.

[28]Woods & Poole Economics, Inc. 1987 New York and New Jersey State Profile. Washington, DC : W&P, 1987

[29]Several private econometric firms produce income estimates including: Data Resources Incorporated (DRI), Woods & Poole Incorporated (W&P), and Wharton Econometric Forecasting Associates (WEFA Group). The state subscribes to the WEFA forecasts but these forecasts have a projection horizon of five years. DRI forecasts are available for all of the forecasts years (1995, 2000, 2005 and 2010), however OSP does not subscribe to this service and therefore cannot use these proprietary estimates.

Table 1
Statewide Per Capita Income for the year 2010
(1985 constant dollars)

FORECAST	PER CAPITA INCOME	POPULATION	EMPLOYMENT
OSP (Eco. Demo)	$21,644	8,996,600	4,497,000
OSP (W&P)	$21,423	9,709,680	6,119,610
BEA	$19,401	8,566,525	4,719,000
W&P	$21,994	9,709,680	6,119,610

All of the estimates of mean state per capita income produce similar results, The possible exception is the BEA model which produced an income estimate about 10% lower than the OSP or Woods & Poole models.

Table 2 compares the 2010 forecasts with a recent (1990) estimate of state mean per capita income ($23,764)[30]. Converting the model estimates to a 1990 constant dollar base results in a year 2010 set of forecasts which range from a low (BEA) of $22,058 to a high (W&P) of $25,007. If the forecasts are correct, the real income of the average New Jerseyan will grow little, if at all, by the year 2010. This income stagnation might be due to the decline of work-age persons in the labor force, to an increase in the percentage and number of elderly, and/or to the increased importance of service type jobs, which tend to have lower wages than do other types of employment, such as manufacturing.

Table 2
Comparison of Estimated 1990 and Estimated Year 2010
State Mean Per Capita Incomes
(1989 Constant Dollars)

FORECAST	PER CAPITA INCOME
NJDOL (1990)	$23,764
OSP (Eco. Demo) (2010)	$24,631
BEA (2010)	$22,058
Woods &Poole (2010)	$25,007
OSP (W&P) (2010)	$24,357

Forecasts of average household incomes also were produced by the OSP model and are compared to the estimates published by Woods & Poole Inc. Again two OSP forecasts are reported: one developed using the NJDOL Economic Demographic model's projections of population and employment, and the second OSP model using the Woods & Poole population and employment estimates. (See Table 3).

[30]NJ Department of Labor. "Economic Brief," New Jersey Economic Indicators. Trenton, NJ : NJDOL, May 1990 p.9

Table 3

Mean Household Incomes for New Jersey Counties in the Year 2010

COUNTY	Woods & Poole	OSP (W&P)	OSP (Eco. Demo)
Atlantic	$42,090	$43,261	$43,462
Bergen	$68,158	$59,953	$61,394
Burlington	$53,492	$50,137	$51,277
Camden	$47,855	$48,693	$48,877
Cape May	$39,277	$38,167	$39,775
Cumberland	$42,204	$40,966	$40,738
Essex	$49,358	$48,683	$47,901
Gloucester	$50,924	$45,057	$46,007
Hudson	$47,148	$41,327	$40,026
Hunterdon	$86,424	$54,157	$61,505
Mercer	$50,504	$50,525	$50,751
Middlesex	$65,355	$53,592	$54,010
Monmouth	$57,472	$54,927	$59,627
Morris	$77,271	$63,838	$64,498
Ocean	$46,951	$43,644	$46,786
Passaic	$62,485	$48,543	$48,586
Salem	$44,594	$39,187	$35,759
Somerset	$71,786	$61,668	$64,992
Sussex	$79,283	$45,072	$54,053
Union	$55,653	$57,075	$56,892
Warren	$48,470	$46,314	$46,513

All amounts are 1985 Dollars

In most of the counties the OSP model's estimate of income is slightly less that the estimate produced by Woods & Poole. While this difference might be reflective of different assumptions in the models, it needs to be noted that the Woods & Poole model includes income from farming, while the OSP model contains no farm income. This results in the OSP model producing a somewhat lower estimate of income. Other county specific differences might be the result of different assumptions related to wages adjustments for these counties. However, this explanation seems to be weakened by the fact that mean statewide per capita estimates from these models are close to one another. Finally, the counties where larger differences are noted generally represent areas where robust growth might be expected (Sussex, Passaic, Somerset, Morris, Middlesex, Hunterdon). The Woods & Poole model might adjust county household incomes based on growth rates.

IV. INCOME DISTRIBUTION MODEL

Income Distribution

Research articles identified two methods to estimate the distribution of incomes in the population. Bianchi[31] suggests that incomes might be estimated using demographic characteristics. Specifically, she reports per capita income differences evident between the different racial groups, and that the sex of the head of the household also might affect income. A second method[32] reported in the research literature is based on the development of a mathematical model of income distribution.

Aspects of the approach suggested by Bianchi have been incorporated into the method described in this section. OSP utilized a Census convention of classifying or segmenting households, identified by the age, race and sex of the head of the household, into income groups(displayed in Table 4), and then assumed that future changes in the numbers of these demographically identified households can be used as the basis to estimate changes in the number of households in the various income groups.

Table 4
Income Groups

	(Income Groups)							
	group 1	**group 2**	**group 3**	**group 4**	**group 5**	**group 6**	**group 7**	**group 8**
1980 Income Ranges	< $5k	$5k to $9.9k	$10k to $14.9k	$15k to $19.9k	$20k to $24.9k	$25k to $34.9k	$35k to $49.9k	$50k or more

Source: 1980 Census Table 244

The income distributions reported in Table 244 of the 1980 Census became the template for all of OSP's income estimations[33]. Data in this table describes that households headed by persons in their teens or twenties, in general make less money that do households headed by more mature workers. It also reports that older citizens generally make less money than would have been the case when the household head was middle aged. The effect of race also is reported. The table contains separate sub-tables which display the total number of households in each of eight income groups, identified in one sub-table by race (white and non-white) and in another sub-table by the age group of the head of the household (cohorts: 15 to 24; 25 to 34; 35 to 44; 45 to 54; 55 to 64; and 65 or older). OSP developed combined tables from this information which display the percentage of total households in each income group for each category in the race-age-income matrix. These data are displayed in Table 5 of this report. Much in the method of "headship" tables, these "incomeship" tables indicate the percentage of households in each demographic category that would be represented in each income group.

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[31]Susanne M. Bianchi. "Racial Differences in Per Capita Income, 1960-76: the Importance of Household Size, Headship, and Labor Force Participation" Demography 17:2 (1980) p. 129 - 143.

[32]Lois Fonseca and Jeff Tayman. "Postcensal Estimates of Household Income Distributions" Demography 26:1 (1989) p. 149 - 159.

[33]OSP attempted to develop a method to modify the 1980 Census reported income distribution data by using identical data for each county from the Special Census Tapes, so that additional information about the effects of demographic differences or differences in employment might be studied. All efforts to collect this Special Census Tape data were unsuccessful. In addition, efforts to secure time series data also were unsuccessful. Comparable data from the 1990 Census should be released in 1992.

Table 5
OSP Incomeship Tables

	Income Groups							
White age Cohorts	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**	**Group 7**	**Group 8**
15 to 24	.133122	.191435	.232623	.184974	.12631	.101853	.022382	.007301
25 to 34	.054387	.080801	.141678	.186427	.179019	.229664	.096743	.031281
35 to 44	.004025	.059198	.090182	.135592	.163144	.271914	.178134	.097813
45 to 54	.034685	.051771	.082274	.102537	.123544	.238959	.219186	.147045
55 to 64	.065713	.096955	.120086	.130331	.128789	.203557	.155716	.098853
65 or older	.217827	.27559	.17231	.109287	.071334	.07894	.044858	.029854
Non-White age Cohorts								
15 to 24	.3962	.254938	.167001	.095774	.049282	.027839	.005329	.003637
25 to 34	.188834	.192608	.184148	.145638	.107198	.12399	.043776	.013808
35 to 44	.239947	.134949	.13412	.124442	.103836	.146495	.083783	.032427
45 to 54	.130871	.142698	.152765	.142346	.113828	.167437	.10503	.045026
55 to 64	.209627	.170048	.155881	.12744	.10572	.123066	.072244	.035973
65 and older	.390897	.265064	.130316	.078291	.048479	.051037	.024467	.011449

Source: US Census 1980 Table 244

To estimate the numbers of households in each income group, the demographic/income group data reported in this 1980 Census table was assumed to continue into the future. Therefore, the number of future households in any income group is a function of the demographics characteristics of the future population.

Incomeship Alternatives

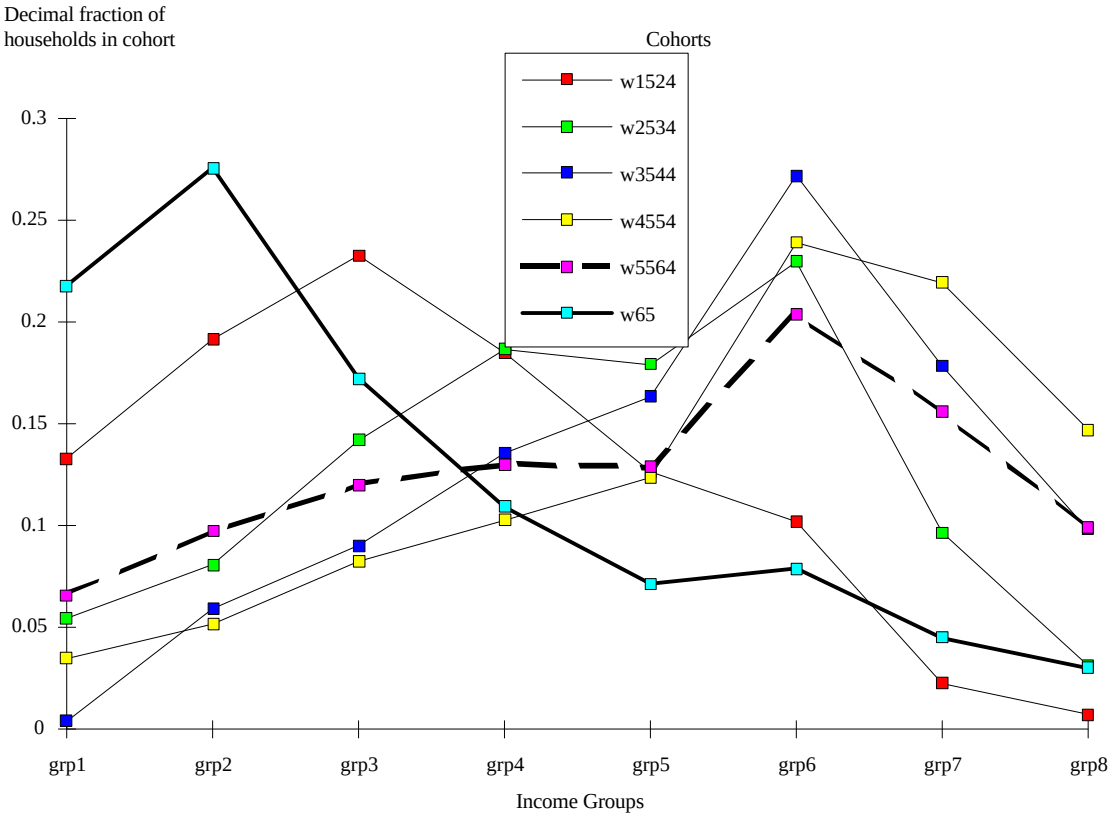
Chart 3 formats the data contained in Table 5 so that the distribution of household incomes for any age cohorts can be easily viewed. Most striking about the chart is the substantial income change evident between the cohorts aged 55 through 64 and aged 65 or older. For example, 6.5% of the white householders aged 54 through 64 are in the lowest income group, while almost 22% of the households headed by persons aged 65 or older have incomes in this lowest income category. Non-whites headed households shift from almost 21% (aged 54 through 64) to 39% (aged 65+) of the households receiving incomes within the category 1 group's range. Similar, but opposite, declines in representation occur in the higher income groups.

However, while money income declined for householders once they passed aged 65 in 1980, research suggests that if money from financial assets were included the financial decline in the cohort 65+ would not be as severe[34]. The argument proposed by these analysts is that New Jersey currently has a large number of its middle aged population in the higher income groups. The retirement income generated by these persons, converting a life time of assets to income, would be under represented if the 1980 Census data were used for forecasts.

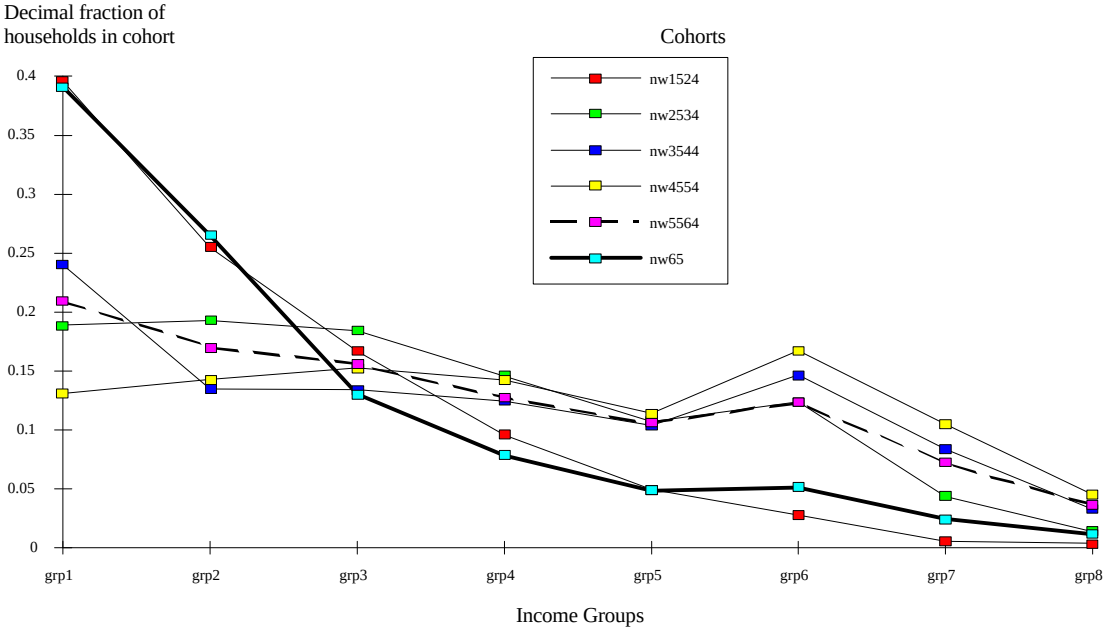
[34]Daniel B. Radner. "Assessing the Economic Status of the Aged and Nonaged Using Alternative Income-Wealth Measures" Social Security Bulletin 53:3 (1990) p.2 - 14.

Chart 3

Income Distribution of White Households Organized by Age Cohort
New Jersey 1980



Income Distribution of Non-White Households by Age Cohort
New Jersey 1980



Therefore, to simulate the effect of converting wealth to income, two alternative income distribution estimates have been prepared for households headed by persons aged 65 or older. Both alternatives modify the 1980 base data, by shifting the income distribution for the cohort 65+ closer to the pattern displayed by the cohort 54 through 64. The first alternative shifts the 65+ groups' income to the midpoint between its 1980 location and the 1980 location of the 54 through 64 aged cohort. This adjustment would be made for each of the income groups. The second alternative proposes only a 25% adjustment in the direction of the 54 through 64 cohorts' location. Table 6 displays the percentage of 65+ headed households in each income group as reported in the 1980 census and for each of the two OSP generated alternatives.

Table 6
Incomeship Alternatives for Percentage of Households
Headed by Person Aged 65 or Older in Each Income Group

	grp1	**grp2**	**grp3**	**grp4**	**grp5**	**grp6**	**grp7**	**grp8**
non white								
1980 Census	.39089	.26506	.13032	.07829	.04848	.05104	.02447	.01145
50% adjustment	.30026	.21756	.14309	.10287	.07710	.08705	.04356	.02371
25% adjustment	.34558	.24131	.13671	.09058	.06279	.06904	.03641	.01758
white								
1980 Census	.21782	.27559	.17231	.10928	.07133	.07894	.04485	.02854
50% adjustment	.14177	.18627	.14619	.11980	.10006	.14125	.10029	.06435
25% adjustment	.17873	.23093	.15925	.11455	.08570	.11009	.07257	.04710

Table 7 displays the number of households in each of the eight income groups in each of the state's counties in the forecast year of 2010. This estimate is based on the NJ DOL "preferred" population and employment forecast and utilizes the 25% adjustment factors for households headed by persons aged 65 or older.

Table 7
Estimate of Number of Households in Each Income Group
for the Forecast Year 2010

	Group1	**Group2**	**Group3**	**Group4**	**Group5**	**Group6**	**Group7**	**Group8**
Atlantic	13361	15401	16110	16440	15781	24032	16577	9613
Bergen	40861	47265	47688	47872	45684	69329	47951	27958
Burlington	24068	26235	26280	25837	23909	35095	23097	12968
Camden	28221	32119	32764	32624	30590	45368	30375	17372
Cape May	4823	6453	6824	7035	6809	10310	7125	4221
Cumberland	6906	8298	8427	8456	7994	11916	8004	4611
Essex	54720	52119	49255	45545	40238	57513	37099	20184
Gloucester	9418	12410	13261	13885	13548	20628	14195	8338
Hudson	27789	31487	32104	31980	30063	44829	30281	17411
Hunterdon	4302	6208	6567	6959	6911	10691	7492	4474
Mercer	20182	22033	22005	21554	19993	29667	19876	11264
Middlesex	33200	40470	41599	41941	40216	61046	42370	24974
Monmouth	28367	36123	36460	36971	35570	54005	38311	22010
Morris	20326	23990	24898	25399	24282	36539	24686	14131
Ocean	20071	28327	29524	30814	30131	45900	31597	18698
Passaic	23115	27368	27888	27935	26418	39518	26871	15604
Salem	3159	3790	3832	3822	3590	5324	3578	2069
Somerset	12000	14604	14984	15284	14783	22657	15827	9318
Sussex	5494	7602	8224	8766	8586	12929	8650	5001
Union	24633	27088	26626	26031	24283	36238	24682	14239
Warren	4131	5169	5200	5258	5028	7543	5128	2998

Estimation of Mean Household Income Values

The estimation of the mean income of each household income group was performed using a mathematical model. Table 244 of the 1980 Census reports the mean household income for the state and identifies eight income categories by income ranges. We assumed that the mean income for each income group was the mid-point of the income range. For example, the lowest income group (income group 1) had an income range of $0 to $5,000. It was assumed that the mean income for this income group 1 was $2,500.

The assumed mean income for each income group then was divided by the state mean household income so that the mean income of each income group was expressed in terms of the state mean household income. Therefore, the assumed mean income of $2,500, for income group 1, was divided by the state mean household income of $23,260 (1980) to produce the result that income group1's mean household income factor was .107. An identical process was used to determine the income factor for all income groups; the results of which are displayed in Table 8. It is interesting to note that the first four income groups all have estimated mean income factors that are less than eighty percent of the mean state household income; which means that these four income groups contain low and moderate income households.

Table 8
Income Group Factors

	(Income Groups)							
	group 1	**group 2**	**group 3**	**group 4**	**group 5**	**group 6**	**group 7**	**group 8**
1980 Income Ranges	< $5k	$5k to $9.9k	$10k to $14.9k	$15k to $19.9k	$20k to $24.9k	$25k to $34.9k	$35k to $49.9k	$50k or more
income factor	.107481	.322442	.537403	.752365	.967326	1.28976	1.82717	2.14961

mean state household income $23,260 source: 1980 US Census Table 244

To forecast the future mean household income for each of the counties, the 1980 income group factors are multiplied by the estimated future mean county household income, separately estimated by the IP model. The resultant preliminary estimates of each income group's mean income then is adjusted so that the sum of the mean incomes multiplied by the estimated number of households in each income group, equals the total future county household income, also separately estimated by the Income projection program.

Table 9 displays the adjusted estimated mean household incomes for all eight income groups in all 21 counties for the future year when the mean state household income is estimated to be $52,475. Mean county household incomes, estimated by the IP model, also are displayed in the table. The results displayed in this table were based on the NJ DOL 2010 population and employment forecast using the 65 and older incomeship factors shifted 25% from that reported in 1980 (fewer lower income households and more higher income households).

Table 9

Estimated Mean County Household Incomes ($) in the Year 2010
for All Eight Income Groups
(1985 constant dollars)

	Mean HH Income	Group1	Group2	Group3	Group4	Group5	Group6	Group7	Group8
Atlantic	$43,467	$5,584	$14,928	$24,272	$33,616	$42,959	$56,975	$80,335	$94,350
Bergen	$61,396	$8,567	$21,765	$34,963	$48,160	$61,358	$81,155	$114,149	$133,946
Burlington	$51,283	$9,254	$20,278	$31,302	$42,326	$53,349	$69,885	$97,445	$113,981
Camden	$48,882	$7,790	$18,298	$28,806	$39,313	$49,821	$65,583	$91,852	$107,614
Cape May	$39,790	$4,324	$12,878	$21,431	$29,984	$38,538	$51,368	$72,751	$85,581
Cumberland	$40,737	$6,058	$14,815	$23,572	$32,329	$41,086	$54,221	$76,113	$89,249
Essex	$47,908	$11,727	$22,026	$32,324	$42,622	$52,921	$68,368	$94,114	$109,562
Gloucester	$46,008	$4,738	$14,628	$24,518	$34,408	$44,298	$59,133	$83,857	$98,692
Hudson	$40,028	$6,229	$14,833	$23,438	$32,042	$40,646	$53,553	$75,064	$87,971
Hunterdon	$61,506	$4,996	$18,218	$31,439	$44,660	$57,882	$77,714	$110,767	$130,600
Mercer	$50,754	$8,845	$19,755	$30,665	$41,575	$52,486	$68,851	$96,126	$112,492
Middlesex	$54,012	$6,881	$18,491	$30,102	$41,712	$53,323	$70,738	$99,765	$117,180
Monmouth	$59,630	$7,482	$20,301	$33,119	$45,937	$58,755	$77,982	$110,028	$129,255
Morris	$64,498	$8,839	$22,704	$36,568	$50,433	$64,297	$85,094	$119,755	$140,552
Ocean	$46,786	$4,720	$14,777	$24,834	$34,891	$44,948	$60,034	$85,177	$100,263
Passaic	$48,586	$7,087	$17,531	$27,975	$38,419	$48,863	$64,529	$90,640	$106,306
Salem	$35,738	$5,487	$13,169	$20,851	$28,534	$36,216	$47,739	$66,945	$78,469
Somerset	$64,992	$7,767	$21,738	$35,708	$49,679	$63,650	$84,606	$119,533	$140,490
Sussex	$54,046	$5,527	$17,145	$28,763	$40,381	$51,999	$69,425	$98,470	$115,897
Union	$56,896	$9,635	$21,865	$34,096	$46,326	$58,554	$76,902	$107,478	$125,823
Warren	$46,511	$6,364	$16,362	$26,360	$36,356	$46,356	$61,353	$86,349	$101,346

V. FUTURE RESEARCH

The analysis conducted during this project has identified other research topic that usefully might be pursued by OSP. The following sections identify the research subjects, describe how the information is used, and identify the product that the additional research would produce.

Group Housing

In the model's calculation of householder pension income, it is assumed that all persons aged 65 or older are householders. This is not the case, since some of the persons in this age cohort live in nursing homes or other group quarters. A related problem occurs when the model calculates personal income for persons living in group quarters. The number of persons in this category is assumed to be the number of persons reported in the 1980 Census. This same 1980 group quarters assumption is made everywhere in the OSP model (and most other models of New Jersey reviewed by OSP).

The magnitude of the resulting error is not large, and it is reasonable to assume that the effect is to under-estimate the number of group quarter persons and to slightly over-state householder and per capita income, by some small amount.

A comprehensive study of the population characteristic of persons living in group quarters should be undertaken. From this research, a method to estimate future group quarters populations should be developed and incorporated into the OSP models. Additional benefits from this research would be a more refined estimate of housing need and an estimate of group housing need, including nursing units.

Wage Alternatives

The Income Projection model uses BEA estimates of statewide future industrial wages to calculate earnings. Alternative wage forecasts can be easily incorporated into the model. Such additions to the model would be beneficial and would be structured as user-selected alternatives. However, research needs to be conducted to identify alternative wage forecasts, or to identify the basis for estimating wage alternatives.

The model also incorporated county wage adjustment factors based on wages reported as paid in 1982 and 1985. Other wage adjustment alternatives can be incorporated into the model. An alternative to using a historic period as a constant would be the development of trended adjustment factors sensitive to labor market location, labor force conditions, and other factors of importance.

Improved Unemployment Assignment

The user-selected unemployment rate is one of the factors which is used in the model to estimate public assistance income. As now applied, the unemployment rate is a constant which affects all population cohorts the same. It is probable that the effect of unemployment is disproportionate, i.e., while the overall unemployment rate might be 6%, the unemployment rate of specific demographic groups would be greater or less than the statewide average.

If research on this subject can be completed, it would be a relatively easy matter to incorporate the findings into the income model. If black females exhibit greater levels of unemployment than that described in the statewide average, then the effect of a model adjustment to account for this factor would be an increase in public assistance income and a slight decrease in household and per capita income.

Public Assistance Correlation

In its calculation of public assistance income, the transfer payments portion of the income model uses a statistical relationship between black females who are not working and public assistance payments. While the relationship existed in 1980, this correlation may not be appropriate for use in the future, since it assumes that conditions will not change. For example, in the future white males might be a better index, due to successful job training focused at today's unemployed population and other Affirmative Action programs and policies.

Furthermore, it important to note that the 1980 correlation does not allow one to conclude that this socio ethnic group is responsible for public assistance, it only implies that they are related. Job discrimination and ineffective education might be among the causal factors.

Updating the Model

Many of the relationships now incorporated into the model are based on the 1980 Census or on limited data. With the availability of the 1990 Census and more recent other types of information, the OSP model should be revised to reflect time series relationships.

APPENDIX A

APPENDIX B